

Respiratory symptoms and pattern of Lung Functions among Commercial Motorcyclists in Sagamu, Nigeria

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Abstract

Background: The relationship between occupational exposure to air pollutants and poor respiratory health is known. The motorcyclists commonly seek medical care for respiratory diseases in Nigeria.

Objective: To determine the prevalence of respiratory symptoms and the pattern of lung functions among commercial motorcyclists compared to control subjects.

Method: The controlled cross-sectional study was conducted in Sagamu, an urban town in south-western, Nigeria. The commercial motorcyclists and the controls with similar age, non-smokers and same male sex were included in the study. The riders and controls recruited were non-smokers. A structured questionnaire approved by the British Medical Research Council/ ATS (American Thoracic Society) was used. The pulmonary function tests were performed according to ATS recommendation.

Results: A total of 200 subjects were studied: 100 were commercial motorcyclists and 100 were non-motorcyclist controls. Compared with the controls, the prevalence of cough (71% vs 21%) and sputum (67% vs 20%) was higher among the commercial motorcyclists. Twenty-one percent of the commercial motorcyclists had an obstructive ventilatory pattern compared to 13% of the control group.

Conclusion: This study provides further evidence that commercial motorcyclists are exposed to occupational hazards which predisposed them to increased frequency of respiratory symptoms and impaired lung functions. Health education strategy may assist this group of workers and reduce the burden of respiratory disorders among them.

Key words: Lung functions, Motorcyclists, Obstructive ventilatory pattern, Occupational hazard

Introduction

The first gasoline-engine motorcycle to appear publicly was built by Gottlieb Daimler, of Bad Commstatt, Germany in 1885. ^[1] The popularity of the vehicle has grown ever since, especially among the young population. ^[2,3] The commercial motorcycle commuter service is popularly called 'Okada' in the Southern part of Nigeria and 'Achaba' in some Northern states of the country. ^[3,4] In this part of the world where the transportation system is ineffective and undesirable, commercial motorcycles readily

become an alternative. The cyclists are exposed to air pollutants such as hydrogen oxide, carbon monoxide, sulphur dioxide, volatile organic compounds and particulate matters in ambient air which impairs lung functions with resultant respiratory symptoms. ^[5-9]

In the urban environments in Nigeria, characteristically, there is increased particulate matter (PM₁₀) to which commercial motorcyclists are exposed, more intensely in traffic -clogged areas. ^[10] The effects of this particulate matter (PM₁₀) on health include higher prevalence of cough, catarrh, asthma, chronic bronchitis, and eye infections. ^[9,10] The effects of particulate matters (PM₁₀) in vertebrates, apart from the afore-mentioned, include sub-fertility, damage to teeth, bones and increased disease susceptibility. ^[9,10]

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The commercial motorcyclists, with their high level of physical and metabolic activity resulting in increased respiratory rates, may inhale pollutants at a higher rate than other commuters.^[9,10] They can be trapped within vehicles especially during traffic hold-ups. The inhaled substances from the heavy emissions can result in inflammation exacerbating airway oxidative stress.^[9,10] Despite the exponential increase in the cyclists in Nigeria, there is paucity of data about the respiratory health effects of their exposure to air pollutants and particulate matters. Therefore, this study was conceived to generate baseline data which will determine the spectrum and the severity of respiratory manifestations. These will be useful in forming the basis for the required intervention to prevent complications. Respiratory disorders are among the ten leading causes of death worldwide.^[11] The major factors which increase the burden of chronic respiratory diseases include occupational exposures^[11 - 15] to tobacco smoke and early lung infections.^[11]

The urgent need for this study arose from the observed large numbers of commercial motorcyclists attending the chest clinic of Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria with diverse respiratory disorders. The study is an occupational surveillance with the objective of determining the prevalence of respiratory symptoms and pulmonary function values of commercial motorcyclists in comparison with apparently healthy controls as well as to determine factors contributing to detectable impaired respiratory function among these transit workers.

Methods

Study design

The study design was controlled cross-sectional study. The study was conducted in Sagamu, an urban town in southwest Nigeria. Ethical

approval for the study was obtained from the Health Research and Ethics Committee of the Olabisi Onabanjo University Teaching Hospital prior to the commencement of the study. The minimum sample size needed to detect a difference of 0.4 units in Forced Expiratory Volume in one Second (FEV₁) between the commercial motorcyclists and the controls at 80% power and 5% level of significance was 96 men per group. This was calculated using a standard deviation of 0.07 from a previous study.^[16] A sampling frame obtained from the administrative office of the associations of commercial motorcyclists in Sagamu was used to prevent non-inclusion bias. One hundred occupationally exposed group (cases) were finally recruited following exclusion of smokers from the randomly selected cyclists using the table of random numbers. Other inclusion criteria included: age 18 years and above, no cardio-respiratory disorder and willingness to participate.

Data collection

The control group comprised 100 males who were non-smokers with no cardio-respiratory disorders. They were not motorcyclists, not engaged in dusty occupation, but with similar BMI and socio-economic status. The control subjects were mainly junior workers in the civil service who work as messengers in the teaching hospital and the college of medicine as well as shop attendants. Cleaners, people in other dusty occupations, and people with cardio-respiratory disorders were excluded from the study. Informed consent was obtained from each participant in the study population. The instrument used for data collection was a questionnaire based on the British Medical Council and the American Thoracic Society (ATS) Standardized.^[17] The socio-demographic data and respiratory symptoms data were personally collected.

Questionnaire was translated to local language

and was pretested prior to the commencement of research work. The anthropometric parameters such as the height (in meters) and body weight (in kg) were measured using standard protocols with minimal clothing without shoes on as described by the World Health Organization.^[18] Spirometric measurements were done according to the ATS/ERS protocols.^[17] This was carried out in a standing position using Schiller SP-150 Spirometer and with the nose clipped. Participants were instructed to breathe maximally into the spirometer. The demonstration was done in groups and manoeuvres were repeated until reproducible maximal performance was obtained for each participant.

The outcome variables included: FEV₁, Forced Vital Capacity (FVC) and Peak Expiratory Flow Rate (PEFR), work related symptoms suggestive of Chronic Obstructive Pulmonary Disease (COPD)/Asthma. FEV₁ (Forced Expiratory Volume in first second) is the volume of air expired in the first second of a maximal expiration, FVC is the total volume of air expired maximally following a maximal inspiration while the PEFR is the peak expiratory flow rate (in litres per minute).

Predictor variables included: age, weight, height, and duration of occupation. Impaired lung functions (obstructive, restrictive or both) is suggested in the presence of reduced FVC, FEV₁, FEV₁/FVC according to the Global Initiative for Chronic Obstructive Lung Diseases (COLD) and the National Institute for Health and Clinical Excellence.^[19,20] Reduced FEV₁ (less than 80% predicted value), FEV₁/FVC less than 0.7 (absolute value less than 80% predicted value) suggest obstructive pattern of lung impairment. On the other hand, reduced FVC, reduced FEV₁ and FEV₁/FVC greater than 0.8 suggest restrictive pattern of lung impairment.

Data management

The SPSS software version 16.0 was used for data analysis. The Student's t-test was used to compare mean and standard deviation values while the Chi-squared test was used to determine the statistical significance of association between categorical variables. P values less than 0.05 was used to define statistical significance.

Results

Table I shows the demographic characteristics of the 100 commercial motorcyclists and 100 control subjects who participated in the study. The two groups had been on their job for more than one year. The mean age of the commercial motorcyclists was 26.8 years, while the mean age of the control group was 27.1 years. In this table, there is no statistically significant difference in the mean values of the parameters compared in the table.

The observed differences in the mean values of FEV₁ as well as the peak expiratory flow rate were statistically significant. These observations suggested obstructive lung disease. A higher percentage of cyclists had obstructive lung pattern while a higher percentage of the control group had normal

Table I: Characteristics of the Cases and the Control groups

Parameters	Motorcyclists (n = 100)	Control (n = 100)	T	P-values
Age (Years) (M±SD)	26.8 ± 5.3	27.1 ± 5.1	1.022	0.92
Heights (meters) (M±SD)	1.69 ± 0.6	1.72 ± 0.6	1.031	0.65
Weight (Kg) (M±SD)	65.9 ± 10.6	67.5 ± 10.5	1.072	0.42
BMI (Kg/Meter squared) (M±SD)	24.6 ± 4.5	24.5 ± 4.8	1.028	0.74
Duration of present job (Years) (M±SD)	1.7 ± 0.9	1.8 ± 1.0	1.018	0.97
PEFR (L/min) (M±SD)	377.6 ± 66.9	396.0 ± 60.2	11.988	< 0.005
(M±SD)	3.3 ± 0.6	3.6 ± 0.6	14.386	< 0.005
FVC (M±SD)	4.2 ± 0.6	4.3 ± 0.6	8.088	0.042
FEV ₁ /FVC	0.7	0.81	6.076	0.063
Normal Lung Function (%)	70	80	6.78	0.04
Obstructive Pattern (%)	20	13	11.656	0.005
Restrictive Pattern (%)	10	7	1.052	0.44

BMI: Body Mass Index

FEV₁: Forced Expiratory Volume in the first second

FVC: Forced Vital Capacity

PEFR: Peak Expiratory Flow Rate

lung function pattern. There was no statistically significant difference in the comparison groups with regards to restrictive lung pattern.

Table II showed that the prevalence of cough was higher among the commercial motorcyclists (71%) than controls (21%). The prevalence of sputum was also higher among the commercial motorcyclists (67%) compared with the controls (20%). Cough and sputum production were observed to have been present for more than 4 years in some of the riders who had been on the job for more than five years. This observation supported the high prevalence of chronic bronchitis in the cyclists.

Table II: Comparison of symptoms among commercial motorcyclists and the controls

Symptoms	Motorcyclists (n = 100)	Control (n = 100)	T value	P Value
Presence of cough (%)	71	21	16.642	<0.005
Cough in morning (%)	68	16	17.393	<0.005
Cough at night (%)	3	5	1.056	0.064
Cough Duration Weeks (%)	20	17	4.181	0.43
Cough Duration Months (%)	50	4	19.644	<0.005
Sputum Production	67	20	12.426	<0.005
Sputum Duration Week (%)	26	16	6.338	0.4
Sputum Duration Month (%)	44	4	19.846	0.04

Discussion

The findings in this study depicted increased respiratory symptoms as well as impaired lung functions among commercial motorcyclists compared with the controls. This observation supported previous works on the adverse effects of occupational exposure on the respiratory system. This study is in consonance with the findings in previous works where urban city motorcyclists and taxi-drivers were found to have unusual amount of outdoor, ambient air pollution with resultant respiratory impairments.^[21]

In Nigeria, the effects of particulate matter on human health had been previously noted by several researchers. These scholars asserted that the high rate of respiratory diseases occasioned by increased PM₁₀ concentrators were experienced by cyclists of most urban areas. These researchers suggested that particulate matter (PM₁₀) may lodge in the lungs and cause chronic respiratory problems such as emphysema, pneumonia, bronchitis, asthma, and respiratory tuberculosis.^[10]

In the urban environments in Nigeria, the concentration of particulate matters (PM₁₀) to which commercial motorcyclists are exposed has increased, more intensely in traffic clogged areas. The effects of particulate matters (PM₁₀) on health include significant prevalence of cough, catarrh, asthma, chronic bronchitis and eye infections as well as increased hospital admission for respiratory infections with attendant increased job absenteeism. The effect of particulate matters (PM₁₀) in vertebrates, apart from the afore-mentioned, include reduced ability to reproduce, damage to teeth, bones, increased disease susceptibility and increased mortality.^[22-27]

Previous studies have described the toxicity of inhaled pollutants, particulate matter and black smoke from work exposure. This is also associated with increased respiratory symptoms and obstructive respiratory pattern of lung function test.^[6-10,22,23] These finding were similar to the findings in the present study characterized by high prevalence of cough, chronic bronchitis (cough productive of sputum of more than two years duration), with an obstructive ventilatory pattern compared to the control group.

Smoking is an important risk factor for pulmonary function impairment hence non-smokers were recruited to remove this

important confounding factor. However, a study carried out among cyclists in the developed world, revealed a better cardiovascular health effect. [6] The observed cardiovascular benefit could be linked to the physical activity from cycling unlike the experience in developing countries, where the risks from inhalation of dusty polluted air and its attendant respiratory morbidity and mortality far outweigh the health benefits. While the cyclists in Nigeria are exposed to PM¹⁰ mean value of 123µg/m³, those in the developed world are never exposed to levels higher than that recommended by the WHO (below 20µg/m³). [6, 28] Therefore, the findings in this study suggest that air pollution is a great threat to respiratory health in Nigeria as documented by other researchers in West African cities. [10]

The strength of the study lies in the comparison of commercial motorcyclists with the controls recruited from the same population, similar in socio- demographic characteristics and using an approved protocol. Measurements were carried out with existing Standardized manuals. The questionnaires were solely administered by the lead researchers. Nevertheless, there are limitations militating against generalization of the findings. The present study cannot prove causality, thus establishing a basis for future cohort study, to establish a cause-effect relationship.

An all-inclusive research may be necessary in the future to corroborate previous studies; particularly, studies which could reveal a much more remarkable decline in the lung function of cyclists who smoke compared to cyclists who are non-smokers. In addition, air sampling in different parts of Sagamu could also be carried out.

Conclusion

This study provided further evidence that motorcyclists have occupational exposure which may adversely affect their respiratory system, thereby increasing the prevalence of respiratory symptoms with resultant impaired lung function pattern. Generally speaking, the concentration of ambient particulate matter (PM₁₀) over Nigerian cities is about 500% more than the 20mg/m³ threshold recommended by the WHO. [28] Therefore, there is a need for the introduction of Emission Standards for vehicles in order to reduce PM₁₀ exposure among motorcyclists. In addition, the commercial motorcyclists can be protected by encouraging, educating and if possible enforcing the use of personal protective equipment including face masks. The intra-city roads also need to be surfaced and tarred. More importantly, improved transportation system will reduce emissions emanating from vehicles. The present study may assist with the development of medical standards for commercial motorcyclists in order to avert chronic respiratory disorders and premature mortality.

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Authors' Contributions: ABO conceived the research, personally administered the questionnaire, and carried out lung-function tests on subjects and controls. APO participated in data collection and analysis. OO participated in literature review, data collection and translated the questionnaire to the local dialect. All the authors contributed to manuscript drafting.

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