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The Burden of Respiratory Symptoms Amongst Petrol Pump Attendants in Southern Part of Nigeria; A Cross-Sectional Controlled Study

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Abstract
Background: *The nature and safety of the occupational environment is important for the health of those who work in those environments. In environments with exposure to pollutants, the longer the duration of exposure to the noxious agents, the more health hazard it causes. Occupational exposure to petrol fumes may consequently lead to acute and chronic respiratory diseases as well as possible carcinogenesis.*
Objective: *To determine the pulmonary symptoms resulting from exposure to petrol fumes in petrol filling station workers.*
Methods and Materials: *A cross-sectional study was carried out. Two hundred and eighty eligible and consenting respondents participated in this study. This study was carried out in Esan West Local Government area in Edo State, Nigeria from June to November 2015. A questionnaire was used to obtain information on demographic characteristics, work history, mode of exposure and duration of exposure to petrol fumes, respiratory symptoms and use of personal protective equipment. Lung function was assessed using a DTspiro spirometer (Model POP - 10. Serial no 110843-005); 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 criterion of significant association was assumed for 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. Respiratory symptoms like cough, catarrh, sputum production, wheeze and chest pain, however catarrh was the predominant and statistically significant when compared to other symptoms observed among the control group.*
Conclusions: *This study observed the presence of respiratory symptoms and among petrol pump attendants when compared to the control group.*
Keywords: *petrol pump attendants, respiratory symptoms, pollution, southern, Nigeria, occupational hazard.*

Introduction

Everyone is a potential victim of pollution and its consequences, especially in the 21st century. Pollution could be in the form of flood, extremes of heat and cold, acid rain, air pollution or global warming[1]. Exposure to air pollution has been known to cause severe health hazards especially in urban areas where pollutant levels are very high[2]. Most automobiles in the world and even in Nigeria use petrol or diesel as fuel. Air pollutants derived from automobile exhaust is one of the major causes of air pollution especially in the urban areas and cities where automobile use is the order of the day. This has become a matter of concern[3].

Petrol also known as gasoline is a complex combination of hydrocarbons. It is mostly composed of alkanes, alkenes, isoalkanes, cycloalkanes and benzene. This composition however varies widely depending on the crude oil used and the refining process available. About 95% of components in petrol vapour are aliphatic compounds and less than 2% are aromatic. The component hydrocarbon of gasoline is a major source of pollution in various occupational settings [4,5]. The possibility of inhaling these toxic substances increases with ascending use of gasoline and gasoline products, thus increasing systemic complications, particularly in the respiratory tract. Evidence has also shown that adverse health effects are linked with dose-dependent exposure to volatile organics including benzene in fuel[6].

Individuals who work in the oil and gas industry are particularly exposed to petrol and petrol fumes and hence at risk of health hazards. Using personal protective equipment in the workplace can also help reduce the risk of health hazards.

However, a certain group of workers like petrol pump attendants in petrol filling stations by virtue of their occupation, are exposed to pollutants from automobile exhaust and fuel vapours and consequently face an increased threat to their health[1]. The decline in lung function may result from the synergist effect of automobile exhaust vapour and petrol fumes[7]. In urban environments, where ultrafine particles are forms of air pollution, motor vehicular emission are the significant source of these pollutant particles[8].

Acute poisoning can lead to death with exposure to high levels of petrol associated with inflammation of the respiratory tract and hemorrhage in the lungs. Various occupational solvents like benzene and atmospheric polluted air are absorbed into the human body either through the respiratory tract or via epidermal contact. These may cause primary respiratory symptoms such as cough, breathlessness and wheeze[9].

Coughing, sneezing, chest pain, dizziness and slurred speech are some of the symptoms exhibited by petrol pump workers who are exposed to petrol fumes which maybe due to benzene toxicity[10]. Petrol station workers also get exposed to gasoline chemicals by skin contact and consumption of food with contaminated hands. The adverse effect of these pollutants depends on several factors including; the dose (amount to which they are exposed), mode of exposure and duration of exposure[11]. Inhaling large quantities of petrol vapor may also cause symptoms like dizziness, unsteadiness and slurred speech; and pneumonitis[12].

Inhalation of petrol fumes primarily results in direct damage to the respiratory epithelium and impairment of the muco-ciliary function, which reduces the clearance of foreign material from the respiratory tract. The extent of the inflammatory response is directly proportional to the dose and duration of the exposure to petrol fumes[7]. Short-term exposure results in disorientation, crumpling and loss of cilia with bleeding and superficial epithelia erosion while prolonged toxic exposure result in severe injury with necrosis and sloughing of the epithelium[13].

Improvement in engine design, soot filters and fuel modification may provide the best approach to control the exposure to these fumes[10].

Materials & Methods

The study was a community-based cross-sectional analytical study which lasted six months. It was conducted in Esan West Local Government Area of Edo State, South-South Nigeria which has an area of about 502 Km^2. Its headquarters is Ekpoma, where

the State University - Ambrose Ali University is located. It also has an official post office, several banks and educational institutions[14].

The population of Esan West L.G.A was 127,718 by March 2006 census. There are fifty petrol filling stations in Esan West Local Government area with an average of four petrol attendants per station bringing it to a total of about 200 Petrol pump attendants[15].

The estimated sample was approximately one hundred and thirty-three. This was obtained using Cochran's formula[16]. A multi-stage sampling technique was used to select the participants of the control sample and subject sample.

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 register of the Independent Petroleum Marketers Association of Nigeria, Esan West LGA branch was used to determine the total number and location of petrol stations within the Local Government. Multi-stage random sampling was used to select the sample used in this study. Forty-five petrol stations were selected from fifty petrol stations within the local government area using a random sampling method (balloting). Using the random sampling method, three petrol pump workers were selected from each of the forty-five petrol 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)[17]. The questionnaire was used to collect data through face to face interview by the research assistants on socio-demographic characteristics of the respondents work history, mode of exposure and duration of exposure to petrol, presence of respiratory symptoms such as cough, catarrh, chest pain, wheezing and breathlessness. Anthropometric data (height in meters, weight in kilograms, waist and hip circumference in centimeters and body mass index in kilograms per meter square) was measured using the WHO step by step measurement of anthropometric data[18].

Anthropometric measurements and data collected using interviewer administer questionnaire were collated and analyzed using the International Business Machines Statistical Product and Service Solutions (IBM- SPSS) version 22[19]. Data were presented using tables and pie charts. Frequencies and percentages were used to present categorical data such as sex, marital status, level of education. Categorical variables were compared using Pearson's Chi-square (X^2) and 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 were compared using the student's t-test. The p values of these variables were calculated and p value < 0.05 was considered statistically significant.

Results

Social demographic characteristics of the Sample Population

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

In Table *1*, the mean value of the ages of petrol pump attendants was 24 ± 3.1 years and the mean value for control was 23 ± 2.8 years, the difference was not statistically significant ($p > 0.05$). Ninety-six (68.6%) were females and forty-four (31.4%) were males among the petrol pump attendants and the control shows that eighty-six (61.4%) were females and fifty-four (38.6%) were males which were not statistically significant though there were more females than males among the petrol pump attendants and the control. One hundred and eleven (79.3%) petrol 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 petrol pump attendants and controls as observed in this study.

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 petrol 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 petrol pump attendants

Table 1: Demographic variables of respondents

Variables	Petrol pump Attendant n (%)	Control n (%)	Statistical test*	P value
Age (Years)				
Mean±SD	24±3.1	23±3.1	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

Anthropometric Parameters of the Sampled Population

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

The body mass index for petrol pump attendants showed that one hundred and four (74.3%) were normal, twenty-two (15.7%) were overweight, four (2.9%) were underweight whereas 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 petrol pump attendants and controls were not statistically significant (p=0.123).

The waist hip ratio for the females greater than 0.85 among the petrol pump attendants were observed to be higher than the controls, the mean value being

eighteen (18.8%) and ten (11.6%) respectively. For the males among the petrol 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.

Table 2: Anthropometric parameters of sampled population

Parameters	PPA 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%)	t=12.20	p= 0.103
18 – 24.9	104(74.3%)	98(70%)		
25 – 29.9	22(15.7%)	34(24.3%)		
≥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	p= 0.113
>0.85	18(18.8%)	10(11.6%)		
Male	n=44	n=54		
≤ 0.90	38(86.4%)	48(88.9%)	t=14.40	p = 0.123
>0.90	6(13.6%)	4(2.9%)		

*Significant statistics at p value< 0.05

Exposure to Petrol fumes by petrol 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 petrol pump attendants were exposed for less than a year, forty-eight (34.3%) exposed for two years, forty-one (29.3%) were exposed for three years and nineteen (13.6%) exposed for four years while ten (7.1%) were exposed for greater than five years.

Table 3: Duration in years of exposure of petrol pump attendants to petrol 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)

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

Figure *1* shows that fifty-five (39.3%) respondents were aware of the effect of exposure to petrol fumes and eighty-five (60.7%) of the respondents had no knowledge of the effect of exposure to petrol fumes.

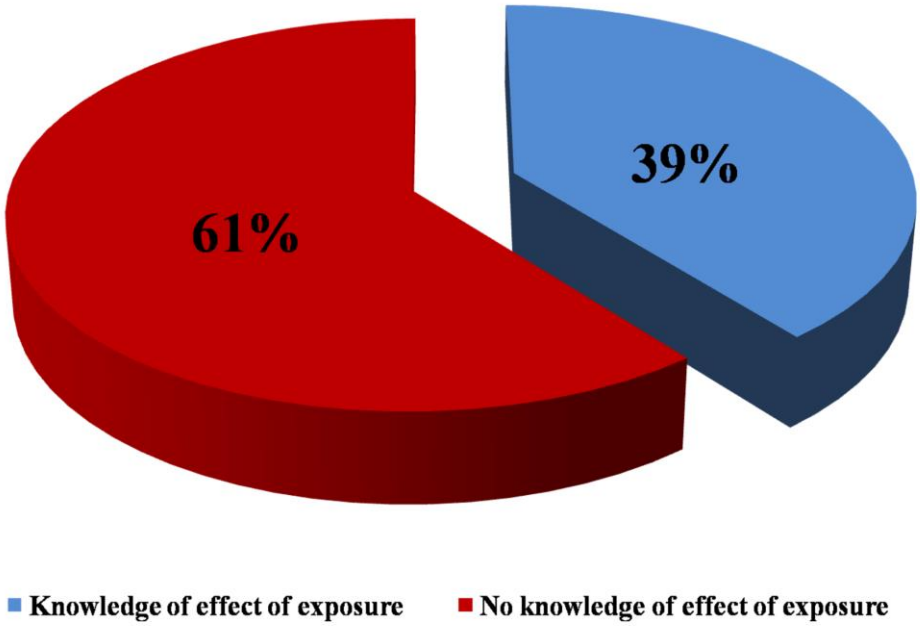

Figure 1: Awareness of effect of exposure to petrol fumes
n =140

Respiratory Symptoms among sampled population

Table *4* Shows analysis of respiratory symptoms among the sampled population. Seventy-two (51%) of the Petrol pump attendants had symptoms and twenty-four (17.1%) of the control had symptoms. The difference was statistically significant ($p<0.05$). The respiratory symptoms observed in this study were cough, catarrh, wheeze and chest pain with predominance of catarrh. The petrol pump attendants that had nonproductive cough were sixteen (11.4%), productive cough were four(2.9%), cough and catarrh were thirteen (9.3%), cough and chest pain were three(2.1%), cough, catarrh and wheeze were six (4.2%), catarrh alone was nineteen (13.6%) and wheeze alone was eleven (7.9%). The controls had similar respiratory symptoms such as nonproductive cough in seven (5%), productive cough in one (0.7%), cough and catarrh in five (3.6%), cough and chest pain in zero (0%), cough, catarrh and wheeze in one (0.7%), catarrh alone was ten (7.1%) and wheeze alone in zero (0%).

Table 4: Respiratory symptoms among sampled population

Symptoms	Petrol pump attendants N=140	Controls N=140	Statistical test	P value
Cough(nonproductive)	16(11.4%)	7(5.0%)	x^2=2.32	p=0.01*
Catarrh	19(13.6%)	10(7.1%)	x^2=2.13	p=0.04*
Wheeze	11(7.9%)	0(0%)	x^2=1.34	p=0.02*
Cough +catarrh	13(9.3%)	5(3.6%)	x^2=3.13	p=0.001*
Cough + sputum	4(2.9%)	1(0.7%)	x^2=2.78	p<0.001*
Cough + chest pain	3(2.1%)	0(0%)	x^2=1.23	p<0.001*
Cough + Catarrh+ wheeze	6(4.2%)	1(0.7%)	x^2=4.12	p<0.001*
No symptoms	68(48.6%)	116(82.9%)		

*Significant statistics at p-value < 0.05

Discussion

Occupational health has gradually become more important due to the fact that long-term exposure to pollution can lead to permanent morbidity. Petrol pump attendants are exposed to products emitted from car engines as well as petro fumes. In short-term exposure, the health risks are minimal provided that the products are used in accordance with appropriate health and safety practices. Health problems of the various body systems particularly the respiratory system are associated with exposure to petrol fumes. Workers in petrol stations like petrol pump attendants as well as people who live near or commute to work through such routes are at risk of these health complications associated with petrol fumes[20].

In contrast to the study carried out by Adeniyi et al[21] in southwest Nigeria, this study observed that there were more females than male petrol pump attendants. They observed that there were more males among the petrol pump attendants. This may have resulted from the possibility that there were more females working as petrol pump attendants in Esan West Local Government at the time of conducting this study compared to the study by Adeniyi et al [21]. Also, this study was done in a rural area where the males in the local Government under study are into farming, transportation and commercial bike riding. This probably left mostly females to seek jobs as petrol pump attendants.

The mean age of petrol pump attendants in this study was 24 ± 3.1 years. This was not in keeping with Adeniyi et al who had a mean age of 30 ± 3.1 years in their study[21]. The difference in mean age may be due to social factors in the area under study. The job for most youths in the study area is seen as temporary job while awaiting admission into higher institutions for several reasons including lack of funds. Parental support due to poverty may be lacking and so while waiting for better jobs, they make do with what is available. However, the influence of gender and age on occupational exposure to petrol fume in this study were not significant, similar findings was observed in a study conducted by Sofola et al[22].

It was observed that there were no significant differences in the anthropometric parameters, body mass index and waist hip ratio among the petrol pump attendants when compared to the control group. Similar results were observed by Sandip et al[23].

This study observed that the frequency of respiratory symptoms was significantly more in petrol pump attendants than control group. Adeniyi et al[21], as well as Hadnagy and Seemayer[24] also observed in their studies that the frequency of respiratory symptoms was more in exposed workers when compared to the control.

The predominant symptoms observed were catarrh (13.68%) and cough (11.4%), which was in agreement with studies done by Mauderly et al [25] and Adeniyi et al [21]. The respiratory symptoms may had resulted from the effect of the petrol fume which can cause direct damage to the respiratory epithelium and impairment of the mucocillary function[3].

Conclusions

The respiratory symptoms associated with petrol pump attendants observed in this study were cough, catarrh; wheeze and chest pain however catarrh was the most predominant symptom among them. Health education should be given to petrol pump attendants, to raise awareness of the health hazards of petrol and its prevention should be part of pre-employment and on-the-job training. Also, control modalities should be put in place to reduce to the barest minimum the fumes concentration in the air, like catalytic converters and vapour absorbent.

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