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Full Length Research Paper

Ethnic differences in Cardiorespiratory Variables among Igbo and Yoruba Young Female Adults resident in Nigeria

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ABSTRACT

This study assessed the pulse rate, blood pressure, forced vital capacity, forced expiratory volume in 1 second, peak expiratory flow rate, rate pressure product, maximum oxygen consumption, weight, height, body mass index and body surface area between young female adults of Igbo and Yoruba with a view to determining the similarities or differences in the cardiorespiratory variables. One hundred (50 Yoruba and 50 Igbo) subjects aged between 18-30 years participated in the study. The weight and height of the subjects were obtained using standard procedures while BMI and BSA were calculated as derivatives of height and weight. The subjects were asked to sit down for 3 minutes and resting cardiorespiratory parameters (pulse rate, blood pressure, forced vital capacity, forced expiratory volume in 1 sec and peak expiratory flow rate) were obtained with the sphygmomanometer and spirometer. They were then subjected to 3 minutes of exercise on a step bench while the metronome was set at 88 beats per minute. The aforementioned variables were measured. There were no differences in pre and post exercise pulse rate, systolic blood pressure, diastolic blood pressure, forced vital capacity, forced expiratory volume in one second, peak expiratory flow rate, rate pressure product and maximum oxygen consumption of Igbo when compared with Yoruba. Similarly, the weight, height, body mass index and body surface area of Igbo were not significantly from that of Yoruba. In conclusion, the similarities in cardiorespiratory variables in both ethnic groups may be due to similarities seen in the anthropometric measurements.

Keywords: *Ethnic, Cardiorespiratory, Exercise, Young Adults*

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INTRODUCTION

Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness. It is performed for various reasons including strengthening muscles and the cardiovascular system, honing athletic skills, weight loss or maintenance, as well as for the purpose of enjoyment. Frequent and regular physical exercise boosts the immune system, and helps prevent the "diseases of affluence" such as cardiovascular disease, Type 2 diabetes and obesity (Stampfer et al., 2000; Hu et al, 2001). It also improves mental health, helps prevent depression, helps to promote or maintain positive self-esteem, and can even augment an individual's sex appeal or body image, which is also found to be linked with higher levels of self-esteem (Silberner, 2010). Healthcare providers often call exercise the "miracle" or "wonder" drug—alluding to the wide variety of proven benefits that it provides (AAKP, 2005) which are; increased flexibility, strengthening the heart and other muscles, increased energy, helping with weight control, improving feelings of depression, self-esteem, well-being and sleep.

Cardiorespiratory fitness is a measure of how well the body is able to transport oxygen to the muscles during prolonged exercise, and also of how well the muscles are able to absorb and use the oxygen, once it has been delivered, to generate adenosine triphosphate (ATP) energy via cellular respiration. Cellular respiration is a chemical process in the body's cells that converts the energy stored in the food into the ATP form of energy that is recruited for use by the muscles.

Essentially, the cardiorespiratory fitness level is a measure of the strength of the aerobic energy system. It can be broken down into two components. The first component of cardiorespiratory fitness is the ability of the body to transport oxygen to the muscles during prolonged exercise. The second component of cardiorespiratory fitness is the ability of the muscles to absorb and use oxygen while exercising. The body's ability to transport oxygen to the muscles is dependent on the coordinated activities of the heart, arteries, veins, and lungs.

Ethnic differences in cardiovascular parasympathetic modulation following maximal exercise had been reported by (Esco and Olson, 2010). They discovered that black men appear to have a faster heart rate recovery (HRR) and a superior heart rate variability (HRV) after maximal exercise which indicates a quicker parasympathetic rebound compared to white men. Levinson et al., (1985) conducted a screening program that included measurements of blood pressure, heart rate, height, weight, triceps skinfold thickness, arm circumference, calculation of body mass index and muscle circumference for non-public school children. Based on data of 4,086 boys and girls aged 5-10 years from the program, this study examined the ethnic differences in blood pressure and heart rate among children of white, black, Latino, and oriental ethnicity. Mean levels for both systolic and diastolic blood pressure were higher for oriental and black children than for white and Latino children. These differences were independent of age, height, weight, and skinfold thickness.

Data are sparse on the variation of the influence of exercise on cardiorespiratory variables in young female adult Nigerians. Norms for foreign subjects may not be suitable for evaluating Nigerian subjects. It is necessary to identify if there are differences or similarities in the response of each ethnic group to exercise in Nigeria and factors that determine it. Hence, we decided to investigate the effects of exercise on selected cardiorespiratory variables among young female adults from different ethnic groups in Nigeria.

MATERIALS AND METHODS

Subjects: One hundred apparently healthy subjects (50 Yorubas and 50 Igbos) were recruited for this study. Subjects were undergraduate students from Ekiti State University (EKSU), within ages 18-30 years. The Igbo subjects were born and raised in Igbo land but were resident in Ado-Ekiti for studies. Ethical clearance was obtained from the research and ethics committee of Ekiti State University Teaching Hospital, Ado-Ekiti. All subjects were aware of the risk and requirement of participating in the study and all signed a written informed consent form prior to the study. Also, subjects filled health status questionnaire to know if they were qualified for the study.

With the use of health status questionnaire and physical examination, individuals with underlying heart, lungs and other systemic diseases were excluded. Alcoholics, athletes, cigarette smokers and chronic coffee users were also excluded.

Anthropometric measurements: Weight and height were measured using portable body weighing scale and wall mounted stadiometer respectively. The body mass index (BMI) was then computed using a standard formula [BMI= weight (kg)/height^2 (m^2)].

Cardiovascular parameters: The pulse rate and blood pressure were measured using a digital sphygmomanometer (OMRON M2^{TM}) with the subjects in sitting position and cuff tied round the arm at 4cm above the cubital fossa.

Metronome: Korg^{TM} solo metronome M-1 was used to determine the pace at which the subject made contact with the bench and the ground in a minute with its rhythm.

Respiratory parameters; The forced vital capacity, forced expiratory volume in one second and peak expiratory flow rate were measured using a CONTEC^{TM} electronic portable hand held spirometer SP10 Model. The American Thoracic Society Standard (ATSS, 1995) was used to get the correct interpretation. The spirometer was set at the age, sex and height of each subject.

Procedure: Subjects were asked to sit down for three minutes and the resting cardiorespiratory parameters (pulse rate, blood pressure, forced vital capacity (FVC), forced expiratory volume in 1 second (FEV_1) and peak expiratory flow rate (PEFR) were measured. Participants were then subjected to 3minutes of exercise on a step bench; the metronome was set at 88 beats per minute to allow the subjects make contact with a foot on each beep in an up-up-down-down manner and thus 22 steps/minute for each participant. All the cardiorespiratory parameters were measured and the rate pressure product and VO_2 max were calculated. The rate pressure product was calculated as resting heart rate multiplied by systolic blood pressure (bpm × mmHg) and VO_2 max was calculated using the formula VO_2 max (ml/ kg/min) = 65.81 - (0.1847 × HR).

Statistical analysis: Data were analyzed using SPSS Windows Version 17.0 (SPSS Inc, IBM, UK). Descriptive statistics of mean standard deviation and percentage were used to summarize the data obtained. Two-sided p values were calculated using the paired sample T test for observed variables. A p-value < 0.05 was considered statistically significant.

RESULTS

A total of 100 participants were recruited for the study, out of which 50(50%) participants were Yoruba and 50(50%) were Igbo. Among the Yoruba participants, 64% of them fall between the ages of 21-25 years with mean age of 23.38 ± 1.36 years. Also, among the Igbo participants, 74% fall between 21 – 25 years with a mean age of 23.97 ± 1.09 years (Table 1).

Baseline characteristics of subjects: In Table 2, it was observed that there was no significant difference in the heart rate between Igbo and Yoruba female participants at rest with a mean pulse rate of 84.36 ± 9.97 beats/minute and 83.08 ± 13.28 beats/minute respectively. No significant difference was also observed in the systolic blood pressure between Igbo and Yoruba female participants at rest with a mean of 117.06 ±

12.11 mmHg and 117.09 ± 9.97 mmHg respectively. Similarly, the diastolic blood pressure of Igbo was not significantly different from that of Yoruba with an average value of 70.40 ± 9.76 mmHg and 70.40 ± 8.30 mmHg respectively.

As observed in Table 3, there was no significant difference in FEV_1 of Igbo and Yoruba female participants at rest, with a baseline mean value of 1.66 ± 0.41 L and 1.73 ± 0.41 L. Similarly, there was no significant difference in FVC between Igbo and Yoruba female participants at rest with an average value of 1.87 ± 0.61 L and 1.88 ± 0.46 L respectively. The baseline PEFR between Igbo 4.15 ± 1.25 L/s and Yoruba 4.29 ± 0.99 L/s female participants was not significantly different.

Post-exercise characteristics of subjects: There was no significant difference in post exercise pulse rate between Igbo and Yoruba female participants with a mean value of 113.88 ± 14.26 beats/minute and 112.73 ± 20.06 beats/minute respectively (Table 4). Also, there was no significant difference in the post exercise systolic blood pressure between Igbo and Yoruba female participants with an average of post exercise systolic blood pressure of 143.22 ± 19.71 mmHg for Igbo females and 139.48 ± 15.05 mmHg for Yoruba females. The post exercise diastolic blood pressure of Igbo was not significantly different from that of Yoruba female participants with a mean value of 69.42 ± 20.58 mmHg and 74.12 ± 9.43 mmHg respectively.

Table 1:
Social Demographic Characteristics according to Tribes

Age Group	Mean Age (±SD)	N	%
Yoruba:			
≤ 20 years	18.67 ± 1.37	6	12.0
21 – 25 years	23.38 ± 1.36	32	64.0
26 – 30 years	27.00 ± 1.95	12	24.0
Igbo			
≤ 20 years	19.00 ± 0.00	2	4.0
21 – 25 years	23.97 ± 1.09	37	74.0
26 – 30 years	27.11 ± 1.05	`9	18.0
> 30 year	31.00 ± 0.00	2	4.0

Table 2:
baseline parameters of Igbo and Yoruba female participants compared

	Yoruba (±SD)	**Igbo (±SD)**	**t-value**	**P-value**
PR (b/min)	83.08±13.28	84.36±9.97	-521.00	0.61
SBP (mmHg)	117.09±9.97	117.06±12.11	0.39	0.70
DBP (mmHg)	70.4±8.30	70.4±9.76	0.00	1.00
FVC (L)	1.88±0.46	1.87±0.61	0.07	0.95
FEV_1 (L)	1.74±0.41	1.67±0.41	0.85	0.40
PEF (L/s)	4.29±0.99	4.15±1.25	0.57	0.57

* *= Significance at p ≤ 0.05. PR- Pulse Rate, SBP- Systolic Blood Pressure, DBP – Diastolic Blood pressure, FVC – Forced Vital capacity, FEV_1 - Forced Expiratory Volume in one second, PEF – Peak Expiratory Flow Rate*

Also, no significant difference was observed in the post exercise FVC and FEV_1 between Igbo and Yoruba female participants with a mean value of 1.80 ± 0.36 L and 1.84 ± 0.53 L for FVC and 1.68 ± 0.60 L and 1.69 ± 0.58 L respectively for FEV_1.

Table 3:
Independent t-test comparison of post exercise parameters of Igbo and Yoruba female participants

Parameters	**Yoruba (±SD)**	**Igbo (±SD)**	**t-value**	**P-value**
PR(b/min)	112.73±20.06	113.88±14.26	-0.36	0.72
SBP(mmHg)	139.48±15.05	143.22±19.71	-1.10	0.28
DBP(mmHg)	74.12±9.43	69.42±20.58	1.39	0.17
FVC(L)	1.84±0.53	1.81±0.36	0.41	0.69
FEV_1(L)	1.68±0.60	1.69±0.58	-0.08	0.94
PEF(L/s)	4.37±1.28	4.29±1.56	0.57	0.80
VO_2max (ml/kg/min)	44.99±3.70	44.77±2.63	1.41	0.72
RPP (b/m×mmHg)	15287.24 ±4036.80	15105.32 ±3304.87	0.23	0.82

* *= Significance at p ≤ 0.05. PR- Pulse Rate, SBP- Systolic Blood Pressure, DBP – Diastolic Blood pressure, FVC – Forced Vital capacity, FEV_1 - Forced Expiratory Volume in one second, PEF – Peak Expiratory Flow Rate*

Table 4:
Independent t-test comparison of anthropometric measurements and age of Igbo and Yoruba female participants

Parameters	**Yoruba (±SD)**	**Igbo (±SD)**	**t-value**	**P-value**
Weight (kg)	60.68±12.36	62.54±10.77	-0.73	0.47
Height (m)	1.64±0.11	1.63±0.10	0.76	0.45
BSA (m^2)	1.66±0.20	1.68±0.17	-0.49	0.63
Age (Yrs)	23.68±2.84	24.62±2.34	-1.79	0.08
BMI(Kg/m^2)	22.15±3.46	23.03±3.85	-1.40	0.18

* = Significance at p ≤ 0.05. BSA- Body Surface Area, BMI-Body Mass Index

No significant difference was observed in the post exercise PEFR between Yoruba and Igbo with a mean value of 4.37 ± 1.28 L/s and 4.29 ± 1.56 L/s respectively. The rate pressure product of Yoruba was not significantly different from that of Igbo with an average value of 15287.24 ± 4036.80 beats/minute × mmHg and 15105.32 ± 3304.87 beats/minute × mmHg and respectively. Similarly, there was no significant difference in the VO_2 max between Igbo and Yoruba with a mean value of 44.77 ± 2.63 ml/kg/min and 44.99 ± 3.70 ml/kg/min respectively.

Anthropometric measurement of subjects: As seen in Table 4, there was no significant difference in the weight of Igbo and Yoruba female participants with a mean weight of 62.54±10.77 kg and 60.68±12.36 kg respectively (p = 0.47). No significant difference was also observed in the height between Igbo and Yoruba female participant with a mean height of 1.64±0.11 m and 1.63±0.10 m respectively (p = 0.45). Between Igbo and Yoruba female participants, there was no significant difference in their age (mean age 24.62±2.34 years and 23.68±2.84 years). There was no significant difference in the body mass index of Igbo and Yoruba female participant with a mean value of 23.03±3.85 kg/m^2 and 22.15±3.46 kg/m^2 respectively (p = 0.18).

DISCUSSION

This study investigated the differences or similarities in the baseline and post exercise cardiorespiratory variables before and after exercise in a subject of specific ethnic group. This is necessary in other to establish the differences or similarities in cardiorespiratory response of young female adult Nigerians.
There are evidences to show racial and sex differences exist in cardiorespiratory parameters across various populations in the world. Liu *et al* (1989) observed that black young adults had lower mean pulse rate, higher systolic and diastolic blood pressure than white young adults. Levinson *et al* (1985) also discovered that black children had lower mean heart rate than Oriental, White and Latino children in Chicago, USA. Lane *et al* (2002) discovered that Afrocaribeans had significant higher mean systolic blood pressure than Caucasians in both sexes studied. Hardings *et al* (2010) observed greater increase in systolic blood pressure of blacks than whites at age 16 years. However, Rosner *et al* (2000) showed that there appeared to be few substantive ethnic differences in either the systolic or diastolic blood pressure during childhood and adolescence, the difference observed were small, inconsistent and can be explained often by the difference in body size. This was also observed in this study where there was no significant difference between pre- and post-exercise systolic and diastolic blood pressure of Yoruba and Igbo female participants.

Maximal oxygen uptake or consumption (VO_2max) is the maximum capacity of an individual's body to transport and use oxygen during incremental exercise (Dlugosz et al, 2013) which reflects the physical fitness of an individual. In a study by Roy *et al* (2006) there was a significant difference in VO_2 max of subjects of different ethnic group. The mitochondrial muscle oxidative capacity and oxygen delivery capabilities as determined by sub maximal oxygen pulse account for most if not all of the ethnic differences, but in this study there was no significant difference in VO_2 max and rate pressure product of female participants between both ethnic groups.

Korotzer *et al.* (2000) investigated ethnic differences in spirometry and gas transfer DL (CO) in a young, healthy population of nonsmoking physicians and medical students aged 22-33 years of European or Asian descent. Asian values for forced vital capacity, forced expiratory volume in 1s (FEV_1), and alveolar volume (VA') were significantly lower than for Europeans, but DL(CO), DL(CO)/VA', and DL(CO)/VA'/Hb did not differ significantly. These differences could not be attributed to age, length of residence in the United States, activity level, or variance in baseline characteristics and anthropometric measurements, and therefore represent a true physiologic difference.

In a study by Jackson et al., (1983) there was no significant difference in PEFR between black and white of either sex working in a factory at Birmingham. Results from the study done by Olufeyi and Arogundade (2002) showed that tidal volume (TV) and forced vital capacity (FVC), and forced expiratory volume in one second (FEV_1) were not significantly different in female athletes and non-athletes. Similarly, in this study, there were no significant differences in the pre and post exercise values of TV, FVC, FEV_1 and PEFR of female participants of both ethnic groups.

In conclusion, the similarities in cardiorespiratory variables seen in both ethnic groups may be due to similarities seen in the anthropometric measurements. The reported data could be used by clinicians in drug prescription and usage.

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