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ACADEMIC JOURNEYS AND FITNESS REALMS: A STUDY OF NIGERIAN UNIVERSITY UNDERGRADUATES

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Abstract: The concept of fitness encompasses a holistic approach to well-being, encompassing mental, emotional, social, spiritual, moral, and physical dimensions tailored to an individual's hereditary disposition (Pate, 1998; Sharma, 2015). Specifically, physical fitness is defined as the capacity to execute Activities of Daily Living (ADL), indulge in leisure pursuits, and possess sufficient energy reserves to handle unforeseen emergencies without experiencing excessive fatigue (Prentice, 1994; Hoeger et al, 2018). At the core of assessing physical fitness lies cardiorespiratory endurance, a pivotal index that reflects an individual's ability to sustain aerobic activities (Charles et al, 2004; Domínguez et al, 2018).
Cardiorespiratory endurance, a key component of physical fitness, is elucidated by the Maximum Capacity of the working tissue to utilize oxygen, commonly denoted as V02max (Bennett et al, 2016). This metric holds paramount importance in gauging an individual's overall fitness level, encapsulating the efficiency with which the body's tissues utilize oxygen during prolonged physical exertion. As such, understanding cardiorespiratory endurance becomes instrumental in comprehending an individual's fitness status and predicting their ability to perform various physical tasks.
This abstract underscores the multifaceted nature of fitness, delving into its diverse dimensions and emphasizing the significance of cardiorespiratory endurance as a pivotal indicator. By exploring the physiological underpinnings of V02max, this study aims to contribute to a nuanced understanding of cardiorespiratory endurance and its role in the broader context of physical fitness assessment. The investigation employs a comprehensive approach to shed light on the intricate interplay between hereditary factors, mental and emotional stability, social consciousness, and adaptability, alongside the indispensable role of cardiorespiratory endurance in achieving an optimal state of physical well-being.
Keywords: Physical Fitness, Cardiorespiratory Endurance, V02max, Holistic Well-being, Fitness Assessment

INTRODUCTION

Fitness is a broad term denoting dynamic qualities that allows an individual to study his/her needs regarding mental and emotional stability, social consciousness and adaptability, spiritual and moral fibres and physical health; consistent with his/her hereditary endowment (Pate, 1998; Sharma, 2015). Physical fitness is the ability to perform one's Activities of Daily Living (ADL), enjoy leisure and have enough vigour left to care for unforeseen emergencies without undue fatigue (Prentice, 1994; Hoeger et al, 2018). Cardiorespiratory endurance is the most important index used in the assessment of physical fitness (Charles et al, 2004; Domínguez et al,

2018). Cardiorespiratory endurance capacity is best indicated by the Maximum Capacity of the working tissue to use oxygen – V02max (Bennett et al, 2016).

Physical inactivity is a modifiable risk factor of cardiovascular diseases (Truthmann et al, 2015) and a widening variety of other chronic diseases including diabetes mellitus (Gilbert et al, 2019), colon (Richardson et al, 2016) and breast (Tamimi et al, 2016) cancer, obesity (Thasanasuwan et al, 2016), hypertension (Ibekwe, 2015), bone and joint diseases (Palazzo et al, 2016) and depression (Gallagher et al, 2016). Various studies have shown that there appears to be a linear relationship between Physical Activity (PA) and health status, such that a further increase in PA will lead to additional improvements in health status (Cooper, 1968; Sulaiman et al, 2010; Adeniyi et al, 2011; Odole et, 2019). Cooper (1968) noted this among individuals with COPD. Adeniyi et al (2011) investigated the relationship between Depression and Physical Activity among adolescents in Nigeria while Suleiman et al (2010) studied the relationship between physical fitness and duration of incarceration of inmates in some selected prisons in Nigeria.

Aside the relationship between physical activity and health status, studies (Grisson, 2005; Coe et al, 2006; Castelli et al, 2007; Viaderi, 2008; Sardinha et al, 2016; Donnelly et al, 2016) have shown a linear relationship between physical activity/fitness and academic performance among students. In a study of 214 sixthgrade students, Coe et al (2006) found that students who either performed some or met Healthy People 2010 guidelines for vigorous activity (20 minutes per session on three or more days per week) had significantly higher grades than students who performed no vigorous physical activity in both semesters. Similarly, Castelli et al (2007) found that among 259 third and fifth graders from four Illinois middle schools, field tests of physical fitness were positively related to academic achievement. Specifically, aerobic capacity was positively associated with achievement, whereas BMI was inversely related. Associations were demonstrated in total academic achievement, mathematics achievement, and reading achievement. The brain is known to benefit in many ways from exercise (Hamzat et al, 2014; Hamzat and

Ekechukwu, 2015; Sleiman et al, 2016; Barha et al, 2017)

Several studies as enumerated above have shown that improved physical fitness can lead to better health status and more importantly improved academic performance among students. It is therefore pertinent to regularly assess students' level of physical fitness as well as the factors that may influence their physical fitness. This study assessed PFL, and influencing clinical/demographic factors of the PFL of undergraduate students in the Faculty of Health Sciences and Technology (FHST), University of Nigeria, Enugu Campus (UNEC).

MATERIALS AND METHODS

Participants

Two hundred and thirty-eight students participated in the study. Sample of convenience was used to recruit the participants (2^{nd} to 5^{th} year students) from the four undergraduate departments: Medical Rehabilitation (MRH), Medical Laboratory Sciences (MLS), Medical Radiography and Radiological Sciences (RAD) and Nursing Sciences (NUR) in FHST, UNEC.

Eligibility Criteria

Only Undergraduates from the Faculty of Health Sciences and in grade 2 to grade 5 (200 level – 500 level) were included in this study. However, those that answered 'Yes' to one or more questions on the Physical Activity Readiness Questionnaire (PAR-Q) or had any obvious cardiorespiratory disorders with emphasis on the absolute and relative contraindications to exercise testing as stipulated by the American Heart Association (Garner et al,

2017; Karnabi, 2017) and students with any known musculoskeletal disorder that limits walking were excluded from this study.

Study Design

A cross sectional exploratory research design was used in this study and purposive sampling technique was employed.

Determination of Sample Size

To estimate sample size, a power analysis was done using the mathematical relationship described by Daniel and Cross (2018) for a finite population: $n = \frac{N}{1 + N(e)^2}$

where n = sample size N = Population Size e = Tolerance Error (0.065)

The population of students in the FHST, UNEC was 3, 800 as obtained from the faculty officer's record.

Hence, N = 3,800.

Calculated Sample Size (n) = 223.

Procedure

Ethical approval for this study was obtained from the University of Nigeria Teaching Hospital Research and Ethics Committee. The protocol for this study was explained to the prospective participants and their informed consent consequently sought and obtained. They were screened using the PAR-Q and the absolute and relative contraindications to exercise testing. Their demographic details (age, gender, height and weight) and academic details (department, grade) were obtained and recorded in a data form. Anthropometric variables of height and weight were obtained following standard protocol (Ezeukwu et al, 2015) and BMI was calculated thereafter from these two variables using the BMI formula [BMI = weight/(height)^2]. The Cooper's 12Minutes' Walk Test (12-MWT) was then administered and their PFL determined using the VO_2 max estimated from the distance walked in 12 minutes (Cooper, 1968).

Data Analysis

Data was analysed using: (1) descriptive statistics of mean, standard deviation, and variance to summarise the demographic and academic variables; (2) independent t – test to compare the PFL of male and female participants; (3) One way ANOVA to compare the mean PFL across the various departments and grades; (4) Pearson correlation coefficient was used to evaluate the relationship between BMI and PFL. Level of significance was set at $\alpha = 0.05$.

RESULTS

Demographic and academic details of the participants

A total Two hundred and thirty-eight undergraduates from Ekechukwu et al.31

The FHST, UNEC participated in this study. They comprised 122 (51.3%) females and 116 (48.7%) males. The mean age of the participants was 23.79±3.11 years and ranged between 19 and 44 years. Their mean heights and weights were 1.68±0.08m and 64.76±10.11 kg respectively. The estimated mean BMI of the participants was 22.78±2.93 kg/m^2 (13.42 – 37.91 kg/m^2) as shown in Table 1.

Physical fitness level of the participants

The mean PFL of students in this study was 17.75 ± 5.38 ml/kg/min, it ranged between 3.17 to 31.68 ml/kg/min. The PFL of male participants (19.92 ± 5.92 ml/kg/min) was higher than those of the female participants (15.67 ± 3.80 ml/kg/min). Students in the departments of MRH (19.65±5.19 ml/kg/ml) and MLS (19.42±5.33 ml/kg/ml)

Table 1: Demographic/Academic Characteristics and the Physical Fitness Level of the Participants (N = 238)

	Min.	Max.	Mean	SD
Age (yrs)	19.00	44.00	23.79	3.11
Height (m)	1.47	1.89	1.68	0.08
Weight (kg)	42.0	107.0	64.76	10.11
BMI (Kg/m^2)	13.41	37.91	22.78	2.93
PFL (ml/kg/min)	3.17	31.68	17.75	5.37
Males			19.92	5.92
Females			15.67	3.80
MRH			19.65	5.19
MLS			19.42	5.33
RAD			17.01	4.54
NUR			14.66	4.92
2^{nd} year			16.85	4.88
3^{rd} year			17.27	5.84
4^{th} year			16.99	4.56
5^{th} year			19.93	5.62

had higher PFLs than those in RAD (17.01±4.54 ml/kg/ml) and NUR (14.66±4.92 ml/kg/ml). In the same vein, the participants in grades five (19.93±5.62 ml/kg/ml) and three (17.27±5.62 ml/kg/ml) had higher levels of physical fitness than those in grades four (16.99±4.56 ml/kg/ml) and two (16.85±4.88 ml/kg/ml) as shown in Table 1. **Comparison of the PFL of male and female participants using unpaired t-test**

There was a significant difference in the mean PFLs between the male and female participants (t= -6.596, p < 0.0001). The level of physical fitness of males (19.92 ± 5.92 ml/kg/min) was significantly higher than those of the females (15.67 ± 3.80 ml/kg/min) as shown in Table 2

Comparison of the PFL of among the various departments and grades using one-way ANOVA

There was a significant difference in the mean PFLs of the participants when compared among the various departments (F = 2.321, P < 0.0001); Participants in MRH and MLS had significantly higher values than those in RAD and NS. Also, there was a significant difference in the mean PFLs of the participants when compared among the various grades of study (F = 4.753, P < 0.0001) as shown in Table 3

Relationship between physical fitness and body mass index (BMI) of the participants

There was a weak, linear but non- significant correlation (r = 0.004, p = 0.951) between BMI and the level of physical

Fitness of the participants as shown in Table 4.

Comparison of the PFL of male and female participants using unpaired t-test

There was a significant difference in the mean PFLs between the male and female participants (t= -6.596, p <

0.0001). The level of physical fitness of males (19.92 ± 5.92 ml/kg/min) was significantly higher than those of the females (15.67 ± 3.80 ml/kg/min) as shown in Table 2.

Comparison of the PFL of the participants among the various departments and grades using one-way ANOVA

There was a significant difference in the mean PFLs of the participants when compared among the various departments ($F = 2.321$, $P < 0.0001$); Participants in MRH and MLS had significantly higher values than those in RAD and NUR. Also, there was a significant difference in the mean PFLs of the participants when compared among the various grades of study ($F = 4.753$, $P < 0.0001$) as shown in Table 3.

Relationship between physical fitness and body mass index (BMI) of the participants

There was a weak, linear but non- significant correlation ($r = 0.004$, $p = 0.951$) between BMI and the level of physical fitness of the participants as shown in Table 4.

DISCUSSION

The mean fitness level of students (17.75 ± 5.38 ml/kg/min) in FHST, UNEC as obtained from this study was below the normal VO_2max (38 to 46 ml/Kg/min) for most college-aged men and women in the United States as reported by Prentice (Prentice 1994). This difference may be due to anthropometric difference (height, limb length and stride lengths) between the two comparing populations (NCD Risk Factor Collaboration, 2016). Also, the average American college students engages in extracurricular sporting activities (Craft, 2012) that is unlikely observed in the study population. There appears to be a general belief in most academic institutions in Nigeria especially among the students in Health Sciences, that extra-curricular activities like exercise and sports are time consuming and so should be relegated to the background in order to have a better academic performance. Studies (Viadero, 2008; Erickson et al, 2015; Mullender Wijnsma et al, 2015; Donnelly et al, 2016; Erwin et al, 2017;) have shown that the above belief is not only erroneous but detrimental to academic excellence. These studies reported positive linear relationship between participation in physical activities to improve physical fitness and academic performance of students.

In 2004 Naperville Central High School in Illinois began a "learning readiness" physical education program (Viaderi, 2008). Students identified as underperforming in literacy were offered an early morning physical education session immediately followed by a literacy support class. By the end of the semester, it was found that the students who took part in both the early morning physical education class and the literacy intervention gained 1.34 years of improvement on a standardized reading test whereas their peers who did not participate in the physical education class prior to literacy instruction only made about 0.7 years of improvement. A more impressive result was obtained when this approach was applied for mathematics instruction. In a Quebec study, Trudeau and Shepard (2008) concluded that given competent providers, physical activity can be added to the school curriculum by taking time from other subjects without risk of hindering student academic chievement. On the other hand, they observed that adding time to academic subjects by taking time from physical activity programs does not enhance grades, but may rather be detrimental to health.

The mean PFL of male participants in this study was significantly higher than the mean PFL of female participants. This is because males are larger, with more muscle mass thus more strength and power (Andrew, 2018); they also have larger heart volumes (Hale, 2003; Best et al, 2012) which gives them a greater oxygen transport capacity. Women's performance times are about 10% lower than men's in most tract events while absolute maximal oxygen consumption is more than 40% greater in men than women (Birtch et al, 2005). Also,

Table 2: Independent t – test Result comparing the Physical Fitness Levels of the male and female participants

						95 % CI	
VO_2 max	t - value	DF	P – Value	MD	SED	Lower	Upper
Equal Variances Assumes	-6.596	236	*<0.0001	-4.234	0.641	-0.642	-0.297

Table 3: One-way ANOVA Comparing the Relationship between the Mean Physical Fitness Level of Participants across the Various Departments and Grades of study.

		Sum of Squares	**Df**	**Mean Square**	**F**	**Sig.**
DEPT	Btw Groups	267.176	172	1.553	2.321	*<0.0001
	Within Groups	43.500	65	0.669		
	Total	310.676	237			
GRADE	Btw Groups	289.286	172	1.682	4.753	*<0.0001
	Within Groups	23.000	65	0.354		
	Total	312.286	237			

Table 4: Pearson Correlation between BMI and PFL of Participants

	PFL
Pearson Correlation (r)	-0.004
BMI Sig. (2-tailed)	0.951
N	238

the amount of 34 and concentration of haemoglobin are higher in men; the average haemoglobin concentration for females is about 13.7 gHb/100 ml while for males, it is about 15.8gHb/100ml (WHO, 2011**)**. This difference is attributed to the stimulating effect of androgens on haemoglobin production and the effects of menstrual blood loss as well as differences in dietary intake (Prentice, 2001; Hall, 2015).

The difference in the mean fitness level across the departments could be that the students may have had different orientation about physical activity/fitness. It is also possible that some courses (e.g. MRH with the highest value) may have exposed the students to the importance of physical activities (Adeniyi et al, 2014) coupled with the presence of a departmental gymnasium available for their utilization. It is also possible that some students may have shown greater degrees of motivation to the 12MWT, which is an important factor that affects its result (Noonan and Dean, 2000; Cazzola et al, 2008). On the other hand, these results may be reflective of the academic workloads or requirements of the students. The low values seen among students in NUR department may be explained by the fact that a good number of the students in this department are females and may have as well reflected in their sampling. Therefore, report from this study that low levels of physical fitness among the female participants may be leaned upon to explain the low value among the NUR students.

There was a significant difference in the mean fitness level across the different grades of study. This may be explained by the differences in academic workloads/expectations and sedentary lifestyle that characterizes the different grades. Students in grade five (with the highest values) may have been more physically active given that they are engaged in clinical postings and research field work (data collection for projects) unlike their colleagues in second grade who are in the preclinical class with perceived greater academic expectation of the preclinical courses and examination that may encourage greater sitting time for personal studies (i.e. increased sedentary

lifestyle). The correlation between BMI and the level of physical fitness in this study was not significant. This may imply that people with higher BMI (e.g. Obese) may not necessarily have lower PFL than those with lower BMI (e.g. Normal). However, this result should be interpreted with caution because the sample selection did not stratify the participants based on BMI. More so, some studies (Frey and Chow, 2006; Huang and Malina, 2007) found inverse relationship between BMI and Physical fitness. Further studies to elucidate on the relationship between BMI and physical fitness is encouraged.

CONCLUSION

The fitness level of students in the Faculty of Health Science and Technology, UNEC, Nigeria is low. Academic work load in the various departments and grades appears to be a major modifiable factor influencing their level of physical fitness. It is therefore pertinent that physical activities and fitness of these students should be factored while drawing up their academic programmes.

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