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Lung Function Impairment among Gasoline Attendants: A Cross-Sectional Study

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Abstract

Background: Occupational health is an important consideration, especially for people that work in an environment with pollutants. Gasoline attendants are individuals that work in filling stations. They are constantly exposed to gasoline fumes and automobile engine products from vehicle exhaust. This increases the risk of acute and chronic respiratory diseases and carcinogenesis among them. The risk of health complications tends to increase with the duration of exposure. The study aimed to determine the proportion of gasoline attendants with lung function impairment. **Methods and Materials:** Two hundred and eight eligible participants were recruited for this study. A cross-sectional analytical study was carried out in Esan West local government area of Edo state, Nigeria. The study was carried out for a period of six months from December 2015 to May 2016. A questionnaire was used to obtain information on demographic characteristics, work history, mode of exposure and duration of exposure to petrol fumes. Lung function was assessed using a DTspiro spirometer (Model POP 10. Serial no 110843-005); also the anthropometric parameters of the respondent were measured. Statistical analysis was done using IBM SPSS version 20.0. Frequency and percentages were used to present categorical data. The mean and standard deviation of continuous variables were calculated and compared using the student's t-test. The criteria of significant association were assumed for a p-value less than 0.05. **Results:** A total of one hundred and forty petrol pump attendants and one hundred

and forty controls participated in this study. The mean age for petrol pump attendants was 24 ± 3.1 years and 23 ± 2.8 years for the control group. There were no significant differences in the gender distribution and anthropometric parameters as observed in this study. The lung impairment pattern observed in this study was obstructive in twelve (8.6%) gasoline pump attendants and restrictive pattern in thirty-nine (27.9%) gasoline pump attendants, while only four (2.9%) had an obstructive pattern and twelve (8.6%) had a restrictive pattern of lung impairment among the control group. This implies that a restrictive pattern was predominant. This study also observed that there was an increase in the number of gasoline pump attendants with declined lung function compared to the control group. **Conclusion:** Restrictive pattern of lung impairment was more predominant than the obstructive pattern among gasoline pump attendants. As a result, public health interventions should be instituted among these individuals, especially in developing countries.

Keywords

Lung Function Test, Lung Impairment, Lung Impairment Pattern, Gasoline Attendants, Occupational Hazards, Cross-Sectional Study

1. Introduction

Crude Oil is a naturally occurring raw material found in several countries of the world including Nigeria. Gasoline which is also known as petrol is one of its major products that are used as fuel for automobiles. It is a complex mixture of hydrocarbons. The typical composition of gasoline hydrocarbons includes alkanes, alkenes, isoalkanes, cycloalkanes and benzene, this compostion, however, varies depending on the crude oil used and the refining process available. Gasoline vapour is made up of 95% aliphatic compounds and less than 2% aromatic compounds. The above-named hydrocarbons are a major source of pollutants in occupational settings. The increasing use of petroleum and petroleum products increases the possibility of inhalation of these toxic substances and thus increased systemic complications which commonly involve the respiratory tract [1] [2] [3].

Everyone is exposed to different forms of pollution; global warming, acid rain, air pollution, flood and extremes of heat. This puts everyone at risk of the consequences of pollution which has drastically increased in the 21st century. This is particularly more serious in urban cities where automobiles are more commonly used. Exhaust-derived air pollutants are a major source of air pollution and pose severe health hazards as most automobiles in Nigeria use gasoline or diesel as fuel [4] [5] [6].

Several volatile compounds of gasoline such as benzene, toluene and hexane are used extensively as industrial solvents. Benzene is ubiquitous and used everywhere. It is highly tolerable such that the daily exposure varies from 5 - 10 micrograms/day. Burning coal and oil, gasoline vapours at gasoline service stations,

motor vehicle exhaust and cigarette smoke, wood burning fire and some adhesives are common sources of benzene in the environment. It is a clear colourless flammable liquid with a gasoline-like odour that can easily vaporize into the air. It is associated with respiratory difficulties, especially in children including bronchitis, asthma, and wheezing. Acute exposure to benzene can result in skin and eye irritation or burning, as well as dizziness, nausea, vomiting and suffocation. Benzene is also classified as carcinogenic while also affecting the immune system and hematopoietic system [7] [8].

A gasoline station is a facility that sells fuel as well as lubricants for motor vehicles. The most common fuels sold today include gasoline, diesel fuel, and gas. Fuel dispensers are used to pump gasoline into vehicles and calculate the financial cost of the fuel transferred to the vehicle. The service of dispensing fuel to vehicles could be in different categories; Full service-an attendant operates the pump, often wipes the windshield, and sometimes checks the vehicle's oil level and tire pressure, and then collects payment. The minimum service-an attendant operates only the fuel pump without any other additional responsibility. In the self-service system, the customer performs all required services. Signs informing the customer of filling procedures and cautions are displayed on each pump. In Edo state currently, the service stations currently operate a minimal service system and this increases the risk of exposure of pump attendants to gasoline fumes in terms of quantity and quality [9].

Gasoline pump attendants are constantly being exposed in their occupational environment to gasoline fumes and automobile exhaust vapour. The combined effect of these two pollutants may result in a decline in lung function. They are exposed to gasoline fumes either by inhalation, skin contact or by eating with contaminated hands. Evidence has also shown that the adverse effects are linked with dose-dependent exposure to volatile organics like benzene in fuel. The duration of exposure and mode of exposure also affect the extent of damage done [4] [6] [10] [11].

In Nigeria, gasoline pump attendants work without the use of personal protective wear, thereby predisposing them to hazards associated with gasoline fumes. The health hazard is mostly multi-systemic, but the respiratory system is affected the most. Gasoline fumes when inhaled into the respiratory tract, fine particles travel down into the distal airway and alveolar space of the lungs. This primarily results in direct damage to the respiratory epithelium and impairment of the mucociliary function with consequent reduction in the clearance of foreign materials from the respiratory tract. Shorter exposure results in disorientation, crumpling and loss of cilia with bleeding and superficial epithelial erosion. Prolonged toxic exposure results in severe injury with necrosis and sloughing of the epithelium [10] [12].

Assessment of Lung function can be performed by estimation of peak expiratory flow rate (PEFR), forced vital capacity (FVC), and forced expired volume in the first second (FEV1), it is primarily used to screen individuals for suspected lung disease [13]. High ambient air concentrations of gasoline vapour pollutants

have a well-defined and marked pulmonary inflammatory response with decreased forced vital capacity (FVC), Forced expiratory volume in the first second (FEV1) and peak expiratory flow rate (PEFR) [6]. Lung function tests have been of increasing interest in their use for quantitative evaluation of pulmonary function in patients with abnormalities of the cardio-respiratory system [14].

Disproportionate reduction in the FEV1 as compared to the FVC (and therefore the FEV1-to-FVC ratio) is the hallmark of obstructive lung diseases while reduction in the FVC with a normal or elevated FEV1-to-FVC ratio should trigger further diagnostic workup to rule out restrictive lung disease. Because the FEV1 is a fraction of the FVC, it also is reduced, but the FEV1-to-FVC ratio is preserved at a normal or elevated level. Measuring the Total Lung Capacity (TLC) and residual volume (RV) can confirm the restriction suggested by spirometry [15].

Following an epidemiological study conducted in Bhopal City, India, the adverse effect of gasoline fumes was mainly on the lower airway with a restrictive pattern of disease [16]. In a study conducted by Afolabi *et al.* [17] where one hundred and eleven men were randomly selected, the data collected suggested an obstructive pattern of disease. An epidemiological study by Mauderly [18] also observed that prolonged gasoline fumes and exhaust exposure can lead to impairment in lung function with an obstructive pattern among gasoline pump attendants.

There is limited data in south-south Nigeria on the effect of gasoline fumes on gasoline attendants, as such this study seeks to assess the pattern of lung impairment among petrol pump workers to make data available for policy formulation and for better health practices among workers from research-based findings.

2. Methodology

A cross-sectional analytical study was carried out in Esan West Local Government Area of Edo state, south-south Nigeria. The study duration was six months from December 2015 to May 2016. Esan West LGA has an area of about 502 Km^2 with its headquarters at Ekpoma where the State University—Ambrose Ali University is located. It also has an official post office, several banks and educational institutions [19].

As revealed by the March 2006 census, the population of Esan West LGA was 127,718. With an average of four gasoline attendants per station, a total of 200 gasoline pump attendants were estimated for the fifty gasoline filling stations in Esan West Local Government Area [20].

Using Cochran's formula [21], the estimated sample size was one-hundred and thirty-three. A multi-stage random sampling method was used to select the control subjects. There are ten wards in Esan West local government area. In every ward, balloting was done to choose seven (7) streets. One respondent was therefore sampled from every two houses in a street. Two respondents were chosen from each street. A total of fourteen (14) respondents were sampled from each ward giving a total of one hundred and forty (140) controls from the ten wards.

The subjects for this study were also chosen using a multi-stage sampling technique. The register of the Independent Petroleum Marketers Association of Nigeria, Esan West LGA branch was used to determine the total number and location of gasoline stations within the Local Government [20]. Forty-five gasoline stations were selected from fifty gasoline stations within the local government area using a random sampling method (balloting). Using the random sampling method, three gasoline pump workers were selected from each of the forty-five gasoline stations making a total of one hundred and thirty-five subjects, which was made up to one hundred and forty to match up with the control group.

Questionnaires were administered to the respondents using a modified version of a standard structured questionnaire; the American Thoracic Society Division of Lung Disease Questionnaire 1978 (ATS DLD-78) [22]. The questionnaire was used to collect data through face-to-face interviews by the research assistants on the socio-demographic characteristics of the respondents, work history, mode of exposure and duration of exposure to gasoline, periodic medical assessment of the gasoline pump attendant's respiratory function and use of personal protective equipment.

Anthropometric data (height in meters, weight in kilograms, waist and hip circumference in centimetres and body mass index in kilograms per meter square) was measured using the WHO step-by-step measurement of anthropometric data [23]. The values that were used for this study to define obesity using body mass index and waist-hip ratio were values greater or equal to 30 kg/m^2 for body mass index, 0.9 and 0.85 for males and females respectively using waist-hip ratio [23].

The Peak Expiratory Flow (PEF), Forced Expiratory Volume in one second (FEV1), Forced Vital Capacity (FVC), FEV1/FVC and FEF25% - 75% were assessed and recorded. Predicted percentage values of ≥80% for forced vital capacity and forced expiratory volume in one second and FEV1/FVC ratio of ≥0.7 was considered as cutoff points. A forced expiratory volume in one second <80% and FEV1/FVC < 70% was used to define obstructive lung disease, restrictive lung disease was defined as forced vital capacity <80% and FEV1/FVC ratio of >70% while a mixed pattern of disease was defined as forced vital capacity (FVC) <80% and (FEV1/FVC) < 80% [24] [25].

Anthropometric measurements, spirometric readings and data collected using an interviewer-administered questionnaire were collated and analyzed using the International Business Machines Statistical Product and Service Solutions (IBM-SPSS) version 22 [26]. Data were presented using tables and pie charts. Frequencies and percentages were used to present categorical data such as sex, marital status, and level of education. Categorical variables were compared using Pearson's Chi-square (x2) and a p-value less than 0.05 was considered statistically significant.

The mean and standard deviations of continuous variables such as age, weight, height, body mass index, waist-hip ratio, duration of exposure, FEV1, FVC, FEV1/FVC, PEFR, FEF25% - 75% were calculated and compared using the

student's t-test. The p-values of these variables were calculated and a p-value < 0.05 was considered statistically significant.

3. Results

3.1. Social Demographic Characteristics of the Sample Population

A total of two hundred and eighty eligible people were sampled in this study which consisted of one hundred and forty gasoline pump attendants and one hundred and forty controls.

In Table 1, the mean value of the ages of gasoline pump attendants and control groups were 24 ± 3.1 years and 23 ± 2.8 years respectively, the difference was not statistically significant ($p > 0.05$). Ninety-six (68.6%) were females and forty-four (31.4%) were males among the gasoline pump attendants and the control shows that eighty-six (61.4%) were females and fifty-four (38.6%) were males which was not statistically significant though there were more females than males among the gasoline pump attendants and the control. One hundred and eleven (79.3%) gasoline pump attendants were single and twenty-nine (20.6%) were married, while ninety-eight (70%) were singles and forty-two (30%) were married among the controls. There were more singles among the gasoline pump attendants and controls as observed in this study.

Table 1. Demographic variables of respondents (n = 140).

Variables	Gasoline pump Attendant n (%)	Control n (%)	Statistical test*
Age			
Mean ± SD	24 ± 3.1	23 ± 2.8	t = 12.2 p = 0.123
15 - 19	5 (3.6)	3 (2.1)	
20 - 24	75 (53.6)	92 (65.7)	
25 - 29	54 (38.6)	39 (27.9)	
30 - 34	4 (2.9)	3 (2.1)	
35 - 39	2 (1.4)	3 (2.1)	
Sex			
Male	44 (31.4)	54 (38.6)	$x^2 = 7.20$ p = 0.750
Female	96 (68.6)	86 (61.4)	
Marital Status			
Single	111 (79.3)	98 (70)	$x^2 = 5.20$ p = 0.301
Married	29 (20.7)	42 (30)	
Level of Education			
Primary	3 (2.2)	2 (1.4)	$x^2 = 23.10$ p = 0.101
Secondary	99 (70.7)	56 (40)	
Tertiary	38 (27.1)	82 (58.6)	

*Significant statistics at $P < 0.05$.

Three (2.1%) had a primary level of education, ninety-nine (70.7%) had a secondary level of education while thirty-eight (27.1%) had a tertiary level of education among the gasoline pump attendants while the educational level for the controls was primary, secondary and tertiary with their respective value of two (1.4%), fifty-six (40%) and eighty-two (58.6%) respectively which were not statistically significant compared to the gasoline pump attendants.

3.2. Anthropometric Parameters of the Sampled Population

Table 2 shows the anthropometric parameters as observed in this study. The mean values of weight were higher in the gasoline pump attendants than the controls, with the values being 70.1 ± 5.0 kg and 68.9 ± 6.4 kg respectively though the difference was not statistically significant (p = 2.30). The mean values of the height of gasoline pump attendants and control were 168.9 ± 6.5 cm and 167.6 ± 5.0 cm respectively and the difference was not statistically significant (p = 0.06).

The body mass index for gasoline pump attendants showed that one hundred and four (74.3%) were normal, twenty-two (15.7%) were overweight, four (2.9%) were underweight and ten (7.1%) had obesity. The body mass index for control shows that ninety-eight (70%) were normal, thirty-four (24.3%) were overweight, six (4.3%) were underweight and two (1.4%) had obesity. The body mass index of both the gasoline pump attendants and controls was not statistically significant (p = 0.123).

Table 2. Anthropometric parameters of sampled population.

Parameters	Gasoline pump Attendant Mean (±SD)	CONTROL Mean (± SD)	Statistical test*
WEIGHT (KG)	68.9 ± 6.4	70.1 ± 5.0	t = 8.40 p = 0.230
HEIGHT (CM)	168.9 ± 6.5	167.6 ± 5.0	t = 16.10 p = 0.060
Body Mass Index			
<18	4 (2.9%)	6 (4.3%)	
18 - 24.9	104 (74.3%)	98 (70%)	t = 12.20
25 - 29.9	22 (15.7%)	34 (24.3%)	p = 0.103
≥30	10 (7.1%)	2 (1.4%)	
Waist-hip Ratio			
Female	n = 96	n = 86	
≤0.85	78 (81.3%)	76 (88.4%)	t = 14.10
>0.85	18 (18.8%)	10 (11.6%)	p = 0.113
Male	n = 44	n = 54	
≤0.90	38 (86.4%)	48 (88.9%)	t = 14.40
>0.90	6 (13.6%)	4 (2.9%)	p = 0.123

*Significant statistics at p value < 0.05.

The waist-hip ratio for females greater than 0.85 among the gasoline pump attendants was observed to be higher than the controls, the mean value being eighteen (18.8%) and ten (11.6%) respectively. For the males among the gasoline pump attendants waist-hip ratio of greater than 0.9 were observed in six (13.6%) and control in four (2.9%). The differences observed in both females and males were not statistically significant.

3.3. Exposure to Gasoline Fumes by Gasoline Pump Attendants

Table 3 shows that the mean duration of exposure to petrol fumes was 2.6 ± 1.1 years. Twenty-two (15.7%) of the gasoline pump attendants were exposed for less than a year, forty-eight (34.3%) were exposed for two years, forty-one (29.3%) were exposed for three years and nineteen (13.6%) were exposed for four years while ten (7.1%) were exposed for greater than five years.

Figure 1 shows that fifty-five (39.3%) respondents were aware of the effect of exposure to gasoline fumes and eighty-five (61%) of the respondents had no knowledge of the effect of exposure to gasoline fumes.

Mean (±SD) duration of exposure = 2.6 ± 1.1.

Table 3. Duration in years of exposure of gasoline pump attendants to gasoline fumes.

Duration in years	Frequency (%)
≤1	22 (15.7)
2	48 (34.3)
3	41 (29.3)
4	19 (13.6)
≥5	10 (7.1)

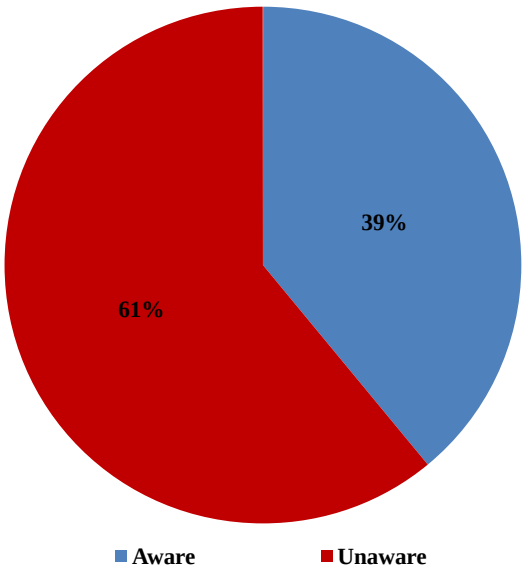

Figure 1. Awareness of knowledge of the effect of exposure to gasoline fumes.

3.4. Lung Function Test Pattern among Respondents

Table 4 shows the lung function parameters among the sampled population.

The mean PEFR of gasoline pump attendants was 496 ± 24.12 L/mins which was significantly reduced when compared to the control which was 543 ± 18.6 L/mins (p = 0.001).

The FVC of gasoline pump attendants compared to the control with the mean values of 3.09 ± 0.71 L and 3.39 ± 0.93 L (p =0.003) was significantly reduced.

The FEV1 for the gasoline pump attendants was 2.76 ± 0.68 L which was significantly reduced when compared to control 3.04 ± 0.88 L (p = 0.003).

The FEV1/FVC for gasoline pump attendants was also observed to be significantly reduced than the control with their respective values being 86.18% ± 15.81% and 90.89% ± 21.16% (p = 0.036).

The FEF 25 - 75 for the gasoline pump attendants and control also shows a significant reduction in their respective values of 3.01 ± 0.73 L/Sec and 4.28 ± 0.84 L/Sec (p = 0.001).

3.5. Lung Function Impairment among Sampled Population

Table 5 shows the pattern of lung impairment among the respondents. The lung function impairment among gasoline pump attendants was an obstructive and restrictive pattern with predominantly restrictive impairment accounting for thirty-nine (27.9%) while an obstructive pattern was found in twelve (8.6%). The control group also shows predominantly restrictive pattern twelve (8.6%) and obstructive four (2.9%) respectively. No mixed pattern of lung impairment was observed in this study. The gasoline pump attendants showed that eight-nine (63.6%) had normal lung function while the control group showed one hundred and twenty-four (88.6) with normal lung function.

Table 4. Mean of measured lung functions of gasoline pump attendants and controls.

PARAMETERS	MEAN ± SD		STATISTICAL TEST
	Gasoline pump Attendant (n = 140)	Control group (n = 140)	
PEFR (Litres/mins)	496 ± 24.12	543 ± 18.60	t = 18.21 p = 0.001*
FEV1 (Litres)	2.76 ± 0.68	3.04 ± 0.88	t = 2.98 p = 0.003*
FVC (Litres)	3.09 ± 0.71	3.39 ± 0.93	t = 3.03 p = 0.003*
FEV1/FVC (%)	86.18 ± 15.81	90.89 ± 21.16	t = 2.11 p = 0.036*
$FEF_{25\% - 75\%}$L/Sec	3.01 ± 0.73	4.28 ± 0.84	t = 13.5 p = <0.001*

*Significant statistic at p value < 0.05.

Table 5. Lung function impairment among respondents.

Lung function impairment	Gasoline pump attendant n = 140	Control n = 140	Statistical test*
Normal	89 (63.6%)	124 (88.6%)	$x^2 = 24.05$
Restrictive	39 (27.9%)	12 (8.6%)	P = 0.001
Obstructive	12 (8.6%)	4 (2.9%)	

*Significant statistic at $P < 0.05$.

4. Discussion

Exposure to gasoline fumes is associated with serious health problems of which the respiratory system is one of the major organs affected, not only in those working in gasoline stations like the gasoline pump attendants but also in other people who live near or commute to work through such routes [27]. Occupational health has been gaining importance for the fact that long-term exposure to pollution can lead to permanent morbidity. The acute health risks involved are minimal provided that the products are used under appropriate health and safety practices. Gasoline pump attendants are liable to inhale not only the product in the gasoline fumes but also the product emitted from the car engine.

Female gasoline pump attendants were more than male pump attendants in this study. This was noticed to be in contrast to what was observed in the study done by Adeniyi *et al.* [28], in South-West Nigeria, where males were more than females among the gasoline pump attendants. This may be due to the fact that more females were working as gasoline pump attendants at the time of conducting this study compared to the study by Adeniyi *et al.* [28]. Bearing in mind the fact that this study was conducted in a rural environment where government establishments and private companies are limited, the males were more into farming, transportation and commercial bike riding. This perhaps resulted in more females seeking jobs as petrol pump attendants.

It was observed that there were no significant differences in the anthropometric parameters, body mass index and waist-hip ratio among the gasoline pump attendants when compared to the control group. Similar results were observed by Sandip *et al.* [29].

The lung functions test among the gasoline pump attendants showed a significant reduction in the PEFR, FVC, FEV1, FEV1/FVC and FEF25 - 75 when compared to the control group. These findings are in agreement with previous studies done in Nigeria by Akor-Dewu *et al.* [30] and Adeniyi *et al.* [28] who also reported a reduction in PEFR, FVC, FEV1 and FEV1/FVC. Sofola *et al.* [31] who did a study on the peak expiratory flow rate of gasoline pump attendants in Nigeria observed a significant reduction in the peak expiratory flow rate which was similar to the reduction in PEFR in this study, however, Ezejindu *et al.* [32] who did a similar study among thirty exposed workers to gasoline fumes found that there was no significant difference in the peak expiratory flow rate. They attributed their observation to the smaller sample size used in their study when they

compared their findings to the study done by Sofola *et al.* [31].

The lung impairment observed among gasoline pump attendants was both restrictive and obstructive, however restrictive pattern was more predominant than the obstructive pattern in this study. This was in keeping with the findings of Kesavachandran *et al.* [33] and Madhuri *et al.* [6]. However, Adeniyi *et al.* [28] and Begum [34] observed only restrictive lung impairment while Afolabi *et al.* [17] observed an obstructive pattern of lung impairment. The difference may be due to the smaller sample size used by the various studies compared to this study and the studies done by Kesavachandran *et al.* [33] and Madhuri [6], as a larger sample size, would have yielded a better result representative of the study population by increasing statistical power. The sample size for gasoline pump attendants in this study was one hundred and forty while kesavachandran *et al.* [33] used two hundred and thirty in their study unlike Afolabi *et al.* [17] who studied seven-five exposed and Adenyi *et al.* [28] who also studied ninety-nine exposed workers.

We expected normal spirometric findings among the controls but we found impaired lung functions in a few of them; both restrictive and obstructive patterns. The fact that most of the control was either farmers or commercial motorbike riders, we consider the findings not to be unusual since they are exposed to exhaust fumes and smoke from bush burning. In Nigeria, a lack of standardized protocols exists concerning the number of petrol pumps present in a given geographical region, the quantity of personnel employed at specific petrol stations, the timeframe surrounding work shifts, as well as the implementation of personal protective measures. All of these facets require careful attention to ensure the occupational health and safety of workers employed at gasoline stations.

Limitation of the study: The study was unable to quantify the exact level of suspended and respirable particulate matter within the various filling stations studied. Contribution to lung disease from exposure to biomass at home during cooking and childhood diseases was difficult to completely rule out.

5. Conclusion

This study had shown that prolonged exposure to gasoline fumes by gasoline pump attendants resulted in a significant reduction of their lung functions such as PEFR, FVC, FEV1, FEV1/FVC, and FEF25 - 75 when compared to the control group. This study also showed impairment of lung function, with more restrictive than obstructive patterns. The recommendations from this study were that health education be given to gasoline pump attendants to raise awareness of the health hazards of gasoline and that its prevention should be part of pre-employment and on-the-job training. Also, a policy on self-service in gasoline stations should be enforced in the country to prevent gasoline pump attendants from constant exposure to gasoline fumes. More studies on lung function and respiratory symptoms among gasoline pump attendants should be encouraged because there is a paucity of such data in Nigeria. This will be important for the generation of a

large database for policy-making concerning the health of gasoline pump attendants.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix 1

QUESTIONNAIRE ON ASSESSMENT OF RESPIRATORY FUNCTION AMONGST PETROL PUMP WORKERS IN ESAN WEST LOCAL GOVERNMENT AREA

Interviewer _____

Questionnaire No_____

1) Age (years) _____

2) Sex: a) Male b) Female

3) Marital status: a) Single b) Married c) Widowed d) Separated/Divorced

4) Level of Education: a) None b) Primary c) Secondary d) Tertiary

5) Occupation: a) Petrol attendant b) Non petrol attendant. Please specify____

6) Have you ever worked full time for 6months or more in a service station a) Yes b) No

IF YES, in what capacity

a) Petrol attendant b) vulcanizer c) storekeeper d) others (specify) _____

6a) Total years worked _____

7) Have you ever worked for a year or more in a dusty job

a) If yes specify job _____

b) In what capacity? _____

c) Total years worked _____

8) Have you ever been exposed to petrol fumes in your work a) Yes b) No

IF YES, Mode of exposure;

a) Inhalation i) Yes ii) No

b) Skin contact i) Yes ii) No

c) Ingestion i) Yes ii) No

9) Did you have any pre-employment medical assessment a) Yes b) No

If yes, what type?_____

10) Do you receive any periodic medical assessment a) Yes b) No

If yes, what type_____

10a) How often_____

11) Do you cough a) Yes b) No

12) Do you cough for as much as 4 to 6 times a day or more days of the week. a) Yes b) No

13) Have you had periods or episodes of increased cough and phlegm lasting for 3weeks or more each year a) Yes b) No

14) Have you had periods or episodes of increased catarrh lasting for 3weeks or more each year a) Yes b) No

IF YES, Do you have any episodes of chest pain in addition to catarrh and cough a) Yes b) No

15) Do you usually bring up phlegm from your chest a) Yes b) No

16) Do you usually bring up phlegm like this as much as twice a day on more days of the week a) Yes b) No

17) Does your chest ever sound wheezy or whistling

a) When you have cold i) Yes ii) No

b) When on duty i) Yes ii) No

c) When off duty i) Yes ii) No

d) Mostly during the day i) Yes ii) No

e) Mostly during the night i) Yes ii) No

18) Have you ever had an attack of wheezing that has made you feel short of breath a) Yes b) No

19) Have you ever been diagnosed of respiratory disease a) Yes b) No

IF YES, AT WHAT AGE?_____

WHICH DISEASE_____

20) Have you ever smoked cigarette a) Yes b) No

*(*No means*: Adult who have never smoked a cigarette or who smoked fewer than 100 cigarette in their lifetime) [42]

a) If yes, how many sticks a day_____ b) How long _____

21) Do you take alcohol a) Yes b) No

a) If yes which type _____ b) Quantity_____

c) How long have you been drinking _____

22) Do you know about personal protective equipment a) Yes b) No

23) Do you use personal protective equipment a) Yes b) No

23a) If yes, which one(s) _____

24) Do you think that exposure to petrol has any adverse effect on your health? a) Yes b) No

25) If yes please list the ones you know_____

26) Spirometric readings

	READING 1	READING 2	READING 3
FEV1			
FVC			
FEV_1/FVC			
PEFR			
FEF 25% - 75%			

27) Anthropometric readings

HEIGHT (metres)	
WEIGHT (kg)	
BODY MASS INDEX (Kg/m^2)	
WAIST CIRCUMFERENCE (cm)	
HIP CIRCUMFERENCE (cm)	
WAIST HIP RATIO	