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Cardiopulmonary Adjustments in Filling Station Pump Attendants in Port Harcourt

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Abstract **Original Research Article**

In order to understand and possibly educate petrol station pump attendants on the associated workplace dangers, related health issues, and safety practices while working, the current study set out to unravel the possible cardiopulmonary adjustments occasioned by the petrol station pump attendance service amongst subjects from Port Harcourt Metropolis The selection tools of purposive/snowball sample size techniques were adopted to recruit participants of this study. Exactly 60 consenting subjects were recruited for the study, making up 30 petrol station pump attendants and 30 non-petrol station pump attendants. Quantitative data obtained from the study were statistical screened using suitable tools of the IBM Statistical Product and Service Solutions (SPSS) version 25.0. The present study revealed that, the socio-demographic profile of male filling station pump attendants (F-S-P-A) in Port Harcourt had non-significantly ($p>0.05$) increased systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) when compared to their other counterparts. Further, the ECG evaluation of the subjects showed comparatively reduced normal sinus rhythm but higher prevalence of abnormal ECG manifestations which amongst others include clockwise QRS Rotation (30%); right ventricular hypertrophy (23.33%) and left ventricular hypertrophy (13.33%) for the F-S-P-A subjects. The study also found that that FVC, FEV1 and FEV6 values that were significantly ($p<0.05$) decreased in the F-S-P-A subjects when compared to the non- F-S-P-A subjects. In conclusion, the petrol station pump attendance service amongst the surveyed subjects in Port Harcourt may have exerted risk-ladened adjustments in their cardiopulmonary profile; thus the need for caution over their health.

Keywords: Occupational health risk; cardiopulmonary profiles; petrol pump attendants; Port Harcourt.

INTRODUCTION

The issue of health risk assessment and promotion intervention that could potentially reach a wide range of working population at different workplaces is of great importance (Burton, 2010). Such investigations or programs can lower the risk factors for chronic health conditions among employees (Tin *et al.,* 2016), protect their health, and ultimately increase their productivity (Damman *et al.,* 2014). Importantly, the continual monitoring of workplace safety and condition can serve as important motivators or catalysts for workers who might not otherwise get health examinations elsewhere. This is especially important for personnel at high-risk prone workplaces, who could be less informed and aware of health hazards (Burton, 2010).

In the light of the foregoing, a typical case study could be the pump attendants at petrol filling stations (Monney *et al.,* 2015; Ogunkoya *et al.,* 2021). At the petrol station, the pump attendants dispense fuel to all who patronizes such facilities. This, of course, predisposes the petrol station pump attendants to continual contact and inhalation of fuel fumes. Expectedly, this presents such personnels to a number of health risks and challenges (Naik, 2020; Adekunle *et al.,* 2023). More so, fuel service stations have proliferated and are now commonplace in urban areas all over the nation. In addition to offering the general public quick accessible retail locations for fuel,

the growth of these stations has helped to create more jobs (Blamah *et al.,* 2012; Šafranić *et al.,* 2017). However, there are serious challenges with such services' safety and health regulations in our locale (Monney *et al.,* 2020).

Indeed, petrol is made up of a complex mixture of hydrocarbons such as benzene, toluene, ethyl benzene, and xylene (BTEX), the most hazardous substances for humans among the many components of petroleum products, are found in petrol (Anigilaje *et al.,* 2024). Workers may be exposed to these volatile and lipophilic substances by ingesting, inhalation, or skin contact. These exposures are sneaky and are often times, unintentional (Thomas *et al.,* 2020; Chijioke, 2020).

In order to understand and possibly educate petrol station pump attendants on the associated workplace dangers, related health issues, and safety practices while working, the current study set out to unravel the possible cardiopulmonary adjustments occasioned by the petrol station pump attendance service amongst subjects from Port Harcourt Metropolis

MATERIALS AND METHODS

Study Design

The study adopted a cross-sectional approach to survey the subjects on the nature of cardiopulmonary profile adjustments in petrol station pump attendants. Consistent with the earlier report of Tamuno-Opubo *et al.,* (2025), such approach is sufficient to achieve the set objectives of the study.

Study Area

Port Harcourt is the capital and largest urban area in Rivers State, Nigeria. It is noted as the 5th largest sub-population in the country, after Lagos, Kano, Ibadan and Benin. It lies along the Bonny River and is located in the Niger Delta. As of 2016, the Port Harcourt urban area had an estimated population of 1,865,000 inhabitants, up from 1,382,592 as of 2006 (Arizona-Ogwu, 2011; Yoade & Adeyemi, 2020). The population of the metropolitan area of Port Harcourt is almost twice its urban area population with a 2021 United Nations estimate of 3,171,076.

Study Population

The study population consists of Petrol station attendants located at any Filling Station in Port Harcourt Metropolis, Rivers State.

Sample Size and Sampling Methods

Considering the nature of the study population and associated limitations involved in determining a exact population, the purposive and snowball sample size determination tools were adopted. In all, a total of 30 petrol station pump attendants were recruited across the Port Harcourt Metropolis into the study with 30 control subjects.

Eligibility Criteria

The inclusion criteria for the study were limited to petrol station pump attendants in Port Harcourt Metropolis between the ages of 18 and 50 years and those who have been working in a filling station for over a year and above. The exclusion criteria were individuals with a known history of cardiovascular diseases (e.g., heart disease, stroke) and subjects with pre-existing respiratory or cardiovascular conditions such as asthma, chronic obstructive pulmonary disease (COPD), coronary artery disease, or hypertension.

Methods of Data Collection

The investigation considered health status, duration of exposure and other demographic information. Trained and skilled research assistants were used to administer the questionnaire and obtain measurements and samples from the study participants. Following issuance of consent by the study participants, blood samples were got from the antecubital vessel by phlebotomists, by means of standard procedures.

Methods of Data Analysis

Quantitative data got from the study participants were statistically screened using version 25.0 of the IBM Statistical Product and Service Solutions (SPSS) software. Statistical significance was done using one-way analysis of variance (ANOVA) and then followed by post-Hoc LSD multiple comparison test. A P-value less than 0.05 were taken to be statistically significant.

Ethical Consideration/Informed Consent

The Research Ethics Committee of the Department of Human Physiology, Faculty of Basic Medical Sciences, Rivers State University, Nigeria as well as other relevant civic agencies gave approval for the present study. Consent letter were obtained from the study participants prior to their inclusion to the study.

RESULTS

Figure 1 shows the age distribution of male filling station pump attendants (F-S-P-A) and their non-filling station pump attendants (Non-F- S-P-A) counterparts in Port Harcourt.

The mean age of the male Non- F- S-P-A was found to be 28.16 ± 4.73 while that of the F- S-P-A was 35.12 ± 8.73. The data on Figure 4.2 shows the body mass index (BMI) changes between F-S-P-A and Non-F-S-P-A in Port Harcourt. The mean BMI of the male Non-F- S-P-A was found to be 30.96 ± 10.20 and that of the F- S-P-A was 20.04 ± 3.32. There was no statistical significance ($p>0.05$) when the mean BMI values of the both groups were compared.

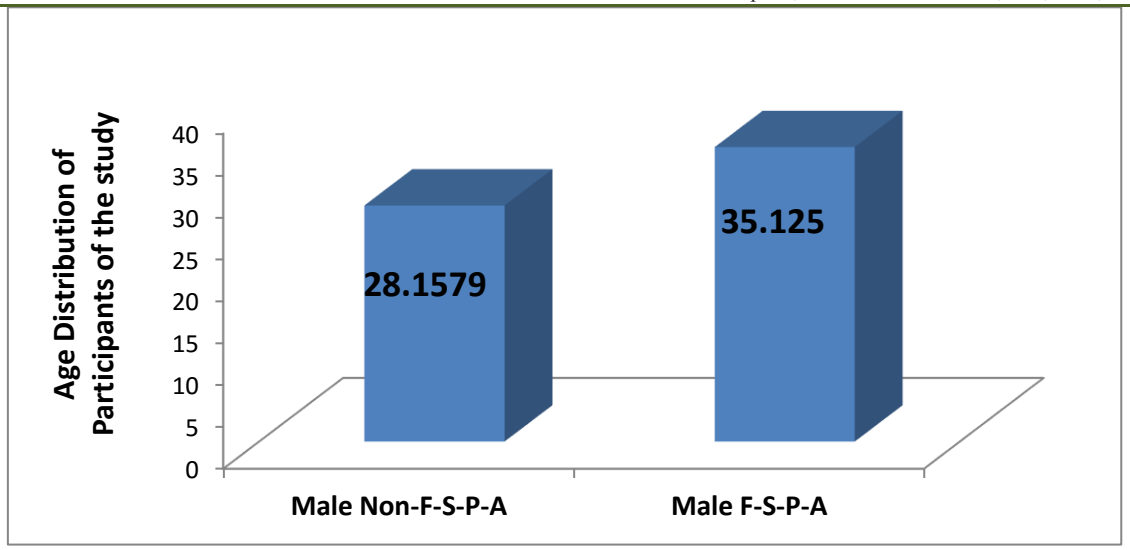

Figure 1: Age Distribution of Participants of the study

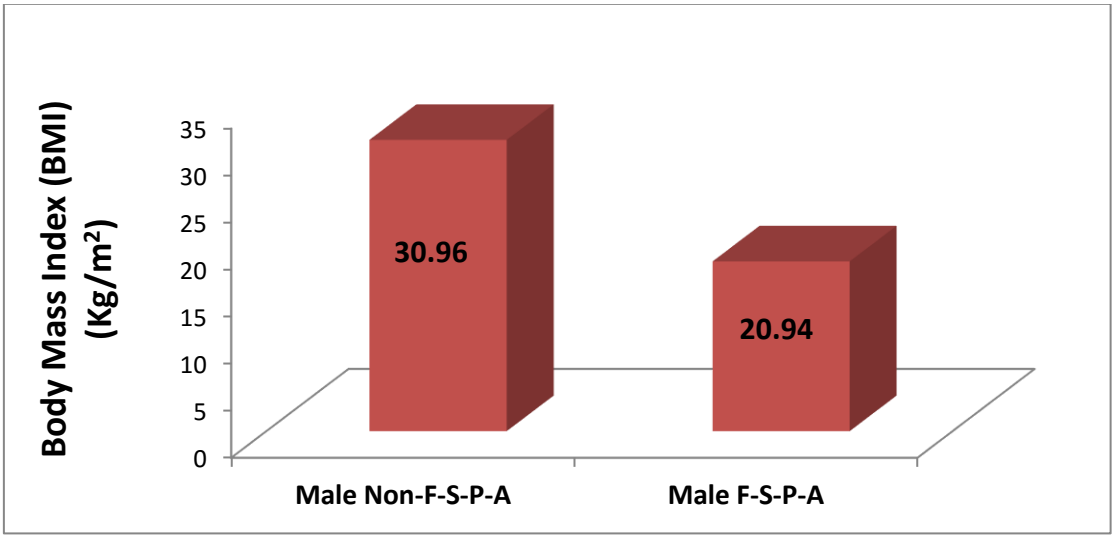

Figure 2: Body Mass Index (BMI) changes between Male Filling Station Pump Attendants (F-S-P-A) and Male Non-Filling Station Pump Attendants (Non-F- S-P-A) in Port Harcourt

Table 1: Comparison of some Cardiovascular Indices between Male Filling Station Pump Attendants (F-S-P-A) and Apparently Normal Male Non- F-S-P- A in Port Harcourt Metropolis

S/N	Parameters	Study Groups	
		Male Non-F-S-P-A (n=32)	Male F-S-P-A (n=30)
1.	SBP	123.74 ± 20.77	127.50 ± 11.83
2.	DBP	76.00 ± 12.31	88.12 ± 8.34
3.	MAP	91.91 ± 14.04	101.17 ± 8.89

Values are expressed as Mean ± SD; *Significant at P<0.05 when F-S-P-A's values were compared to those of Non-F-S-P-A. Note: SBP=systolic blood pressure; DBP =diastolic blood pressure; PR = Pulse rate; MAP = Mean arterial blood pressure; FVC = forced vital capacity; FEV1 = forced expiratory volume in 1 second; PEF = expiratory flow rate.

On Table 1 is displayed the outcome on the comparison of some cardiovascular indices between male filling station pump attendants (F-S-P-A) and apparently normal male non- F-S-P-A in Port Harcourt Metropolis. There were non—significant (p>0.05) increases in the mean levels of SBP, DBP and MAP of the male filling station pump attendants (F-S-P-A) when compared to those of their non- F-S-P-A counterparts. This result reveals the tendency of the speed boat drivers to possibly present with hypertension.

Table 2: Changes in Heart Rhythm of the Study Participant

S/N	ECG Findings on Heart Rhythm	Study Groups	
		Male Non-F-S-P-A (n=32) [Frequency (%)]	Male F-S-P-A (n=30) [Frequency (%)]
1.	Normal sinus rhythm	32(100)	13(43.33)
2.	Septal Ischemia	-	1(3.33)
3.	Lateral Q wave abnormality	-	1(3.33)
4.	Clockwise QRS Rotation	-	9(30)
5.	Right Atrial Deviation	-	1(3.33)
6.	Right Ventricular Hypertrophy	-	7(23.33)
7.	Left Atrial abnormality	-	1(3.33)
8.	Hyperacute T waves	-	1(3.33)
9.	Left Axis Deviation	-	1(3.33)
10.	Left Ventricular hypertrophy	-	4(13.33)

(Source: Field Research Data by Researcher).

Table 2 shows the changes in heart rhythm of the study participants

The electrocardiographic findings (ECG) of heart rhythm indicated normal sinus rhythm for 100% of the non-F-S-P-A subjects as against 43.33% of the F-S-P-A subjects.

The most prevalent abnormal ECG manifestations amongst others include clockwise QRS Rotation (30%); right ventricular hypertrophy (23.33%) and left ventricular hypertrophy (13.33%) for the F-S-P-A subjects.

Table 3: Comparison of some Pulmonary Function Indices between Male Filling Station Pump Attendants (F-S-P-A) and Apparently Normal Male Non- F-S-P- A in Port Harcourt Metropolis

S/N	Parameters	Study Groups	
		Male Non-F-S-P-A (n=32)	Male F-S-P-A (n=30)
1.	**FVC (%)**	91.57 ± 5.07	46.24 ± 20.82*
2.	**FEV1 (%)**	88.68 ± 5.84	48.46 ± 18.71*
3.	**FEV6 (%)**	92.46 ± 18.71	46.23 ± 20.24*
4.	**FEV1/FVC ratio (%)**	96.45 ± 4.31	109.95 ± 13.07*

Values are expressed as Mean ± SD; *Significant at P<0.05 when F-S-P-A's values were compared to those of Non-F-S-P-A. Note: SBP=systolic blood pressure; DBP =diastolic blood pressure; PR = Pulse rate; MAP = Mean arterial blood pressure; FVC = forced vital capacity; FEV1 = forced expiratory volume in 1 second; PEF = expiratory flow rate.

The data on Table 3 represents the outcome on the comparison of some pulmonary function parameters between male filling station pump attendants (F-S-P-A) and apparently normal male non- F-S-P-A in Port Harcourt Metropolis.

Virtually all evaluated pulmonary function parameters (FVC, FEV1 and FEV6) values were found to be significantly ($p<0.05$) decreased in the F-S-P-A subjects when compared to the non- F-S-P-A subjects. Only the FEV1/FVC ratio was seen to be significantly ($p<0.05$) raised in the F-S-P-A subjects when compared to the non- F-S-P-A subjects.

DISCUSSION

A complicated mixture of aliphatic and aromatic hydrocarbons makes gasoline and other petroleum products frequently volatile liquids. They are frequently used as fuel for some household combustibles and internal combustion engines. It is well known that some of their ingredients are extremely harmful or can cause cancer in people. (Kuppusamy *et al.,* 2020). The Link between exposure to benzene or benzene-containing mixtures and certain types of blood disorders has been shown in epidemiological studies in different countries. Benzene, an important petrol component is a widely distributed environmental contaminant and is mainly associated with increased incidences of blood disorder (Lan *et al.,* 2004). Bearing in mind the socio-demographic data of the population under study (male filling station pump attendants (F-S-P-A) and male non-filling station pump attendants (Non-F- S-P-A) in Port Harcourt) in this current investigation on the effects of petroleum products on cardiopulmonary parameters the mean age of the exposed population 35.13 years. Over time and even recently, this workforce made of people in the exploration of the petroleum sector is growing. Often times, these group of people are confronted with severe occupational hazards (Alemuddin *et al.,* 2015). Petrol station attendants are known to be significantly exposed to petroleum derivatives mainly via inhalation of the volatile components of petrol during vehicle refueling (Ali and Sahb, 2011). Therefore, relating the finding of the socio demographic investigation of the current study with other earlier similar works did not only reveal that majority of the workers in petrol stations are young

people, and as such could be exposed to severe occupational risks through the inhalation of volatile and dangerous petroleum derivatives. This cardiopulmonary evaluation may be very helpful in revealing any possible actual health impacts on such subjects (Olson *et al.,* 2000).

Interestingly, the F- S-P-A subjects were seen to have marginally lower mean BMI value compared to their non- the F- S-P-A colleagues. This finding is in line with the notion of Saeidifard *et al.,* (2020), who stated that standing expends significantly more energy than sitting and standing for 6 hours per day for a year could have a significant effect on energy expenditure, thus theoretically having a reductive effect on BMI. Thus, the demand of the job on the F- S-P-A subjects grand them a moderate BMI. Although, this could suggest a possible tendency of underweight on long term engagement in such services.

A major finding of the present study was on the assessment of changes of blood pressure parameters in the F-S-P-A subjects. It revealed non-significant increase on systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) in the F-S-P-A subjects when compared to other counterparts. It shows that they stand a higher risk of presenting with hypertension or other cardiovascular conditions. This may not be farfetched as the inhalation of such toxic products as from petrol may elicit a number of cardiovascular cases. The above finding by the present study is in line with the earlier submission of Ovuakporaye, (2019), who reported remarkably raised mean arterial pressure systolic and diastolic blood pressure in petrol station pump attendants.

Degeneration of myocardial tissue and creatine kinase-dependent mechanism has been linked to petroleum product toxicity in mammalian models (Azeez *et al.,* 2015). The above findings from the present study may thus be revealing cardio-toxic effect of petroleum fume inhalation in the F-S-P-A.

The ECG evaluation of the subjects revealed normal sinus rhythm for 100% of the non-F-S-P-A subjects but just 43.33% of the F-S-P-A subjects. The F-S-P-A subjects presented with abnormal ECG manifestations which amongst others include clockwise QRS Rotation (30%); right ventricular hypertrophy (23.33%) and left ventricular hypertrophy (13.33%) for the F-S-P-A subjects.

It has been reported that clockwise rotation of the QRS on an electrocardiogram (ECG) is associated with the most risk of heart failure and non-cardiovascular mortality QRS rotation (Patel *et al.,* 2017).

On the outcome of pulmonary function investigation, it was found that FVC, FEV1 and FEV6 were significantly decreased in the F-S-P-A subjects when compared to the non- F-S-P-A subjects. This is a direct indication of pulmonary function deficits. It may be pointing at possible obstructive or restrictive pulmonary conditions in the exposed subjects. It has been earlier reported that the respiratory tract's mucous membranes may become irritated by gasoline and that severe exposures have been associated with pulmonary congestion, edema, acute exudative tracheobronchitis, and intrapulmonary hemorrhage (Tormoehlen *et al.,* 2014).

It is known that if the FVC is less than the lower limit of normal, then two possibilities exist: firstly, it could be that, there is a mixed pattern with both an obstructive and a restrictive component. Secondly, it could be that a possible obstruction may be very severe and could lead to significant air trapping (Hoesein *et al.,* 2011). Similarly, accumulating evidence shows that reduced FVC is associated with multiple comorbid conditions (e.g., aging, cardiovascular disease, and obesity) and reduced exercise capacity in the general population (Moon *et al.,* 2021). From the above findings of the present study, it can be deduced that the significant exposure to petroleum products in the F-S-P-A subjects may have impacted on the function of the mucous membranes of the respiratory tract thus resulting in the above outcome.

This is a call for more caution by both employers and employees on such industries. And is suggestive to state that the use of personal protective equipment (PPE) by pump attendants and promotion of good health seeking culture is necessary.

CONCLUSIONS

The present study has found that, the socio-demographic profile of male filling station pump attendants (F-S-P-A) in Port Harcourt) indicated a mean age 35.13 years and a moderate/comparatively lower BMI value. Again, the present study revealed that the F-S-P-A subjects had non-significantly increased systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean arterial pressure (MAP) when compared to their other counterparts.

Further, the ECG evaluation of the subjects showed comparatively reduced normal sinus rhythm but higher prevalence of abnormal ECG manifestations which amongst others include clockwise QRS Rotation (30%); right ventricular hypertrophy (23.33%) and left ventricular hypertrophy (13.33%) for the F-S-P-A subjects.

The study also found that that FVC, FEV1 and FEV6 values were significantly decreased in the F-S-P-A subjects when compared to the non- F-S-P-A subjects.

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