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Respiratory symptoms and pulmonary functions of firefighters in Ogun State, Nigeria: A preliminary report.

***Ogunkoya, J.O.[1, 2], Ehioghae, O.[2]**

Abstract

Objectives: This study was done to determine the prevalence of respiratory symptoms and abnormal respiratory functions as well as the association between the respiratory functions and the duration of employment among fire fighters in Ogun State, Nigeria.

Methods: Forty seven (47) fire fighters were included in this study. Data was collected with MRCQ questionnaire and Spirometry was done with Spirolab III. Data collected was analyzed using IBM-SPSS 20.

Results: The mean age in this study was 44.09 ± 6.89 years. 43 (91.5%) were male while 4 (8.5%) were females. 46.8% and 48.9% had cough and breathlessness respectively. 44.7% had been firefighters for 21-25 years while 70.2% work 21-30-hours/week. Spirometry was normal in 37(78.7%), obstructive in 8(17%) and restrictive in 2(4.3%).

Conclusion: The prevalence of respiratory symptoms was high in the firefighters in this study. Cough and breathlessness were the most reported symptoms. Majority of the firefighters had normal spirometry.

Keywords: Spirometry, firefighters, Medical Research Council's Committee Questionnaire (MRCQ).

*Corresponding author:
Ogunkoya J.O.
ORCID-NO: http://orcid.org/0000-0002-8403-9679
E-mail: ogunkoyaj@babcock.edu.ng

[1]Benjamin Carson Senior College of Health and Medical Sciences, Babcock University, Ilishan Remo, Nigeria.
[2]Respiratory Medicine Division, Department of Medicine, Babcock University Teaching Hospital, Ilishan-Remo, Nigeria.

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Symptômes respiratoires et fonctions pulmonaires des pompiers dans l'État d'Ogun, au Nigéria : rapport préliminaire.

***Ogunkoya, J.O.[1, 2], Ehioghae, O.[2]**

Resume

Objectifs: Cette étude a été réalisée pour déterminer la prévalence des symptômes respiratoires et des fonctions respiratoires anormales ainsi que l'association entre les fonctions respiratoires et la durée d'emploi chez les pompiers de l'État d'Ogun, au Nigeria.

Méthodes: Quarante sept (47) pompiers ont été inclus dans cette étude. Les données ont été collectées avec le questionnaire MRCQ et la spirométrie a été réalisée avec Spirolab III. Les données collectées ont été analysées à l'aide d'IBM-SPSS 20.

Résultats: L'âge moyen dans cette étude était de 44,09 ± 6,89 ans. 43 (91,5%) étaient des hommes tandis que 4 (8,5 %) étaient des femmes. 46,8 % et 48,9 % avaient respectivement une toux et un essoufflement. 44,7 % étaient pompiers depuis 21 à 25 ans tandis que 70,2 % travaillaient 21 à 30 heures/semaine. La spirométrie était normale dans 37 (78,7 %), obstructive dans 8 (17 %) et restrictive dans 2 (4,3 %).

Conclusion: La prévalence des symptômes respiratoires était élevée chez les pompiers de cette étude. La toux et l'essoufflement étaient les symptômes les plus signalés. La majorité des pompiers avaient une spirométrie normale.

Mots-clés: Spirométrie, pompiers, questionnaire du comité du Conseil de recherches médicales (MRCQ).

*Corresponding author:
Ogunkoya J.O.
ORCID-NO: http://orcid.org/0000-0002-8403-9679
E-mail: ogunkoyaj@babcock.edu.ng

[1]Benjamin Carson Senior College of Health and Medical Sciences, Babcock University, Ilishan Remo, Nigeria.
[2]Respiratory Medicine Division, Department of Medicine, Babcock University Teaching Hospital, Ilishan-Remo, Nigeria.

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INTRODUCTION

Despite the known hazards associated with firefighting as an occupation, there are doubts on the likelihood of long-term career firefighting leading to an increase in rate of decline in lung function than would normally be expected (1). It is also not very clear how this degree of decline is as a result of firefighting exposures. Some reductions in lung function, increases in airway hyper-responsiveness, and the onset of respiratory symptoms have been seen in firefighters following exposures during firefighting duties (2). There are few reports of long term respiratory symptoms following exposure to toxic gases and fumes but reports about the prevalence of respiratory symptoms during and immediately following firefighting events are available (3). Symptoms such as cough, chest pain, breathlessness and chest tightness have been reported in firefighters following firefighting events (4). Fire fighters inhale toxic fumes containing carbon monoxide which is odorless, carbon dioxide and particulates of carbon, aluminum, silica, lead, hydrocarbon, fluoride, acid and bases. The combined effect of these substances may cause lung injury and obstruction of airways (5). One of previous investigations of lung function in active fire fighters showed a more than expected rate of loss of their lung capacity over a one year period relative to the frequency of exposure to fire (6, 7).

There are few local data and studies done to look at this demographic in Nigeria and none were done in the western part of Nigeria where majority of the fire outbreak occur (8, 9). This study aimed to fill this gap and improve the burden of knowledge in this group (10). The specific objectives are to determine the prevalence of respiratory symptoms among fire fighters in Ogun State, Nigeria, to determine the prevalence of abnormal respiratory functions among them and to determine the association between he respiratory functions and the duration of employment among these fire fighters in Ogun state, Nigeria.

MATERIALS AND METHODS

Study population/ study design

The study population include 47 (forty seven) professional fire fighters employed by ogun state fire service with fire stations located in Abeokuta, Ijebu Ode, Sagamu and Ota, Ogun State. Appropriate ethical clearance was obtained from Health Research and Ethical Committee of Babcock University Ilishan Remo, Ogun State. This descriptive cross-sectional study was carried out among professional firefighters of Ogun State Fire in Ogun State between December 2019 and February 2020. Fire fighters with pre existing lung diseases like COPD, asthma and other chronic lung diseases were excluded from this study.

Data collection

Data was collected with a validated questionnaire and Spirometry was then carried out with Spirolab III. Interviewer-administered questionnaire was adapted from relevant sections of Medical Research Council's Committee (MRCQ) on Environmental and Occupational Health questionnaire that applied to this study. Information obtained includes the social and demographic characteristics, occupational history including the duration of present employment and respiratory symptoms of the study subjects.

The firefighters then performed spirometry in line with the American Thoracic Society (ATS) and European Respiratory Society (ERS) guidelines (11). Appropriate quality control measures were strictly adhered to during the procedure. A maximum of eight trials were done and a minimum of three acceptable tests with reproducible forced expiratory volumes in the first second (FEV1) and forced vital capacity (FVC) values were obtained. Before use, the spirometer was calibrated on daily basis. The environment was monitored and effort made to ensure conditions were within accepted ranges (12). The pulmonary function parameters measured include FEV1, FVC, the ratio of FEV1 to FVC, peak expiratory flow (PEF) and the percentage predicted values for the demographics (age, height and sex) were also recorded for each firefighter.

Statistical analysis

Data collected was analyzed using IBM-SPSS 20. Demographic characteristics of the professional firefighters were assessed as n (%) and means (±SD). The primary outcome variables FEV1, FVC, FEV1/FVC ratio, PEF and the respiratory symptoms were summarized using means (±SD) and graphs. Independent t test was used to compare means. Evaluation of associations between variables was done using Chi-square test.

RESULTS

A total of 47 firefighters participated in this study. The ages of the study participants ranged from 32-57 years, with a mean age of 44.09 ± 6.89 years. Forty three (91.5%) of the firefighters were male while 4 (8.5%) were

females, indicating that there were nearly 11 males for every female in our study sample. A majority (24; 51.1%) of the firefighters had secondary education as their highest level of education, followed by 16 individuals (34.0%) who had completed tertiary education. Other had either primary or technical (post-secondary) education as their highest level of education. Well over half (57.4%) of the respondents were of the Christian faith, and most of them (85.1%) were married.

Prevalence of Respiratory Symptoms

Study participants reported different respiratory symptoms at the time of data collection, as shown in Table 2. A little below half (46.8%, 48.9%) of the firefighters had cough and breathlessness respectively. Lower proportions of the firefighters reported sore throat, itchy throat, choking sensation (globus), sputum production, chest pain and hemoptysis (see Table 2).

Occupational History

A majority of the firefighters (44.7%) had been in service at their current job for 21-25 years, and most of them (70.2%) work 21- to 30-hour weeks (See Fig. 1 and Fig. 2)

Smoking History

Five (5) of the firefighters (10.6%) admitted to having a smoking habit. While all five (5) of them that smoked admitted to smoking cigarettes, 3 individuals reported smoking cannabis. Three (3) of the firefighters who smoke reported that they started smoking regularly when they were between 10 and 19 years old, while the remaining 2 individuals started smoking regularly when they were between 20 and 29 years of age. Four of the participants with a smoking habit reported having smoked regularly for 6-10 years, while the last individual reported smoking regularly for 11-15 years. All of the firefighters who smoke admitted to smoking about 11-15 stick of cigarettes per day. As for the three individuals who also smoked cannabis, 2 smoked 6-10 wraps per day, while 1 individuals reported smoking more than 10 wraps per day.

Lung Function Test Results

The result of the lung function tests are detailed in Table 3 below. It shows that the median post-bronchodilator FEV1: FVC was slightly higher than the pre-bronchodilator values. In addition, this difference between the pre-bronchodilator and post-bronchodilator FEV1: FVC was significant. However, the pre- and post-bronchodilator values for FEV1, FVC and PEFR were not significantly different amongst the firefighters. Overall the spirometry results indicated that most of the firefighters (78.7%) had normal spirometry, while 8 (17%) had obstructive pattern and 2 (4.3%) had restrictive pattern of lung disease. Furthermore, all of the firefighters who had obstructive pattern of lung disease had been at the job for more than 10 years, with 50% of them fighting fires for between 16 and 20 years and 2 of them had history of smoking cigarette and cannabis. Similarly, all the firefighters who had restrictive lung disease had been at the job for about 16 to 20 years with none having history of smoking cigarette or cannabis. On the other hand, most of the firefighters that had normal lung function had been at the job for more than 10 years, with 51.4% having worked for 21 to 25 years. There was however no significant association between duration of work at present job and spirometry pattern (Table 4). Likewise, no significant association was found between smoking and spirometry pattern (Table 5).

DISCUSSION

The mean age of participants in this study was 44.09 ± 6.89 years. This is similar to the study done by Isara *et al* in Benin City, Nigeria (9) but lower than other studies done indifferent parts of the world (14, 17, 18). This may be associated with the small sample sizes in this and Benin studies while the others are large population based studies.

The prevalence of respiratory symptoms ranges from 12.8% to 48.9% for nasal itching and breathlessness respectively and is higher than findings in the study done in Benin City Nigeria (9) but lower than the findings in Lagos in which the prevalence of respiratory symptoms was as high as 67.0% (8). The reason for this disparity may be due to the fact that majority of the fire fighters (80.9%) in this study have spent more than 15 years in service and most (70.2%) work for less than 30 hours a week putting out fires compared to the Lagos study (8). Also the fact that Lagos has higher population density than Ogun State and Benin City with higher rate of fire outbreaks than Ogun state where our study was conducted (8).

The duration of employment in years in this study is higher to that found in the Benin study. However, majority of participants in this study have worked for between 21-25 years as firefighters compared to the Benin study (9) in which most worked for 5- 10 years with mean duration of employment of 7 years. This may

explain the higher prevalence of respiratory symptoms seen in this study compared to findings in Benin City.

The spirometry results indicated that most of the firefighters (78.7%) had normal spirometry, while 8 (17%) had obstructive pattern and 2 (4.3%) had restrictive pattern of lung disease. This is similar to findings by Isara *et al* in Benin (9) and in New York (16). These findings were not influenced by cigarette smoking similar to findings in other studies (13, 15, 17). Furthermore, all of the firefighters who had obstructive pattern of lung disease had been at the job for more than 10 years, with 50% of them fighting fires for between 16 and 20 years. Multiple studies done in the different parts of the world had shown an established relationship between respiratory injury and decline in lung functions, different to what was discovered in this study (3, 7, 9, 13, 14)

The limitation of this study is the small sample size utilized for the study and this is due to the fact that there has been no new recruitment into the Ogun State fire service in the last few years. However a study involving all the states in the southwestern geo political zone of the country is being planned.

CONCLUSION

This study showed that the prevalence of respiratory symptoms was high in the firefighters in Ogun State, Nigeria. However, cough, breathlessness, sore throat, itchy throat and globus were the mostly reported symptoms. The spirometry results indicated that most of the firefighters had normal spirometry, while 8 (17%) had obstructive pattern and 2 (4.3%) had restrictive pattern of lung disease. We strongly recommend yearly respiratory evaluation and lung function testing on all firefighters.

Conflict of interest: The authors have no conflict of interest to declare.

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Ethics: This research adhered strictly to the ethical principle for medical research involving human subjects in conformity with the Helsinki Declaration 1975 (as amended). Ethical approval for this research was obtained from the health and research committee of Babcock University (BUREC 407/20) Ilishan Remo, Ogun State. Verbal and written informed consent was obtained from all participants and strict confidentiality of all information and findings were maintained throughout the study.

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Authors' contributions: JOO was responsible for the concept, literature search, data collection, data analysis, drafting and review of manuscript. OE was responsible for the literature search, data analysis, drafting and review of manuscript.

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Table 1 shows the socio-demographic Characteristics of Study Participants

Variable	Frequency (N = 47)	Percentage (%)
Age Group		
20-39 years	14	29.8
40-59 years	33	70.2
= 60 years	0	0.0
Gender		
Male	43	91.5
Female	4	8.5
Level of Education		
Primary	5	10.6
Secondary	24	51.1
Technical (Post-secondary)	2	4.3
Tertiary	16	34.0
Religion		
Christianity	27	57.4
Islam	15	31.9
Traditional	3	6.4
None	2	4.3
Marital Status		
Single	3	6.4
Married	40	85.1
Divorced	3	6.4
Widowed	1	2.1

Table 2 shows the pattern of Respiratory Symptoms of study participants.

S/N	SYMPTOM	YES (%)	NO (%)
1	Cough	22 (46.8)	25 (53.2)
2	Breathlessness	23 (48.9)	24 (51.1)
3	Chest pain	7 (14.9)	40 (85.1)
4	Sore throat	10 (21.3)	37 (78.7)
5	Itchy throat	10 (21.3)	37 (78.7)
6	Choking sensation or Globus	10 (21.3)	37 (78.7)
7	Noisy breathing	6 (12.8)	41 (87.2)
8	Sputum production	8 (17.0)	39 (83.0)
9	Coughing blood (hemoptysis)	2 (4.3)	45 (95.7)

Table 3. compares the pre-bronchodilator and post-bronchodilator lung function values using Wilcoxon Rank-Sum Test and Paired t-test.

Variable	Mean ± Standard Deviation	Median	Sig. 2-tailed
FEV1 (Litres)[a]			
Pre-bronchodilator	2.52±0.84	2.58	0.05
Post-bronchodilator	2.58±0.82	2.57	
FVC (Litres)[b]			
Pre-bronchodilator	3.27±1.01	3.30	0.62
Post-bronchodilator	3.24±0.95	3.28	
FEV1:FVC[a]			
Pre-bronchodilator	0.99±0.76	0.77	0.02*
Post-bronchodilator	0.97±0.77	0.80	
PEFR (Litres/second)[b]			
Pre-bronchodilator	11.66±6.32	6.61	0.72
Post-bronchodilator	11.31±6.26	6.43	

a – Wilcoxon rank-sum test used (due to non-normality of sample distribution)
b – Paired t-test used (due to normality of sample distribution)
Note – FEV1 and FEV1: FVC were not normally distributed, hence Wilcoxon rank-sum test was used to compare medians. FVC and PEFR were normally distributed; hence paired t-test was used to compare means.

Table 4 shows the association between duration at job and Spirometry pattern among study participants.

Spirometry Pattern	Duration at present job				Chi square	Sig. 2 tailed
	6-10 years	11-15 years	16-20 years	21-25 years		
Normal Pattern	2 (5.4%)	5 (13.5%)	11 (29.7%)	19 (51.4%)	6.490	0.371
Obstructive Pattern	0 (0%)	2 (25%)	4 (50%)	2 (25%)		
Restrictive Pattern	0 (0%)	0 (0%)	2 (100%)	0 (0%)		

Table 5 shows the association between Smoking and Spirometry Pattern in study participants.

Spirometry Pattern	Smoking History		Chi Square	Sig. 2 tailed
	Yes	No		
Normal	4 (10.8%)	33 (89.2%)	0.268	0.874
Obstructive	1 (12.5%)	7 (87.5%)		
Restrictive	0 (0%)	2 (100%)		

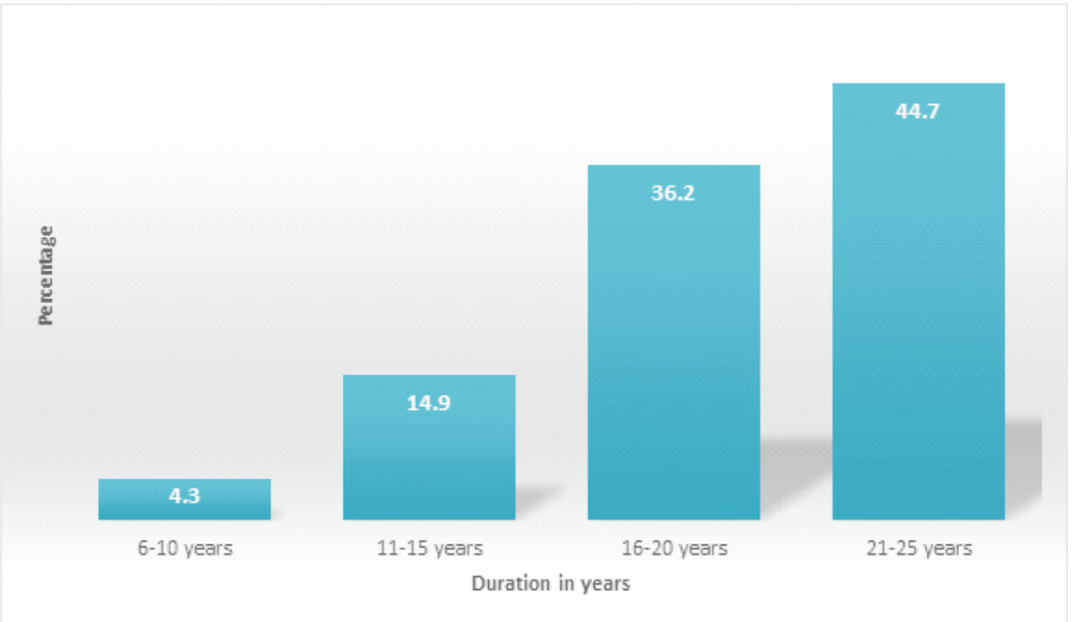

Figure 1 shows the number of years as firefighters among study participants.

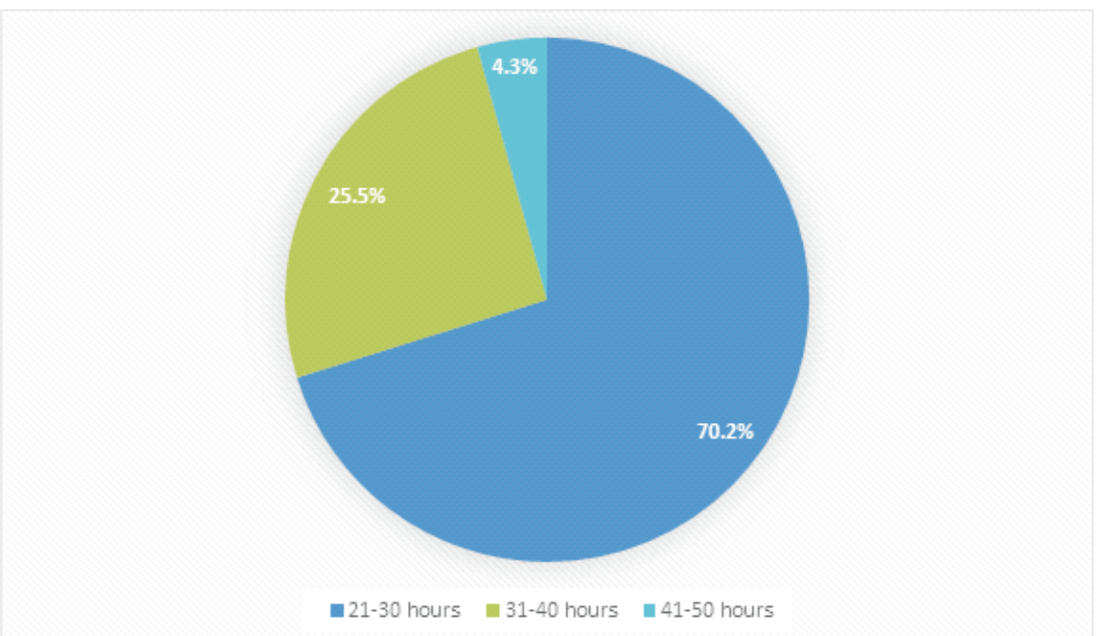

Figure 2. shows the average Number of Work Hours per Week among study participants.