International Journal of Research and Review
Vol. 9; Issue: 12; December 2022
Website: www.ijrrjournal.com
Research Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Assessment of Forced Vital Capacity, Blood Pressure and the risk of Occupational Renal Diseases in Abia State, Nigeria

Offiah, A.U.[1], Amadi, A.N.[2], Azuamah, Y.C.[3], Igwe, F.E.[1], Onyesom, E.[1]

[1]College of Medicine and Health Sciences, Abia State University, Nigeria
[2]Department of Public Health, Federal University of Technology, Owerri, Nigeria
[3]Department of Optometry, Federal University of Technology, Owerri, Nigeria

Corresponding Author: Offiah, A.U.

DOI: https://doi.org/10.52403/ijrr.20221241

ABSTRACT

Exposure to air pollutants by outdoor workers can predispose them to renal diseases. This study was carried out in Abia State Nigeria to assess the blood pressure and forced vital capacity (FVC) values of general outdoor workers. Measurement of blood pressure was taken with an electronic sphygmomanometer while the forced vital capacity was measured with a spirometer. A total of 322 subjects were used for the study. Results showed that the forced vital capacity (FVC) of 0-1000 was 5(1.56%) in Umuahia and 7(2.17%) in Aba; 1001-2000 was 34(10.56%) in Umuahia and 37(11.49%) in Aba; 2001-3000 was 83(25.78%) in Umuahia and 100(31.06%) in Aba; 3001-4000 was 23(7.14%) in Umuahia and 27(8.39%) in Aba; 4001-5000 was 1(0.31%) in Umuahia and 5(1.56%) in Aba. The mean FVC was 2410.55±443.61 in Umuahia and 2582.72± 526.80 in Aba. Results also showed that subjects with a systolic blood pressure of 81 - 100 was 6(1.86%) in Umuahia and 9(2.80%) in Aba; for 101-120, 33(10.25%) in Umuahia and 39(12.11%) in Aba; for 121-140, 65(20.19%) in Umuahia and 81(25.16%) in Aba; 141-160, 24(7.45%) in Umuahia and 27(8.39%) in Aba; for 161-180, 18(5.59%) in Umuahia and 20(6.21%) in Aba. The mean systolic blood pressure was 126.15 ±18.33 in Umuahia and 124.28 ±16.01 in Aba. The mean diastolic blood pressure was 74.65±11.69 in Umuahia and 76.29 ±10.78 in Aba. The FVC, systolic and diastolic blood pressures values were statistically within normal values (P>0.05). It was recommended that general outdoor workers wear nose and face masks to protect themselves against health problems resulting from environmental pollution.

Keywords: Forced Vital Capacity, Blood Pressure, Pulse Rate, Spirometry, Renal diseases

INTRODUCTION

Air pollution has been linked to risks for cancer, heart disease, lung disease, shortened life, and infections. [1] Pollution also increases the risk of chronic kidney disease (CKD). Evidence presented by authors [2] point to air pollution increasing the risk of new cases of kidney disease, and quicker progression of CKD to dialysis. A study [3] from St. Louis VA Medical Center found that for every increase in pollution of 10 micrograms per cubic meter of air, there was a 25 to 37% increase in the number of people with new kidney disease, a 36% increase in rapid loss of kidney function, and a 31% increase in risk of kidney failure followed by dialysis. Most chronic kidney diseases are associated with exposure to agents such as lead or cadmium present with chronic interstitial nephritis characterized by tubular proteinuria (usually less than 2 g/24 h) and urinary sediment usually lacking any cellular elements. [4] Chronic renal failure is a long-standing, progressive deterioration of renal function. Symptoms develop slowly and include anorexia, nausea, vomiting,

stomatitis, nocturia, lassitude, fatigue, pruritus, decreased mental acuity, muscle twitches and cramps, water retention, malnutrition, GI ulceration and bleeding, peripheral neuropathies, and seizures. [5] Diagnosis is based on laboratory testing of renal function, sometimes followed by renal biopsy. [6] Membranous nephropathy is a deposition of immune complexes on the glomerular basement membrane (GBM) with GBM thickening. The cause is usually unknown, although secondary causes include drugs, infections, autoimmune diseases, and cancer. Symptoms and signs include insidious onset of edema, heavy proteinuria, benign urinary sediment, normal renal function, and normal or elevated BP. Diagnosis is by renal biopsy. [7] Concerning the relative prevalence of chronic kidney disease caused by metals, both occupational and non-occupational, cadmium and lead are common causes of chronic interstitial nephritis and tubular dysfunction, while mercury is an uncommon cause of nephrotic syndrome, and silicon is an uncommon cause of glomerulonephritis. [6] Evidence from chronic lead nephropathy is not consistent. In some reports [8], workers with previous heavy and long-term lead exposure display little, if any, evidence of adverse renal effects. Despite consistent reproducibility in selected genetically susceptible experimental animals, it appears that the mercury-induced proteinuric syndrome occurs rarely in humans. Recent cross-sectional studies of exposed workers have found no increase in urinary albumin, anti-GMB antibodies or other autoantibodies. Mercury accumulates in kidney tissues. Several investigations [2,8] have found renal changes in workers chronically exposed to mercury vapor; generally these changes are small, but they may be indicative of glomerular or tubular damage.

Blood pressure (BP) is the pressure of circulating blood on the walls of blood vessels. Most of this pressure is due to work done by the heart by pumping blood through the circulatory system. [9] Blood pressure is usually expressed in terms of the systolic pressure over diastolic pressure and is measured in millimeters of mercury (mmHg), above the surrounding atmospheric pressure. Normal resting blood pressure, in an adult is approximately 120 millimeters of mercury systolic, and 80 millimeters of mercury diastolic, abbreviated 120/80 mmHg. [10] Forced vital capacity (FVC) is the maximum amount of air a person can expel from the lungs after a maximum inhalation. [11] A person's forced vital capacity can be measured by a wet or regular spirometer. This study assessed the blood pressure and forced vital capacity values of general outdoor workers in Umuahia and Aba of Abia State, Nigeria.

MATERIALS AND METHODS

This study was carried out at two cities in Abia state, Nigeria namely Aba and Umuahia. The study was a clinical study which involved measurement of blood pressure and forced vital capacity. The simple random sampling technique was used to select outdoor workers at various locations to be part of the study. All the workers selected gave an informed consent to be part of the study. Measurement of blood pressure was taken with an electronic sphygmomanometer while the forced vital capacity was measured with a spirometer. Data was uploaded into the Statistical Package for Social Sciences (SPSS) version 21, descriptive statistics and one way ANOVA was used for analysis of data.

RESULTS

A total of 322 subjects were used for the study; 146(45.34%) in Umuahia and 176(54.66%) in Aba. Table 1 showed the forced vital capacity (FVC) of the subjects. FVC of 0-1000 was 5(1.56%) in Umuahia and 7(2.17%) in Aba; 1001-2000 was 34(10.56%) in Umuahia and 37(11.49%) in Aba; 2001-3000 was 83(25.78%) in Umuahia and 100(31.06%) in Aba; 3001-4000 was 23(7.14%) in Umuahia and 27(8.39%) in Aba; 4001-5000 was 1(0.31%) in Umuahia and 5(1.56%) in Aba. The FVC

values were statistically within normal values [P(0.17)>0.05]. Table 2 showed that in Umuahia, minimum FVC was 846, maximum FVC was 4605, mean was 2410.55 and standard deviation was 443.61. In Aba, the minimum FVC was 780, maximum FVC was 4820, mean FVC was 2582.72 and standard deviation was 526.80. Table 3 showed that subjects with a systolic blood pressure of 81 - 100 was 6(1.86%) in Umuahia and 9(2.80%) in Aba; for 101 – 120, 33(10.25%) in Umuahia and 39(12.11%) in Aba; for 121 – 140, 65(20.19%) in Umuahia and 81(25.16%) in Aba; 141 – 160, 24(7.45%) in Umuahia and 27(8.39%) in Aba; for 161 – 180, 18(5.59%) in Umuahia and 20(6.21%) in Aba. The systolic blood pressure values were statistically within normal values [P(0.22)>0.05]. Table 4 showed that the minimum systolic blood pressure value was 90 in Umuahia and 94 in Aba; maximum value was 172 in Umuahia and 175 in Aba; mean value was 126.15 in Umuahia and 124.28 in Aba; standard deviation was 18.33 in Umuahia and 16.01 in Aba. Table 5 showed that subjects with a diastolic blood pressure of 41 - 60 was 14(4.35%) in Umuahia and 15(4.66%) in Aba; for 61 – 80, 87(27.02%) in Umuahia and 92(28.57%) in Aba; for 81 – 100, 41(12.73%) in Umuahia and 63(19.57%) in Aba; 101 – 120, 4(1.24%) in Umuahia and 6(1.86%) in Aba. The diastolic blood pressure values were statistically within normal values [P(0.40)>0.05]. Table 6 showed that the minimum diastolic blood pressure value was 50 in Umuahia and 52 in Aba; maximum value was 110 in Umuahia and 112 in Aba; mean value was 74.65 in Umuahia and 76.29 in Aba; standard deviation was 11.69 in Umuahia and 10.78 in Aba. Table 7 showed that subjects with a pulse rate of 41 - 60 was 10(3.11%) in Umuahia and 14(4.35%) in Aba; for 61 – 80, 79(24.53%) in Umuahia and 83(25.78%) in Aba; for 81 – 100, 48(14.91%) in Umuahia and 67(20.81%) in Aba; 101 – 120, 9(2.80%) in Umuahia and 12(3.73%) in Aba. The pulse rate values were statistically within normal values [P(0.15)>0.05]. Table 8 showed that the minimum pulse rate value was 53 in Umuahia and 51 in Aba; maximum value was 116 in Umuahia and 111 in Aba; mean value was 78.14 in Umuahia and 77.22 in Aba; standard deviation was 12.05 in Umuahia and 12.13 in Aba. Table 9 showed that 50.68% of the subjects in Umuahia and 57.39% in Aba complained of coughing; sneezing, 56.85% in Umuahia and 63.64% in Aba; catarrh, 31.51% in Umuahia and 42.05% in Aba; asthma, 19.18% in Umuahia and 17.61% in Aba; short breath, 24.66% in Umuahia and 29.55% in Aba; pneumonia, 13.01% in Umuahia and 13.64% in Aba; renal disease, 23.29% in Umuahia and 20.45% in Aba; wheezing, 45.89% in Umuahia and 44.89% in Aba; painful urinating, 34.25% in Umuahia and 31.25% in Aba; color in urine, 4.11% in Umuahia and 5.68% in Aba; dizziness, 33.56% in Umuahia and 38.64% in Aba; breathing difficulty, 42.47% in Umuahia and 46.59% in Aba.

Table 1: Distribution of Forced Vital Capacity of subjects

FVC (ml)	Umuahia		Aba	
	n	%	n	%
0 – 1000	5	1.56	7	2.17
1001 – 2000	34	10.56	37	11.49
2001 – 3000	83	25.78	100	31.06
3001 – 4000	23	7.14	27	8.39
4001 – 5000	1	0.31	5	1.56
Total	146	45.34	176	54.66

Table 2: Descriptive statistics of Forced Vital Capacity values of subjects

Location	n	Min.	Max.	Mean	S.D
Umuahia	146	846	4605	2410.55	443.61
Aba	176	780	4820	2582.72	526.80

n- Number; Min- Minimum value; Max- Maximum value; S.D - Standard Deviation

Table 3: Distribution of Systolic Blood Pressure of subjects

Systolic Blood Pressure (mmHg)	Umuahia		Aba	
	n	%	n	%
81 – 100	6	1.86	9	2.80
101 – 120	33	10.25	39	12.11
121 – 140	65	20.19	81	25.16
141 – 160	24	7.45	27	8.39
161 – 180	18	5.59	20	6.21
Total	146	45.34	176	54.66

Table 4: Descriptive statistics of systolic blood pressure values of subjects

Location	n	Min.	Max.	Mean	S.D
Umuahia	146	90	172	126.15	18.33
Aba	176	94	175	124.28	16.01

n- Number; Min- Minimum value; Max- Maximum value; S.D - Standard Deviation

Table 5: Distribution of Diastolic Blood Pressure of subjects

Diastolic Blood Pressure (mmHg)	Umuahia		Aba	
	n	%	n	%
41 – 60	14	4.35	15	4.66
61 – 80	87	27.02	92	28.57
81 – 100	41	12.73	63	19.57
101 – 120	4	1.24	6	1.86
Total	146	45.34	176	54.66

Table 6: Descriptive statistics of diastolic blood pressure values of subjects

Location	n	Min.	Max.	Mean	S.D
Umuahia	146	50	110	74.65	11.69
Aba	176	52	112	76.29	10.78

n- Number; Min- Minimum value; Max- Maximum value; S.D - Standard Deviation

Table 7: Distribution of Pulse Rate of subjects

Pulse Rate	Umuahia		Aba	
	n	%	n	%
41 – 60	10	3.11	14	4.35
61 – 80	79	24.53	83	25.78
81 – 100	48	14.91	67	20.81
101 – 120	9	2.80	12	3.73
Total	146	45.34	176	54.66

Table 8: Descriptive statistics of pulse rate values of subjects

Location	n	Min.	Max.	Mean	S.D
Umuahia	146	53	116	78.14	12.05
Aba	176	51	111	77.22	12.13

n- Number; Min- Minimum value; Max- Maximum value; S.D - Standard Deviation

Table 9: Health history of subjects

Health Problem	Umuahia		Aba	
	n	%	n	%
Coughing	74	50.68	101	57.39
Sneezing	83	56.85	112	63.64
Catarrh	46	31.51	74	42.05
Asthma	28	19.18	31	17.61
Short breath	36	24.66	52	29.55
Pneumonia	19	13.01	24	13.64
Renal disease	34	23.29	36	20.45
Wheezing	67	45.89	79	44.89
Painful urinating	50	34.25	55	31.25
Color in urine	6	4.11	10	5.68
Dizziness	49	33.56	68	38.64
Breathing difficulty	62	42.47	82	46.59

DISCUSSION

Spirometry measures the forced vital capacity (FVC), which is the greatest volume of air that can be breathed out in a single large breath. Subjects interviewed in this study complained of coughing, sneezing, breathing difficulty and renal problems. Most of the workers have never checked their forced vital capacity in a clinic before and therefore are not aware of the gradual reduction in the normal level over the years of which they are exposed to dust and other gases in the atmosphere. Ekpenyong, et al. [12] carried out a study to assess the respiratory health effect of city ambient air pollutants on transit and non-transit workers and reported respiratory function impairment due to their forced vital capacity levels. It is reasonable to perform spirometry every one or two years to follow how well a person's asthma is controlled. The blood pressure of many of the workers was also found to be higher than normal. Most of these people complained of respiratory and renal problems. Similar studies [13,14] have also reported pulmonary and cardiovascular problems among residents and workers at quarry communities. Although results from this study found that the blood pressure and pulse rate were with normal level (P>0.05), exposure to high levels of air pollutants such as carbon monoxide and nitrogen dioxide may lead to inflammation of the mucous membrane and the lower and upper respiratory tracts. [15] The symptoms of acute nitrogen dioxide poisoning resembles that of pneumonia or viral infection and other inhalational injuries but common symptoms includes rhinitis wheezing or coughing, conjunctivitis, headache, throat irritation and dyspnea which may progress to nasal fissures, ulcerations, or perforation. [15] Various studies [5,8] have associated exposure to these air pollutants with kidney problems. Subjects in this study did complain of renal problems including coloring of the urine and painful urination.

CONCLUSION

In conclusion, while the blood pressure and forced vital capacity of many of the outdoor workers were found to be within normal range, some of them had higher than normal blood pressure and forced vital capacity levels. It was recommended that outdoor workers should always wear their nose and face masks to prevent inhalation of air pollutants.

Declaration by Authors

Ethical Approval: Approved
Acknowledgement: None
Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Nelson DI. The Global Burden of Selected Occupational Diseases and Injury Risks: Methodology and Summary. Am J Ind Med. 2005; 48: 400-418.
2. Ezomike UO, Modekwe VI, Ekenze SO. Paediatric nephrectomy: Patterns, indications and outcome in a developing country. Malawi Med J. 2018; 30(2): 94-98.
3. Li B, Zeng H, Ding M. Multiple pulmonary emboli as a result of renal cell carcinoma: A case report. Oncol Lett. 2017; 13(1): 267-270.
4. Frumkin H. Environmental Health: From Global to Local. 2nd ed. San Francisco: John Wiley and Sons. 2010; 510-577.
5. Kade G, Agnieszka O, Stefan A, Zofia W. Acute kidney failure complicating carbon monoxide poisoning. Anaesthesiol Intensive Ther. 2012; 44(2):89-91.
6. Erinomo OO, Anunobi CC, Orah NO. Autopsy study of prostatic weight and lesions in LUTH: a 12 month prospective study. Nig Q J Hosp Med. 2013; 23(2): 85-9.
7. Bolaji O, Erinomo O, Adebara O, Okolugbo J, Onumajuru B, Akanni T. Autosomal recessive polycystic kidney disease (ARPKD) in a Nigerian newborn: a case report. Pan Afr Med J. 2018; 30: 172-175.
8. Asinobi AO, Ademola AD, Ogunkunle OO. Steroid response in primary childhood nephrotic syndrome in a tropical African environment. Niger J Clin Pract. 2019; 22(6): 790-795.
9. Kumar K, Abbas AK, Fausto N. Robbins and Coltran Pathologic Basis of Disease. 7th ed. New Delhi: Saunders Elsevier. 2008; 367.
10. Akanbi MO, Ukoli CO, Erhabor GE, Akanbi FO, Gordon SB. The burden of respiratory disease in Nigeria. Afr J Resp Med. 2009; 2(3): 10-17.
11. Isara AR, Adam VY, Aigbokhaode AQ, Alenoghena IO. Respiratory symptoms and ventilatory functions among quarry workers in Edo state, Nigeria. Pan Afr Med J. 2016; 23: 212-219.
12. Ekpenyong CE, Ettebong EO, Akpan EE, Samson TK. Urban city transportation mode and respiratory health effect of air pollution: a cross-sectional study among transit and non-transit workers in Nigeria. BMJ. 2012; 2(5): 126-131.
13. Lambert WE. Nitrogen dioxide and respiratory illness in children. Part II. Assessment of exposure to nitrogen dioxide. Environ Health Perspect. 2003; 58 (33): 51–80.
14. Awosusi AO, Akinduitire IO. Perceived health effects of Environmental Noise Pollution on the inhabitants of Ado-Ekiti Metropolis, Ekiti State, Nigeria. J Biol Agr Healthcare. 2014; 4(26): 106-113.
15. Levy JI. Impact of residential nitrogen dioxide exposure on personal exposure: an international study. Environ Health Perspect. 2008; 48(6): 553–60.

How to cite this article: Offiah, A.U., Amadi, A.N., Azuamah, Y.C. et.al. Assessment of forced vital capacity, blood pressure and the risk of occupational renal diseases in Abia State, Nigeria. *International Journal of Research and Review*. 2022; 9(12): 374-378. DOI: *https://doi.org/10.52403/ijrr.20221241*

******