



E-ISSN: 2707-7020
P-ISSN: 2707-7012
JSSN 2020; 1(2): 35-41
Received: 11-11-2020
Accepted: 22-12-2020

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Journal of Sports Science and Nutrition

Cardio-respiratory endurance as a measure of physical fitness level of Nigerian para-military personnel

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Abstract

Physical fitness is an indispensable tool for all Para-military personnel globally to be fit and combat ready for any emergency. The training programmes of all men and women of Para-military personnel significantly emphasize physical fitness. The study was on the cardio-respiratory endurance fitness of Nigerian Para-military personnel. The motivation for the research was kindled by the observed variations in the results of physically demanding tasks performed by personnel of the three selected Para-military Services in joint security operations. The magnitude and quality of their operations varies from arm to arm depending on their responsibilities. The study was to assess the cardio-respiratory fitness levels of the three selected Nigeria Para-military personnel (Nigerian Civil Defence, Road Safety and Immigration) towards ensuring efficient operations in joint security operations among the Para-military agency. The research methodology applied in the study was basically descriptive. Data were collected using field method and document analysis. In achieving the purpose of the study, 35 male and 20 female Nigerian Civil Defence personnel, 30 male and 13 female Nigerian Road Safety personnel and 25 male and 10 female Nigerian Immigration personnel were randomly selected to serve as participants in this study. The 12 minute run test for cardio-respiratory endurance was conducted on the participants. The data thus collected were statistically analyzed. The findings of this study revealed that the Nigerian Civil Defence personnel had significantly better cardio-respiratory endurance fitness level than their counterparts from the Nigerian Road Safety and Immigration. The performances of the participants in the tests were measured against the physical fitness standards established for the Para-military Personnel. On the basis of the findings of this study, it was recommended that the Nigerian Civil Defence needs to improve their cardio-respiratory endurance fitness level. Also, there is need for the three selected Para-military personnel to strengthen the physical training programmes of their female personnel. Henceforward, the three Para-military personnel should embark on cardio-respiratory fitness control programmes for their personnel.

Keywords: Civil Defence, programmes, physical fitness, healthy

Introduction

Globally, the strength of every country military and Para-military depends on the physical activity engage by the military and Para-military personnel's. Para-military regulations require its personnel's to be fit, as excessive weight negatively impacts their readiness, health, and morale. The practices of physically fitness by engaging in physical activity among children, adolescents and adults have become public health objectives Simonen *et al.*, 2003) [30]. Physical activity maintains and improves cardiorespiratory fitness, reduces the risk of obesity and associated comorbidities, and results in greater longevity (ACOG, 2015) [1]. Physical fitness is an essential tool not only for optimal health, but also for better performance and quality of life (Hayward, 1998; Venkateswarlu, 2009, 2010) [36, 37]. It is of particular importance to armed Forces all over the world, not only because of its benefits, but also because it makes the soldiers battle ready. A soldier's high level of physical fitness has direct impact on combat readiness. The role of regular participation in a sound physical fitness programme and maintenance of healthy weight is to enhance a person's quality of life, improve productivity and bring about positive physical and mental changes (United States President's Council on Physical Fitness and Sports, 2005) [36]. Physical activity, defined as any bodily movement produced by the contraction of skeletal muscles (ACSM's, 2018) [2] in all stages of life, maintains and improves cardiorespiratory fitness, reduces the risk of obesity and associated comorbidities, and results in greater longevity.

The inability of a public security personnel's to be tactical good is as a result of lack of

physical exercise to be physically fit. Recently, the scientific community has been monitoring and reporting the deleterious effects of a sedentary lifestyle on health of personnel (Kohl *et al.*, 2012) ^[19]. Thus, physical exercise programs must include cardiorespiratory, strengthening, and flexibility components to maintain and/or improve overall health and physical fitness (Garber *et al.*, 2011) ^[14]. Individuals with higher levels of cardiorespiratory fitness and strength have a 57% and 45% lower risk of all-cause mortality, respectively, than do those with lower levels of these components of physical fitness (Nocon *et al.*, 2008; Kraschnewski *et al.*, 2016) ^[26, 20].

Cardiorespiratory endurance is one of the health-related components of fitness which Malina *et al.*; (2000) ^[23] defined as the ability of the circulatory and respiratory systems to adjust to vigorous exercise and to recover from the effect of that exercise with more energy still spared for other daily routines activities (Lohman, 1989; Oja and Tuorth, 1995) ^[22, 28].

Cardiorespiratory endurance is the ability to deliver oxygen and nutrients to tissues, and to remove waste products over sustained period of time (President's Council on Physical Fitness and Sports, 2005) ^[34].

Cardiorespiratory endurance is your body's ability to keep up with exercise like running, jogging, swimming, cycling, and anything that forces your cardiovascular system (lungs, heart, blood vessels) to work for extended periods of time. Together, the heart and lungs fuel your body with the oxygen needed by your muscles, ensuring that they have the oxygen needed for the work they are doing. The Cooper Run (running as far as possible in 12 minutes) is a test commonly used to assess cardiovascular endurance, but many trainers use the Step Test (stepping onto a platform for 5 minutes). Both are accurate measures of a subject's cardiovascular endurance.

Cardio-Respiratory Endurance is refers to the heart and blood vessels and the efficiency by which oxygen (O₂) is taken into the lungs and into the bloodstream and carried to the various parts of the body where it is needed. It is the ability of the circulatory system to keep the muscles supplied with oxygen and nutrients and to keep the muscles free of waste products during heavy exercise. Bray *et al.* (1970) ^[7] defined cardio-respiratory endurance in terms of the "ability of the circulatory and the respiratory systems to adjust to vigorous exercise and to recover from the effect of exercise". Cardiorespiratory endurance is the mostly means of determining a person's maximal oxygen consumption (VO₂ max) (Mathews and Fox, 1981) ^[24]. Maximum oxygen uptake according to Verducci, (1983) ^[38], indicates how well various physiological functions can be adjusted to increasing metabolic demands of work. Over the years, various tests were developed to measure VO₂ max but most of these tests require laboratory tests. Such tests include treadmill running/walking, cycle ergometer pedaling and stepping tests. Again, most of these tests cannot be used on large populations at the same time, because of cost of equipment, time consumption, and their technical complexity. Thus, to overcome these limitations, varied field tests were developed as alternatives to the more complex laboratory tests. These tests are not only reliable, having been compared with the laboratory tests, but found to be more convenient when large samples are involved.

Some of these field tests include the 6-minutes, 9-minutes, 12-minutes and the ½ mile run tests. Cooper (1968) designed at 12-minutes run/walk test, which was not only considered suitable for large sample, but also found reliable when compared with laboratory tests. Burke (1976) reported that the 12-minutes run test correlated as high as .91 with selected laboratory tests.

Pollock *et al.* (1984) ^[29] stated that the widely used fields tests for measuring VO₂ max are the 12-minutes and the 1 ½ mile run tests. This, according to them, is because both tests have very high inter-correlation. Both tests have a moderate to high relationship with the laboratory max. O₂ uptake test. They however warned that these field tests should not be used as diagnostic tool. Gwani (1986) ^[15] reported that the 6-minute run and the Cooper's 12-minute run tests are correlated as high as .778. This suggests that the two tests are reliable measures of cardio-respiratory fitness. McArdle *et al.* (1981) ^[25] stated that prediction of maximum aerobic capacity should be approached with caution when using running performance factors, such as the pacing of inexperienced subjects, body weight and body fitness, running efficiency and the percentage of one's aerobic capacity that can be sustained without lactic acid build-up, all contribute significantly to successful running.

Maximum Oxygen uptake is often referred to as maximal aerobic power. This is the highest rate of oxygen consumed by the body in a given period of time during exercise involving a significant portion of a muscle mass (Falk *et al.*, 2001; Kim *et al.*, 2000) ^[13, 18]. It provides a great measure of the state of the gas transport system and reflects pulmonary capacity. The cardiovascular fitness is the ability of the heart, lungs and blood vessels and working muscle cells to work effectively and efficiently. Similarly, William *et al.* (1986) ^[39] and Ekblom *et al.* (1968) ^[11] were of the view that maximum oxygen consumption is a significant factor in determining cardiorespiratory endurance. Their evidence is that trained individuals have a lower rise in lactic acid than the untrained individuals working at the same workload. They contended that better oxygen transport in the trained individual than in the untrained is due to better condition of the heart, blood vessels and the lungs that determine oxygen carrying capacity.

When an increase in overload fails to elicit a significant increase in oxygen consumption, the highest value attained represents the VO₂Max. More importantly is the finding that O₂ consumption linearly increased with exercise intensity (Astrand, 1996). Using 6-9 and 12 minute run tests and VO₂max test on 40 college females, Custer and Chaloupka (1977) found a significant (<0.05) relationship between predicted VO₂Max and performance in all the three runs. The investigator therefore felt that since the difference between correlation of 6 minute (r=45) and 12 minute runs was not significant, the 6 minute run could be used, instead of the longer 12 minute run.

It can be understood that distance run-tests of 12 minute duration and above are suitable tests for cardiorespiratory fitness; longer distance run-tests are more valid than the shorter ones though there are hardly any significant differences between the two. In the present study, the 12 minute run test will be used for the research.

As in the general population, higher levels of physical fitness are associated with a better quality of life and health indicators in public security forces, such as policemen, firemen, Civil Defence, Immigration, road safety and

military personnel (Baur *et al.*, 2012; Leischik *et al.*, 2015) [5, 21]. Due to the tactical nature of these professions, these agents are often exposed to situations that involve great physical demands, including running, jumping, crawling, hauling, lifting, and transporting weight (Beck *e al.*, 2015) [6]. Thus, evidence shows the importance of regular monitoring of physical fitness in these occupations, since maintaining acceptable levels of physical fitness is an essential condition for performance of these professions (Stamford *et al.*, 1978; Vanderburgh, 2008; Dawes *et al.*, 2017) [31, 35, 10].

National publications have reported on indicators of physical fitness among various public Para-military security agents (Esteves *et al.*, 2014; Nogueira *et al.*, 2016) [12, 27]. However, these studies have limitations in establishing the actual physical fitness level among Nigerian Civil Defence, Road safety and Immigration personnel's.

Purpose of the Study

This study was conducted to assess the level of cardio-respiratory endurance physical fitness of both male and female of the Nigerian Civil Defence, Road safety and Immigration personnel's.

Statement of the problem

For an individual to promote physical readiness that is commensurate to one's life style, physical activity is vital in piloting the health benefit of the person irrespective of occupational specialty, unit, age or gender, individual is expected to acquire a high level of physical fitness.

For Nigerian security personnel, there are standards set but not properly followed and supervised by the physical training (PT) officers. As such, they don't take fitness programme seriously making the personnel very unfit all over. For Security personnel's to be tactical good and fit, physical exercise should be encouraged in all security levels to enable them be healthy and always combat ready for any emergency. Thus, physical exercise programs include cardiorespiratory, strengthening, and flexibility components to maintain and/or improve overall health and physical fitness (Garber *et al.*, 2011) [14]. Cardiorespiratory endurance is one of the health-related components of fitness which keeps security personnel healthy (Malina *et al.*, 2000) [23]. This allows the heart and the blood vessels to take in oxygen (O₂) into the lungs and into the bloodstream and transport it to various parts of the body where it is needed. It is the sole responsibility of the circulatory system to keep the muscles supplied with oxygen and nutrients and to keep the muscles free of waste products during heavy exercise. The circulatory and the respiratory systems adjust to vigorous exercise and recover from the effect of exercise (Bray *et al.*, 1970) [7].

Due to the quality of life and health benefits of physical fitness in the Para-military levels, also to the tactical nature of their various professions, these agents are often exposed to moderate and rigorous physical exercise activity that involve great physical demands, including running, jumping, crawling, hauling, lifting, and transporting weight (Beck *e al.*, 2015) [5], to maintained acceptable levels of physical fitness as an essential condition for performance of these professions (Dawes *et al.*, 2017) [10], cardio-respiratory endurance as one of the indicator and testing of physical fitness level of Para-military personnel's was adopted.

Hypothesis

There are no significant differences among some of the selected Nigerian Para-military Personnel's (Civil defence, Road Safety and Immigration) in their cardio-respiratory endurance.

Methodology

Field research design as suggested by Thomas and Nelson, (1996) was used in this study. In this design, the subjects were tested cardio-respiratory endurance for both male and female personnel of Nigerian Civil Defence, Road Safety and Immigration.

Population

The population of this study was 1330 samples consisted of both men and women of Nigerian Civil Defence, Road Safety and Immigration respectively in the Nigerian Para-military personnel.

Sample and Sampling techniques

Stratified random sampling technique was used for selecting the sample in this study. This technique, stratified the identified tri-service population into male and female groups. The sample was selected using simple random sampling technique, in which ten percent of the total number of male and female subjects from each of the three armed services, resident in Mogadishu Cantonment, were picked blindfolded, as suggested by Thomas and Nelson (1996) [33]. Thus, 35 male/20 female army personnel, 30 male/13 female air force personnel and 25 male/ 10 female Navy personnel were selected. The sample therefore comprised of 900 male and 430 female armed forces personnel, which gave a total sample of 1,330. The researcher grouped the army sample into male and female. 350 piece of paper were prepared, out of which 35 were numbered and the rest pieces of paper were left blank. Another 200 pieces of paper were prepared for the female sample out of which 20 were numbered and the rest pieces of paper were left blank. The army personnel that picked numbers 1-35 from the male group and 1 to 20 from female group were selected as the subjects for the study. In the case of the air Force, they were also grouped into male and female. 300 pieces of paper were prepared for the male group, out of which 1-30 were numbered and the rest were left blank. Another 130 pieces of paper were prepared for the females, out of which from 1-13 were numbered and the rest were left blank. The air force personnel that picked numbers 1 to 30 from the male group and 1 to 13 from the female group were selected as the subjects for the study. The researcher grouped the navy personnel into male and female. 250 pieces of paper were prepared for the male group, out of which, 1-25 were numbered and the rest were left blank. Another 100 pieces of paper were prepared for the females, out of which 1-10 were numbered and the rest were left blank. The navy personnel that picked numbers 1 to 25 from the male group and 1 to 10 from the female group were selected as the subjects for the study. The number of subjects selected for each of the armed service was ten percent (10%) of their total population. This 10% of the total population is statistically accepted in sampling technique (Thomas and Nelson, 1996; Kerlinger, 1986).

Data Collection Instrument & Test Description:

The data were collected using this instrument; Stop watch

(was used to time 12 minute run/walk test), Whistle (used to start and stop the subject at the expiration of the 12 minutes run/walk test) and Assistant Recorder (helps in giving command and records).

The Cooper Run Test (12 Minutes Run/ Walk Test Test): The Cooper Run test was used to determine the subject’s cardiorespiratory endurance within 12 minutes of run

Procedure: The subjects of the experimental group started running on 400m athletics track. The subjects were required to run many laps around the running track for 12minutes. The subjects were allowed to run at their own pace. Each of the subjects may walk or stop completely when tired. To avoid biase, subjects were randomly selected, 12 per group to run, while the research assistant helped to count the number of laps covered by each subject. At the expiration of the 12 minutes, whistle was blown and all the subjects stopped running and stood on their spot points until the research assistant went around marking the distance each of

the subjects had covered. Then, the amount of distance covered by each subjects within twelve (12) minutes was measured in meter.

Statistical Analysis

Descriptive characteristics (Mean, standard deviation and standard error) were calculated for Cardio-respiratory endurance, T-test for differences between male and female groups and One-way analysis of variance (ANOVA) and Scheffe’s post hoc test for differences on the mean scores among the difference Nigerian Para-military Personnel’s was used to compare the differences in the Cardio-respiratory endurance of the selected Nigerian Para-military officers. Statistical significance was set at P < 0.05 and all analyses were performed using SPSS version 20.

Results

Information regarding the mean age, height and weight of the three selected personnel’s’ and of the male and female subjects of the Nigerian Civil Defence, Road Safety and Nigerian Immigration are presented in table 1

Table 1: Demographic characteristics of some selected Nigerian Para-military. Mean scores of the groups on the physical fitness variables

Variables	Civil Defence			Road Safety			Immigration		
	Male N=35	Female N=20	Total N=55	Male N=30	Female N=13	Total N=43	Male N=25	Female N=10	Total N=35
Age (Years)	31.34	27.60	29.47	32.40	27.08	29.74	29.84	27.60	28.72
Height (mts)	1.66	1.64	1.65	1.65	1.65	1.65	1.65	1.65	1.65
Weight (kg)	66.29	60.50	63.395	63.27	62.23	62.75	63.40	62.30	62.85

Table 1 shows that the mean age of the Nigerian Civil Defence, Road Safety and Immigration was 29.47, 29.74 and 28.72 respectively. The mean age of the Nigerian Civil Defence male and female subjects was 31.34 and 27.60 respectively. The mean age of Road safety male and female subjects was 32.40 and 27.08 respectively. Whereas the mean age for Nigerian Immigration male and female subjects was 29.84 and 27.60 respectively. On the whole, the Nigerian Road Safety subjects were older than subjects from other two Para-military personnel’s, whereas subject from Nigerian immigration were younger than the subjects from the other two Para-military personnel’s. Among the male subjects, Nigerian Immigration subjects were younger than subjects from Nigerian Road Safety were older. Among the female subjects, Nigerian Road Safety subjects were younger than the subjects from other two Para-military personnel’s.

Table 1 shows that the mean height of each of the three Para-military personnel’s was 1.65 meters the male and female subjects of the Nigerian Civil Defence were taller than their counterparts from Nigerian Road Safety and the Nigerian immigration. The Nigerian Civil Defence personnel were heavier than their counterparts from Nigerian Road Safety and the Nigerian Immigration. Among the male subjects, the Para-military personnel were heavier than the subjects from the Nigerian Road Safety and Nigerian Immigration, whereas females from Civil Defence were lighter than the subjects from the other two Para-military personnel’s. Information regarding the mean scores of Nigerian Civil Defence, Nigerian Road Safety and Nigerian Immigration personnel in 12 minutes run test, muscular strength and endurance, muscular strength, flexibility and body composition is shown in table 2.

Table 2: Mean scores of Civil Defence, Road Safety and Immigration Personnel in Physical fitness tests

Variables	Civil Defence			Road Safety			Immigration		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
12 Minute Run	2.38	2.06	2.22	2.07	1.93	2	2.13	1.57	1.85

Table 2 shows that the Nigerian Civil Defence personnel had greater endurance that their counterparts from Road Safety and Immigration. Among both men and women, Nigerian Civil Defence personnel had greater endurance than their counterparts from Road Safety and Immigration as shown by their scores in 12 minute run test. Similarly, the Nigerian Civil Defence personnel had better scores in muscular strength and endurance than their counterparts from Road Safety and Immigration. However, Nigerian Immigration personnel had better scores in flexibility than their counterparts from the other two Para-military

personnel’s. Among men, Nigerian Road Safety personnel had better flexibility, whereas among women, Nigerian Civil Defence women had greater flexibility. In body composition, Nigerian Civil Defence personnel were better than their counterparts from the other two Para-military personnel. Among men, Nigerian Immigration men had better body composition, whereas Nigerian Civil Defence women had better body composition than the other two Para-military personnel’s.

Hypothesis

There are no significant differences among Nigerian Civil Defence, Road Safety and Immigration personnel in their cardiorespiratory endurance as tested by 12 minutes run test. The hypothesis was tested by using one way analysis of variance, the results of which are shown in table 3

Table 3: One Way analysis of Variance for differences among Nigerian Civil Defence, Road Safety and Immigration personnel on cardiorespiratory endurance

Source Square	Sum of Squares	Df	Means	F	P
Between Groups	2.256	2	1.128	3.581	0.029
Within Groups	40.954	130	.315		
Total	43.211				

$F(2, 130) 3.581 > 3.00 < 0.05$

From table 3 above, the results shows that there was a significant differences among the three Para-military personnel's of the Nigerian Para-military personnel's in their cardiorespiratory endurance as tested by 12 minutes run test. This is because the calculated p value of 0.029 is lower than the 0.05 alpha level of significance and the computed F value of 3.581 is greater than the 3.000 F critical value at df 2, 130/ The Scheffe's post hoc test (table 4) revealed that these significant differences were due to the highest scores of civil Defence personnel compared with their counterparts from Nigerian immigration. However, the difference in cardiorespiratory endurance between personnel from Nigerian Civil Defence and Road Safety were not significant.

Table 4: Result of the Scheffe's post hoc test on the mean scores for Cardio-respiratory endurance of Nigerian Para-military Personnel's

Para-military (i)	Para-military (j)	Mean Difference (i-j)	Standard Error
Civil Defence	Road Safety	.23433	.11425
	Immigration	.29286	.12136
Road Safety	Civil Defence	-.23433	.11425
	Immigration	.05853	.12778
Immigration	Civil Defence	-.29286	.12136
	Road Safety	-.05853	.12778

* The main difference is significant at the .05 level

Discussion

This study revealed significant differences among the three selected Nigerian Para-military Personnel's in cardio-respiratory endurance. This was mainly because the Nigerian Civil Defence had greater level of cardiorespiratory endurance compared with the Road Safety and immigration, whereas the Nigerian Road Safety had greater cardiorespiratory endurance than the Nigerian Immigration. This may be attributed to the fact that the intensity, frequency and duration of physical training of the Nigerian Civil Defence were more than those of the Road Safety and the Immigration. These findings are in agreement with findings of Suleiman (2008) [32], which showed higher level of cardiorespiratory endurance among the Nigerian Civil Defence Personnel compared with their counterparts in the Road Safety and the Nigerian Immigration. This finding may be justified on the basis of the fact that the

cardiorespiratory adaptation to training depends largely on the intensity, duration and mode of training (Katch *et al.*, 2010; Venkateswarlu, 1990, 2009, 2010) [17, 36, 37]. This is attributable to increased capacity to utilize oxygen with increased training and enhanced cardiovascular dynamics in terms of improved circulation and increased red blood cell concentration that promote oxygen transport. Studies conducted elsewhere have conclusively shown that cardio-respiratory endurance improves better with increased training (Astrand, 1996; Katch, 2010; Venkateswarlu, 2010) [4, 17, 37]. The results of this study also showed that the Nigerian Civil Defence men had greater cardiorespiratory endurance than their female counterparts which supports the earlier findings of Matthew and Fox (1981) [24], Pollock *et al.* (1984) [29]. This sex difference in cardio-respiratory endurance response to training maybe attributed not exactly to the difference in the capacity to adapt, but to the inherent morphological differences between male and female subjects. It is well known that a female has a smaller heart and lower circulation than their male counterpart. This study could not establish a sex difference in cardio-respiratory response to training.

Conclusions

From the results obtained above, it showed that the majority of the para-military has good cardiorespiratory endurance fitness level and excellent neuromuscular fitness especially the Nigerian Civil Defence. Male Civil Defence officers possess higher cardiorespiratory and neuromuscular fitness than the female officers. There was a decline in neuromuscular fitness with age, with values close to one repetition every 2 years. For cardiorespiratory fitness, the decline is close to 3.5 mL/kg/min with every 10 years of age. In addition, Para-military personnel's were declared fittest.

Recommendation

The researcher recommended that Physical Training exercise should be set as a top priority by the Physical Trainer Officers to boost the fitness of the Para-military personnel's. The findings shows that generally, the physical fitness level of personnel of the Nigerian Road safety was not as good as those of the Nigerian Civil Defence and Nigerian Immigration. There is therefore the need for the Road Safety to strength its physical fitness program by increasing its frequency, intensity and duration of exercise to improve cardiorespiratory endurance of its personnel.

The investigator in the course of this research found that the Nigerian Immigration does not have an established physical fitness norms for its personnel. There is therefore the need for the Nigerian Immigration to develop norms for different components of physical fitness for different age and gender groups.

The investigator found that while the Nigerian Civil Defence and Road Safety developed a point system to determine the standards of each component of physical fitness, the Nigerian Immigration had no such developed system. There is therefore the need for the Nigerian Immigration to develop a point system which can be used to determine the standard of each component of their physical fitness.

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