An investigation of Cardiopulmonary Parameters of Internally and Non-Internally Displaced Persons in Maiduguri Metropolitan Council, Borno State, Nigeria

Ashiyat Akodu, Ibrahim Abubakar,** and Happiness A. Aweto****

Journal of Internal Displacement, Volume 12, Issue 1, January 2022, pages 32-43
First received 07 July 2021, accepted 06 December 2021, Published 24 January 2022
Link: https://journalofinternaldisplacement.org/

Abstract

Internally displaced persons (IDPs) are at high risk of developing cardiopulmonary problems compared to non-internally displaced persons (NIDPs). This study examined selected cardiopulmonary parameters in internally and non-internally displaced persons in a Nigerian population. The analytical cross-sectional study design employed a purposive sampling technique to recruit 800 participants (400 IDPs and 400 NIDPs) from four internally displaced camps and four host communities at camps located in Maiduguri Metropolitan Council of Borno State. Mercury sphygmomanometer, pulse oximeter and spirometer were used to measure the cardiopulmonary parameters of the participants. Descriptive statistics of the mean and standard deviation were used to evaluate socio demographic characteristics while an independent t-test was used to compare selected cardiopulmonary parameters of the participants. The result revealed a significant difference (P=0.001) in cardiopulmonary parameters of systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), mean arterial pressure (MAP), rate pressure product (RPP), respiratory rate (RR), forced expiratory volume in one second (FEV_{1}) and forced vital capacity (FVC) between internally and non-internally displaced persons. There was a significant difference (P<0.05) in the age and sex matched of the cardiopulmonary parameters between internally displaced and non-internally displaced groups. But there was a significant difference (P<0.05) in the sex matched of the cardiopulmonary parameters within non-internally displaced persons, while significant difference only exist in the DBP (P=0.029) and MAP (P=0.030) within internally displaced persons. The study concludes with findings highlighting cardiopulmonary deficit faced by a significant number of IDPs as compared to NIDPs, who unavoidably found themselves in unfortunate conditions of displacement.

Keywords

Internally displaced persons, heart rate, blood pressure, spirometer, pulmonary parameters, sex, Nigeria

Author's Institutional Affiliation and Correspondence

*, **, and *** Department of Physiotherapy, College of Medicine, University of Lagos, Lagos, Nigeria.
Correspondence, Dr Ashiyat Akodu, email: akoduashiyat@gmail.com or aakodu@unilag.edu.ng.

Acknowledgments

The authors wish to appreciate the assistance of the State Emergency Management Agency (SEMA) Maiduguri Borno State and the internally displaced persons and non-internally displaced persons that participated in this study.

An investigation of Cardiopulmonary Parameters of Internally and Non-Internally Displaced Persons in Maiduguri Metropolitan Council, Borno State, Nigeria

Ashiyat Akodu, Ibrahim Abubakar, and Happiness A. Aweto

Introduction

Internally displaced persons (IDPs) are groups of persons who have been forced or obliged to flee their homes or places of habitual residence within an internationally recognized state border in order to avoid the effects of armed conflict, natural or man-made disasters (Internally Displaced Monitoring Centre (IDMC), 2007; Wanninayake, 2019). Globally, there are over 70.8 million persons worldwide who have been forcibly displaced from their homes due to conflict and insecurity (UNHCR, 2019; Alawa & Bollyky, 2020), and over 25.9 million of these are internally displaced persons (UNHCR, 2019). In 2015, a population of 12 million IDPs were displaced by armed conflict and violence in Sub-Saharan Africa (Owoaje et al, 2016). In Nigeria, most displacement situation is as a result of public violence, armed conflicts and natural disasters (Akuto, 2017). Majority of IDPs live in internally displaced (IDP) camps which are characterized by poor hygiene, insufficient healthcare, over-crowding, insecurity, food shortage, social problems and illness (Sharif *et al*, 2013). Internal displacement has major impact on public health and the well-being of the IDPs. These effects can be either direct due to violence and injury or indirect due to increased rates of infectious diseases and malnutrition (Lam *et al*, 2015). The health of an individual most especially IDPs is very important putting into consideration the United Nations Sustainable Development Goal number 3 which ensures promotion of healthy lives and wellbeing for the populace (UN, 2018). This will help in making sure adequate healthcare is provided for the wellbeing of the IDPs, if poor health conditions are identified early, thus the reason for this study.

Conceptual Framework

Wanninayake, (2019) demonstrates how social, economic and security factors in a contextual circumstance can influence the decision of internally displaced persons to remain in a host community after a long period of displacement. This conceptual framework reveals the background factor explaining the reasons (e.g., socioeconomic and security) behind IDPs flight in the case of conflict induced displacement. The framework also suggests the factors that attract IDPs to host communities and barriers that prevent IDPs from returning to their usual location. These latter factors show two other indicators that collectively demonstrate why IDPs leave. They are the push and pull factors. Wanninayake, (2019) considered a robust social relationship between IDPs and host community as a factor to pull IDPs to the host community and a weak relationship between IDPs and original region as a factor that contributes to pushing the populace away from the area.

The livelihood and economic status, especially the earnings of IDPs, are also considerable factors that affect IDPs movement within the host areas. Fear and insecurity condition in the process of displacement could push IDPs away from the original area. Notwithstanding, better security between IDP and host community may determine the pull (attraction) for staying in the host community. Availability of aids and assistance from government help to pull IDPs to the host community, consequently prolonging their stay in the IDP camps. Provision of better facilities for transport, health, education and communication are more reasons IDPs are pulled (attracted) to their host area, thus the impetus for protracted displacement situation. This framework (figure1) draws an attention to the significance of enthusiasm and anticipations of IDPs. It can be used to evaluate conflict induced return and

resettlement problems as it highlights the link between IDPs place of origin and their host community.

A brief overview of the literature: Health related concerns of IDPs

The health status of IDPs is a major determinant of the movement. Identified health issues affecting IDPs in an African study by Owoaje et al, (2016) included fever/malaria, acute malnutrition in children and adult males, diarrhoea and acute respiratory infections which constitute about 45 percent of the health issues. Roberts *et al.* (2006), reported the prevalence of some major health disorders such as pulmonary diseases among the IDPs in internally displaced camps across Uganda. Also, there is a high risk of developing respiratory infections (Roberts *et al*, 2006), non-communicable diseases, such as, hypertension, diabetes, kidney diseases, mental disorders and morbidity among IDPs within the camps (Habibullah *et al,* 2014). Akuto et al. (2017) reported that IDPs suffer from sexually transmitted disease, such as, HIV/AIDS, gonorrhoea, and syphilis due to unprotected sex.

Cardiopulmonary status as a strong predictor of health outcome is the extent to which the heart and lungs are able to adequately supply the body's tissue with blood, oxygen and remove carbon dioxide to meet metabolic demands (Boyette and Manna, 2021). Individuals with cardiac or lung disease suffer changes in their cardiopulmonary functions over time due to disease progression (Chapman et al, 2017). Such changes in cardiopulmonary functions affect optimal response of cardiopulmonary parameters that specify the work of the cardiovascular and respiratory system (Bob-Manuel et al, 2017). Generally, cardiopulmonary function is evaluated using exercise testing and assessment of cardiopulmonary parameters (Chapman et al, 2017). Therefore, proper evaluation of cardiopulmonary functions can give a good measure of the cardiopulmonary status of IDPs and non IDPs (NIDPs) (Kadhiresan, 2007).

The effect (or increase) of psychological, physical and ecological factors in blood pressure and heart rate are mostly experienced by IDPs during and after displacement (Rubia *et al*, 2002). Thus, specific alterations in the cardiopulmonary function may occur more readily in IDPs as compared to NIDPs (Rubia *et al,* 2002). A growing number of research studies carried out on IDPs report on their psychological health conditions (Khechuashvili, 2014; Oladeji, 2015). Furthermore, studies on prevalence and comparison of psychological response of internally displaced with non-internally displaced persons had also been carried out across different countries (Deniz *et al,* 2008; Khechuashvili, 2014). Many factors such as overcrowding, economic, poverty, lack of safe water, poor sanitation and waste management affect IDPs livelihood. This situation is worsened by the absence of shelter, food shortages and poor access to healthcare (Azam, 2009). The combined effects of these factors, frequently reported by IDPs during and after displacement (Rubia *et al*, 2002), result in increased risk of diseases such as acute respiratory infections (ARI) (Owoaje et al, 2016).

The real course of displacement and the dilemma of IDPs in IDP camps can lead to health-related problems (Rubia *et al,* 2002), predominantly for susceptible groups such as children, women and the elderly (Akuto, 2017). As indicated above, the danger associated with displacement comprise health-related difficulties including a lack of basic amenities needed to sustain good basic health such as food, shelter and water (Azam, 2009, Akuto, 2017). Despite knowledge of these difficulties and disorders among IDPs residing in camps (Sharif *et al*, 2013), putting into perspective the right to health of an individual, it is imperative to know the IDPs cardiopulmonary status with particular regard to the trauma and unhealthy situation they find themselves and to consequently provide the highest attainable health care for them. By so doing, cardiopulmonary complications such as stroke and acute respiratory infections that can develop as a result will most likely be prevented. Therefore, this study evaluates and compares selected cardiopulmonary parameters of IDPs with that of NIDPs in a Nigerian population.

Methods

This study is a cross-sectional analytical survey conducted between July and November 2016. Using a purposive sampling technique, a total of 400 IDPs and 400 NIDPs were recruited from four internally displaced camps and host communities where IDPs sites were situated in Maiduguri Metropolitan Council of Borno state Nigeria. The sample size was determined using Yamane (1967) formula, where N is the total number of finite population and e = 0.05 (i.e., the level of precision). The inclusion criterium for the study was internally and non-internally displaced persons must be apparently healthy residing in the camps and host community of the camps in Maiduguri Metropolitan Council of Borno state. Internally displaced persons who have not stayed up to a year in the camp, internally displaced persons with history of smoking, NIDPs that have not stayed up to a year in the host community, and NIDPs with history of smoking were excluded from the study.

Before commencing the study, permission to conduct the study was obtained from the State Emergency Management Agency (SEMA) Maiduguri Borno state. Ethical clearance was gotten from health research and ethics committee of College of Medicine, University of Lagos with approval number ADM/DCST/HREC/APP/1083. During the recruitment phase, the purpose of the study was carefully explained to all participants, and they were given adequate information on how the procedures were to be carried out. Participants who were willing to participate in the study voluntarily signed an informed consent prior to date collection. Participants that agreed and signed the informed consent form were screened based on study criteria. Socio-demographic data such as name, household number/home address, age and gender of participants were taken and documented. Thereafter, cardiopulmonary parameters of participants were measured and recorded on a data sheet. The protocol for assessing the weight, height, BMI and cardiopulmonary parameters are as follows:

Body Mass Index (BMI)

Assessment of Weight of the Participants: The weight was measured in kilograms (kg) with the participant in a standing position, weight evenly distributed over the centre of the weighing scale, shoes off, and looking straight ahead. The weighing machine was calibrated using reference weights of known mass. Weight was recorded to the nearest 0.1kg (ISAK, 2001).

Assessment of Height of the Participants: To measure height, the participants were barefooted, standing erect, heels together and touching the base of the standiometer, arms hanging by the side, buttocks, upper part of the back, and back of the head in contact with the vertical wall. Participants were instructed to look straight ahead and take a deep breath while keeping the head in the Frankfort plane, a gentle upward lift was applied through the mastoid processes, at the same time the headboard was applied firmly down on the vertex, crushing the hair as much as possible, also ensuring that the feet did not come off the ground and that the position of the head was maintained in the Frankfort plane. Measurement was recorded at the end of the participant's inward breath. Measurement was taken to the nearest 0.1m (ISAK, 2001).The body mass Index was calculated by dividing the weight over the square of the height of the participants. $BMI = \frac{\text{Weight (kg)}}{\text{Height}^2\ (\text{m}^2)}$

Blood pressure (Systolic and diastolic blood pressure): blood pressure (BP) is the force exerted by the blood upon the walls of the blood vessels and it is measured in mmHg (Kenyon and Kenyon, 2005). Using mercury sphygmomanometer and stethoscope the measurement of the BP of the participants (systolic and diastolic blood pressure (SBP, DBP) were taken and recorded with the participants in a relaxed sitting position and the cuff wrapped around the

left/right arm of the participants and inflated using the pump as designed in a compact format (Kenyon and Kenyon, 2005).

Mean Arterial Pressure (MAP): is the normal arterial pressure in a single cardiac cycle and is determined by the Cardiac Output (CO), Systemic Vascular Resistance (SVR) and Central Venous Pressure (CVP). It was approximately determined by using the systolic and the diastolic pressure while there is a normal resting heart rate. The formular for calculation is: MAP = diastolic + 1/3(systolic-diastolic) in mmHg (Klabunde, 2007).

Pulse Pressure (PP): is another derived cardiovascular parameter (Klabunde, 2007), which was calculated and recorded from the difference of the systolic and diastolic pressure obtained from the participants.

Rate Pressure Product (RPP): is the product of heart rate and the systolic blood pressure (SBP) and it is an amount of pressure place on cardiac muscle and is measured in beat per minute of mmHg (Klabunde, 2007). It specifies the amount of energy utilised by the heart (Klabunde, 2007).

Respiratory Rate (RR): was measured while the participant was in a relaxed sitting position by observing the repeated movement (rise and fall) of the chest wall using the stopwatch to record the amount of breathes per minute.

Spirometry: The guideline of the American Thoracic Society/European Respiratory Society (Adegoke *et al*, 2015) was employed for the spirometry assessment. The participant was in a relaxed sitting position is instructed to take in a deep breath to full inspiration through the nose. Participants was then asked to hold firmly the mouthpiece of the spirometer with their lips and then breath out hard and forceful as possible. The spirometer immediately displayed the readings of forced expiratory volume in one second (FEV_1) and force vital capacity (FVC). The procedure was done three (3) times and the average reading was recorded. The mouth-piece cap was consistently replaced for each of the participants. Measurements of cardiopulmonary parameters (systolic blood pressure, diastolic blood pressure, heart rate, mean arterial pressure, rate pressure product, respiratory rate, forced expiratory volume in one second, forced vital capacity) were recorded on a data sheet, respectively.

Data analysis

Data was analyzed using statistical package for social science (SPSS) version 22 and summarized using descriptive statistics of mean, frequency and standard deviation. Inferential statistics of independent t-test was used to compare the difference in selected cardiopulmonary parameters of the participants. Level of significance was set at $P < 0.05$.

Result

Socio-demographic characteristics of the participants

Eight hundred participants (i.e., 400 IDPs and 400 NIDPs) participants were eligible for this study having met the inclusion criteria. All participants completed the study, and their findings were analysed.

Sex: Four hundred and seventy-seven (60%) out of 800 participants were females while 323 (40%) were males. Sex distribution within the two groups of participants were as follows; for IDPs, 130 (40.7%) were males and 270 (59.3 %) were females For NIDPs, 193 (48.3%) were males while 207 (51.7%) were females.

Age: The mean age for all the participants was 25.99 ± 10.64 years (with an age range of: 18-73) years. The descriptive statistics of mean ($\bar{x}$) and standard deviation (SD) within the two groups of participants on socio demographic characteristics for age were 22.36±6.47 years for IDPs and 21.61±12.59 years for NIDPs

Marital status: Three hundred and thirty-nine (84.4%) of IDPs were married and 61 (15.3%) were single while 374 (93.5%) of NIDPs were married and 26 (6.5%) were single.

Cardiopulmonary indicators
Body Mass Index (BMI): The mean ($\bar{x}$) and standard deviation (SD) for height of the participants were 1.58±0.17 for IDP and 1.70±0.08 for NIDPs, while for weight was 60.33±12.13 for IDP and 65.86±11.37 for NIDPs. The descriptive statistics of mean ($\bar{x}$) and standard deviation (SD) within the two groups of participants for BMI were 24.5±7.01kg/m^2 for IDPs and 22.5±2.70 Kg/m^2 for NIDPs (see, Table 1).

Systolic blood pressure: The mean and standard deviation for selected cardiopulmonary parameters of SBP were 136.79±24.10mmHg for IDPs and114.67±15.16mmHg for NIDPs (see, Table 2).

Diastolic blood pressure: The mean and standard deviation for selected cardiopulmonary parameters of DBP were 84.51±15.49mmHg for IDPs and 73.67±12.31mmHg for NIDPs. (see, Table 2).

Respiratory rate: The mean and standard deviation for selected cardiopulmonary parameters of DBP were14.40 $\pm$ 1.06 for IDPs and 14.17 $\pm$ 1.03mmHg for NIDPs

T-test comparing cardiopulmonary parameters: The difference in participants cardiopulmonary parameters was investigated using independent t-test; statistically significant difference was observed in systolic blood pressure (p = 0.001), diastolic blood pressure (p = 0.001), heart rate (p = 0.001), mean arterial pressure (p = 0.001), Rate pressure product (p = 0.001), respiratory rate (p = 0.001), forced expiratory volume in 1 second (FEV_1) (p = 0.001) and forced vital capacity FVC (p = 0.001) between IDPs and NIDPs (see, Table 2).

Also, statistically significant difference in participants cardiopulmonary parameters of IDPs with age (p = 0.001) and gender matched NIDPs in SBP (p = 0.001) males and SBP (p = 0.001) females, DBP (P = 0.006) males and DBP (P = 0.022) females, HR (p = 0.001) males and HR (p=0.001) females, MAP (p = 0.001) males and MAP (p = 0.000) females, RPP (p = 0.001) males and RPP (p = 0.001) females, RR (p=0.021) males and RR (p = 0.042) females, FEV_1 (p=0.001) males and FEV_1 (p = 0.001) females, and FVC (p = 0.001) males and FVC (p = 0.001) females were summarized in (see, Table 3).

Table 4 shows sex difference in cardiopulmonary parameters of IDPs and NIDPs. There was a statistically significant difference in SBP (p = 0.044), DBP (p = 0.001), HR (p = 0.001), MAP (p = 0.001), RPP (p = 0.024), RR (p = 0.001), FEV in 1 second (p = 0.001) and FVC (p = 0.001), between male and female participants of NIDPs population. There was a significant difference in DBP (p = 0.029), MAP (p = 0.030), between male and female participants of IDPs population. But there was no significant difference in SBP (p= 0.324), HR (p = 0.558), RPP (p = 0.292), RR (p = 0.389), FEV in 1 second (p = 0.393) and FVC (p = 0.222), between male and female IDPs population.

Table 1: Socio-demographic characteristics of the participants

Variable	IDPs Mean ± SD	NIDPs Mean ± SD
Age (year)	22.36±6.47	21.61±12.59
Height (m)	1.58±0.17	1.70±0.08
Weight (Kg)	60.33±12.13	65.86±11.37
BMI (Kg/m^2)	24.5±7.01	22.5±2.70
Duration in camp/host community in months	1.91±0.66	1.86±0.64

Key: Body mass index (BMI), Internally displaced persons, (IDPs) Non-Internally displaced persons (NIDPs), Standard deviation (SD).

Table 2: Comparison between Cardiopulmonary Parameters of IDPs and NIDPs

Parameters	IDPs Mean ± SD	NIDPs Mean ± SD	t-value	p-value
SBP (mmHg)	136.79±24.10	114.67±15.16	-15.53	0.001*
DBP (mmHg)	84.51±15.49	73.67±12.31	-10.95	0.001*
HR (bpm)	96.59±17.19	71.83±22.52	-17.48	0.001*
MAP (mmHg)	101.94±14.03	87.34±11.38	-16.15	0.001*
RPP (mmHg)	13244.45±3426.98	8303±11.38	-21.41	0.001*
RR (cpm)	14.40 ±1.06	14.17 ± 1.03	3.38	0.001*
FEV_1 (L)	1.25±0.48	2.86±0.68	38.63	0.001*
FVC (L)	1.59±0.52	3.16±0.85	31.26	0.001*
FEV_1 (%)	79.54±18.46	97.92±45.07	7.45	0.001*

Key: *Significant at $P \leq 0.05$, Diastolic Blood Pressure (DBP), Forced Expiratory Volume in one second (FEV_1), Forced Vital Capacity (FCV), Heart Rate (HR), internally displaced persons (IDPs), Mean Arterial Pressure (MAP), Non-internally displaced persons (NIDPs), Rate Pressure Product (RPP), Respiratory Rate (RR), Systolic Blood Pressure (SBP), t-Independent t-test, FEV_1 %. Percentage predicted FEV_1/ FVC

Table 3: Comparison between participants' Cardiopulmonary Parameters of IDPs with age and sex matched NIDPs

Parameters	IDPs Mean ± SD	NIDPs Mean ± SD	t-value	p-value
Age (years)	22.36±6.47	29.61±12.59	10.235	0.001*
SBP				
Male	135.55 ±24.72	116.25 ± 15.36	-0.9335	0.001*
Female	137.94± 23.52	113.19 ± 14.86	-12.42	0.001*
DBP				
Male	82.77 ± 14.43	78.09 ± 11.73	-3.978	0.006*
Female	86.14 ± 16.28	69.56 ± 11.40	-11.814	0.022*
HR				
Male	96.07 ± 17.36	85.94 ± 20.70	-4.653	0.001*
Female	97.08 ± 17.06	58.68 ± 14.92	-25.576	0.001*
MAP				
Male	100.36 ± 13.71	90.81 ± 10.74	-8.025	0.001*
Female	103.41 ± 14.20	84.10 ± 11.01	-15.120	0.001*
RPP				
Male	13057.20±3473.94	10073.62 ±3121.31	-8.628	0.001*
Female	13419.04 ± 3381.67	6652.46 ± 1939.07	-24.881	0.001*
RR				
Male	14.31 ± 1.07	14.31 ± 1.07	-2.568	0.021*
Female	14.48 ± 1.05	14.48 ± 1.05	-2.643	0.042*
FEV_1				
Male	1.27 ± 0.49	3.37 ± 0.55	34.532	1.27 ± 0.49 0.001*
Female	1.23 ± 0.47	2.39 ± 0.37	23.650	0.001*
FVC				
Male	1.63 ± 0.51	3.37 ± 0.55	25.930	0.001*
Female	1.56 ± 0.52	2.39 ± 0.37	-25.576	0.001*

Key: *Significant at P ≤ 0.05, Diastolic Blood Pressure (DBP), Forced Expiratory Volume in one second (FEV_1), Forced Vital Capacity (FCV), Heart Rate (HR), internally displaced persons (IDPs), Mean Arterial Pressure (MAP), Non-internally displaced persons (NIDPs), Rate Pressure Product (RPP), Respiratory Rate (RR), Systolic Blood Pressure (SBP), t-Independent t-test.

Table 4: Sex difference in participant's cardiopulmonary parameters within IDPs and NIDPs

Parameters	IDPs Mean ± SD	t-value	p-value	NIDPs Mean±SD	t-value	p-value
SBP						
Male	135.55 ±24.72			116.25 ± 15.36	2.02	0.044*
Female	137.94± 23.52	-0.99	0.324	113.19 ± 14.86		
DBP						
Male	82.77 ± 14.43			78.09 ± 11.73	7.38	0.001*
Female	86.14 ± 16.28	-2.18	0.029*	69.56 ± 11.40		
HR						
Male	96.07 ± 17.36			85.94 ± 20.70	-15.18	0.001*
Female	97.08 ± 17.06	-5.86	0.558	58.68 ± 14.92		
MAP						
Male	100.36 ± 13.71			90.81 ± 10.74	6.16	0.001*
Female	103.41 ± 14.20	-2.18	0.030*	84.10 ± 11.01		
RPP						
Male	13057.20±3473.94			10073.62±3121.31	13.26	0.001*
Female	13419.04 ± 3381.67	-1.05	0.292	6652.46 ± 1939.07		
RR						
Male	14.31 ± 1.07			14.31 ± 1.07	3.38	0.001*
Female	14.48 ± 1.05	0.86	0.389	14.48 ± 1.05		
FEV_1						
Male	1.27 ± 0.49			3.37 ± 0.55	21.027 ± 0.49	0.001*
Female	1.23 ± 0.47	0.85	0.393	2.39 ± 0.37		
FVC						
Male	1.63 ± 0.51			3.37 ± 0.55	17.55	0.001*
Female	1.56 ± 0.52	1.22	0.222	2.39 ± 0.37		

Key: *Significant at P ≤ 0.05, Diastolic Blood Pressure (DBP), Forced Expiratory Volume in one second (FEV_1), Forced Vital Capacity (FCV), Heart Rate (HR), internally displaced persons (IDPs), Mean Arterial Pressure (MAP), Non-internally displaced persons (NIDPs), Rate Pressure Product (RPP), Respiratory Rate (RR), Systolic Blood Pressure (SBP), t-Independent t-test.

Discussion

This research determined and compared selected cardiopulmonary parameters of IDPs with that of NIDPs. The study reported that 477 (60%) out of 800 participants were females while 323 (40%) were males (i.e., male-to-female ratio was 1:1.2). The male-female ratio observed is possible due to the fact that females, as children and the elderly, tend to be more vulnerable during displacement (Thomas and Thomas, 2004). This result is not in accordance with the report of Deniz et al (2008) who revealed more males than females in their own report. The mean age and age range of the participants for this study was 25.99 ± 10.64 years (with a range of 18-73 years), this is not consistent with the reported mean age of 53.80 ± 11.62 years (range: 35-82 years) of participants of a study of similar population (Deniz *et al,* 2008). Eighty four percent of the participants were married which is higher than previous study of 81.5% on similar population (Sharif *et al*, 2013).

A report by Owoaje et al, (2016) stated that IDPs in Africa suffer from different conditions in which cardiopulmonary compromise is one of them. Their study confirmed that almost half of the population studied had acute respiratory symptoms. This present study reveals an elevation in some cardiovascular parameters (SBP and DBP) among IDP population which explains the traumatic and emotional experiences IDPs are going through necessitating the increase in blood pressure. The abnormal values of the pulmonary parameters (FEV_1 and FVC) explain how the environment in which IDPs live affect their health status which if not treated may result in serious health complications that can lead to increase mortality rate of the IDPs. This observation was emphasised in the study by Rentería-Ramos et al, (2019) that IDPs experience high rate of morbidity and mortality than the rest of the population out of the total records of conflicts in the world.

In this study it was revealed that there was a significant difference in the cardiopulmonary parameters (SBP, DBP, heart rate, mean arterial blood pressure, rate pressure product, respiratory rate, FEV_1, forced vital capacity and forced expiratory ratio) of internally displaced persons in comparison to non-internally displaced persons. The significant difference in cardiopulmonary parameters between the two groups can be attributed to the activation of sympathetic adrenergic system as a result of constant fear, anxiety and depression the process of displacement predisposed internally displaced persons to (Rubia *et al,* 2002; Krzeminski *et al*, 2012). The activation of sympathetic adrenergic system directly or indirectly act upon the brain stem, in which a significant sympathetic discharge is induced at the spinal cord and terminal endings of the sympathetic nervous system resulting in release of norepinephrine causing vasoconstriction, which raises peripheral resistance and increase in cardiovascular and respiratory functions (Krzeminski *et al*, 2012).

The result of this study reveals a significant difference in selected cardiopulmonary parameters of internally displaced persons with age and gender matched with the non-internally displaced persons. The reasons for this can be explained on the basis of physiologic differences that exist between male and female of the two groups of participants such as height, weight and body composition (Charkoudian and Joyner 2004). With regards to these differences few studies have shown that resting blood pressure of women is typically lower than that observed in men of the same age (Fu *et al*, 2005, Wheatley et al, 2014). There was a significant sex difference in (DBP, MAP) among the respondents of IDPs population. This is contrary to the findings of a previous study that showed no significant difference in DBP between males and females participants studied (Wheatley *et al*, 2014). This may be as a result of reduced DBP that contributed to low MAP experienced by the male IDPs in this study. However, there was no significant difference in (SBP, heart rate, rate pressure product, respiratory rate, FEV_1 and forced vital capacity) between males and females IDPs population. This finding may be attributed to the fact that both male and female IDPs population experience almost similar health related difficulties, environmental, physical disorders and psychological stressors

(Rentería-Ramos et al, 2019) that may directly or indirectly affect cardiopulmonary response during and after displacement.

This study also reveals a significant sex difference in (SBP, DBP, heart rate, mean arterial pressure, rate pressure product, respiratory rate, forced expiratory volume in one second and forced vital capacity) between males and females non-IDPs population. This observation is in agreement with findings of a study that reported difference in sex as having significant impact on cardiovascular and respiratory function (Krzeminski *et al*, 2012). This explains the reason why the incidence of orthostatic hypotension is greater in women than in men (Fu *et al*, 2005) and women have lower tonic autonomic support of resting arterial pressure (Christou *et al*, 2005).

Conclusion

The findings of this study have pointed out some challenges in the cardiopulmonary system, faced by a significant number of IDPs and non-internally displaced persons (NIDPs), who unavoidably find themselves in the unfortunate situation of displacement. Although IDPs are traumatized by war and conflict related experiences, almost equally the distressing experiences of living in internally displaced camps had affected their general health status in negative way by increasing their health problems. Hence it is recommended that IDPs should undergo regular health check-ups and counselling on general health conditions most especially cardiopulmonary health status. The mode of counselling will assist IDPs to have a broad knowledge of their health status, and what could cause and aggravate cardiopulmonary symptoms they presents with and how they can seek for proper care when it is needed. Good sanitary condition and emergency health care could go a long way in improving the cardiopulmonary health status of IDPs as well as NIDPs. This will assist policy makers to draw a robust health policy that will benefit internally displaced persons in Nigeria. Furthermore, putting into perspective the United Nations Sustainable Development Goals number three, the health of IDPs should be considered when making national health policies to ensure healthy living and promote proper wellbeing for all individuals' especially vulnerable groups.

Reference

Adegoke BOA, Akinremi AA, Akintobi AE (2015) Effects of tobacco smoking on pulmonary function indices among undergraduate students. *Nigerian Journal of Medical Rehabilitation* 18(2):17

Akuto GW (2017). Challenges of Internally Displaced Persons (IDPs) in Nigeria: Implications for Counselling and the Role of Key Stakeholders. *International Journal of Innovative Psychology & Social Development 5(2):21-27*

Alawa J Bollyky TJ (2020). A Silent Crisis: *The Rise of Non communicable Diseases in Refugee Settings* https://www.cfr.org/report/silent-crisis. Accessed 25th, November, 2021

Bob-Manuel T, Ifedili I, Reed G, Ibebuogu UN, Khouzam RN (2017). Non-ST Elevation Acute Coronary Syndromes: A Comprehensive Review. Current Problems in Cardiology 42(9):266-305.

Boyette LC, Manna B (2021). StatPearls [Internet] (Physiology, Myocardial Oxygen Demand) Treasure Island (FL): StatPearls Publishing, PMID: 2976307

Chapman AR, Adamson PD, Mills NL (2017). Assessment and classification of patients with myocardial injury and infarction in clinical practice. Heart. 103(1):10-18.

Charkoudian N, Joyner MJ (2004) Physiologic considerations for exercise performance in women. Clinic in Chest Medicine 25:247–255

Christou DD, Jones PP, Jordan J, Diedrich A, Robertson D, Seals DR (2005) Women have lower tonic autonomic support of arterial blood pressure and less effective baroreflex buffering than men. Circulation 111:494–498

Deniz E, Mehmet C, Ebru, Cakici M (2008) Comparing psychological responses of internally displaced and non-displaced Turkish Cypriots *Torture* 18:1-13

Fu Q, Witkowski S, Okazaki K, Lavine BD (2005). Effects of gender and hypovolemia on sympathetic neural responses to orthostatic stress. American Journal of Physiology-Regulatory, Integrative and Comparative Physiology 289:R109–R116

Habibullah K, iftikhar A (2014). Internally displaced persons and health challenges *Journal of Medical Sciences* 12- 2.

Kadhiresan V (2007). Cardiopulmonary Functional Status Assessment; Via Heart Rate Response Detection by Implantable Cardiac Device. https://patents.google.com/patent/US7869877. Accessed 28th November, 2021

Klabunde R (2007). Physiology Concepts. Lippincott Williams and Wilkins 93–4.

Kenyon J and Kenyon K (2005).The physiotherapist's pocket book, Essential fact at your fingertips. *Elsevier Publication* 4:178-179.

Khechuashvili L (2014) Comparative study of psychological well-being and posttraumatic growth indicators in IDP and NON-IDP citizens of Georgia. GESJ: Education Science and Psychology 6(32)-36.

Krzeminski K, Cybulski A, Ziemba A, Nazar K (2012). Cardiovascular and hormonal responses to static handgrip in young and older healthy men. *European Journal Applied Physiology*. 112(4):1315-25.

Internal Displacement Monitoring Centre (2021) Global Overview of Trends and Developments in 2006 Geneva: Internal Displacement Monitoring Centre. https://www.internal-displacement.org/internal-displacement. Accessed 26th of November, 2021

International Society for the Advancement of Kinathrometry (2001). International Standards for Anthropometric Assessment. Underale, S.A: *International Society for the Advancement of Kinathropometry* (ISAK).

Lam E, McCarthy A, Brennan M (2015). Vaccine-preventable diseases in humanitarian emergencies among refugee and internally-displaced populations. Human Vaccines & Immunotherapeutics. 11:2627-36.

Oladeji A (2015). Humanitarian crisis and internally displaced persons (IDPS): addressing the plights of youth and women victims in Nigeria *Basic Research Journal of Social and Political Science* 3(3)42-55

Owoaje ET, Uchendu OC, Ajayi TO, Cadmus EO (2016). A review of the health problems of the internally displaced persons in Africa. Nigerian Postgraduate Medical Journal, 23: 161-171

Rentería-Ramos R, Hurtado-Heredia R and Urdinola BP (2019). Morbi-Mortality of the Victims of Internal Conflict and Poor Population in the Risaralda Province, Colombia International. Journal of Environmental Research and Public Health, 16: 1644

Roberts F, Browne J, Oyok T, Sondorp E (2006). Factors associated with the health status of internally displaced persons in northern Uganda. *Journal Epidemiology Community Health* **63**(3): 227–232.

Rubia M, Marcos I, Muennig PA (2002) Increased risk of heart disease among foreign-born females residing in the United States *American Journal Preventive of Medicine***22**: 30–5

Sharif M, Ahamd F, Proyecto K (2013). Humanitarian Aid Studies Centre. Assessment of vulnerabilities faced to IDPs settled in Qargha area of Kabul (A Case Study): Research thesis. UNHCR (2019). "Global Trends Forced Displacement in 2018." Accessed 16 November 2021. https://www.unhcr.org/statistics/unhcrstats/5d08d7ee7/unhcr-global-trends-2018.html?query¼global%20trends%202019.

United Nation department of economic and social affairs (2018). THE 17 GOALS - Sustainable Development Goals. Accessed 24 January 2022. https://sdgs.un.org/goals/goal3.

Wanninayake S (2019). A Brief Conceptual Analysis on Conflict Induced Internal Displacement, Return and Resettlement Sri Lanka Journal of Sociology.1 (1): 121-150.

Wheatley CM, Snyder EM, Johnson BD, and Olson TP (2014) Sex differences in cardiovascular function during submaximal exercise in humans Springer Plus Open journal, 3:445

Yamane T (1967) Statistics, an Introductory Analysis, 2nd Ed New York. Harper and Row.