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COMPARATIVE ASSESSMENT OF ELECTROCARDIOGRAPHIC (ECG) PATTERNS OF PROFESSIONAL MALE HEAVY WEIGHTLIFTERS AND UNTRAINED SUBJECTS IN PORT HARCOURT

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Abstract: **The present cross-sectional study assessed the electrocardiographic (ECG) patterns of Professional male Heavy weightlifters compared to Untrained Subjects. The study recruited 80 Subjects comprising 40 Professional male heavy- weightlifters and 40 Untrained Subjects. The ECG recording of each subject was collected using the Aspel 12-channel ECG machine. The subject's demographic data as well as their anthropometric measurement and vital signs were also recorded. Quantitative data were subjected to descriptive and statistical analysis. The Statistical Package for Social Sciences (SPSS) version 20.00 software was used. It was observed that the limits of P-wave, QRS-complex, PR, and QT intervals were found to be within their normal limits. However, there is a prevalence of T-wave and ST-Segment abnormalities in Heavy weightlifters in Port Harcourt. Twenty-five (25%) of the Heavy Weightlifting Subjects presented with ST-Segment elevations. On the other hand, different forms of T-wave abnormalities were recorded amongst Heavy Weightlifting Subjects. Exactly 12.5%, 5% and 2.5% of the heavy weightlifters had inverted T-Wave, flat T-Wave, and hyperacute T-Wave respectively. The mean values of systolic and diastolic blood pressures (SBP and DBP) mean arterial pressure (MAP) and the pulse pressure (PP) of the Male Heavy weightlifters were all seen to be marginally ($p<0.05$) lower than those of the Untrained Subjects.**

Keywords: **electrocardiogram, weightlifting, exercise, blood pressure.**

I. INTRODUCTION

Weightlifting is a sport in which athletes compete in lifting a barbell loaded with weight plates from the ground to over the head, with each athlete vying to lift the heaviest weights. According to the International Weightlifting Federation (IWF)[1]. Athletes compete in two specific ways of lifting the barbell overhead: these are the snatch and the clean and jerk[1].

The snatch is a wide-grip lift, in which the weighted barbell is lifted overhead in one motion[2]. The clean and jerk is a combination lift, in which the weight is first taken from the ground to the front of the shoulders (the clean), and then from the shoulders to overhead (the jerk)[1]. The clean and press, wherein a clean was followed by an overhead press, was formerly also a competition lift but was discontinued due to difficulties in judging proper form[1]. Electrocardiography is the process of producing an electrocardiogram (ECG), it is a graph of voltage versus time of the electrical activity of the heart using electrodes placed on the skin. These electrodes detect small electrical changes that are consequences of cardiac muscle depolarization followed by repolarization during each cardiac cycle (heartbeat)[3]. Changes in the normal ECG pattern occur in numerous cardiac abnormalities, including cardiac rhythm disturbances (such as atrial fibrillation and ventricular tachycardia), inadequate coronary artery blood flow (such as myocardial ischemia and myocardial infarction), and electrolyte disturbances (such as hypokalemia and hyperkalemia)[3]. An ECG conveys a large amount of information about the structure of the heart and the function of its electrical conduction system[4]. Among other things an ECG can be used to measure the rate and rhythm of the heartbeats, the size and position of the heart chambers, the presence of any damage to the cardiac myocytes or conducting system, the effects of drugs on the heart, and the function of implanted pacemakers[4].

Exercise and even strenuous exercise are associated with enormous heart health benefits in the vast majority of people when compared with people who do not exercise. However, in a very small minority who have underlying problems, exercise can trigger arrhythmia. "While there is evidence that prolonged strenuous exercise can increase risk of atrial fibrillation, the long-term risk of this is small compared to inactivity,"[2]. Chronic extreme exercise training and competing in endurance events can lead to heart damage and rhythm disorders. People with genetic risk factors are especially vulnerable, though "Moderate exercise is still the best prescription for good physical and mental health – and competitive athletes should not give up their training schedule just yet,"[2]. Competitive sports training cause structural and conductive system changes manifested by various electrocardiographic alterations[2]. This research aims to do a comparative assessment of the electrocardiographic (ECG) patterns of Professional male Heavy weightlifters and Untrained Subjects in Port Harcourt.

II. METHODS

Study Area

This study was carried out in some selected gymnasiums within Port Harcourt for a period of 6 months.

Study Design

The cross-sectional study design was adopted in this study to determine the Comparative Assessment of Electrocardiographic (ECG) Patterns of Professional Male Heavy- weightlifters from selected Gymnasiums and Untrained Subjects located within Port Harcourt Metropolis and its environs.

Study Sample

The sample size for this study is 80 Subjects comprising 40 Professional male heavy weightlifters from selected gymnasiums and 40 Untrained Subjects located within Port Harcourt Metropolis and its environs using the necessary sample size formula.

Ethical consideration

Ethical approval for the study was sort and obtained from the Institutional Ethics Committee of Rivers State University. Informed consent was also sought from the research participants.

Data Analysis

The quantitative data collected were subjected to descriptive and analytical analysis. The Statistical Package for Social Sciences (SPSS) version 20.0 software was used. Student z-test and Pearson's product-moment correlation to were used for intergroup variation and relationship in the respective variables. The P-value of $p<0.05$ was considered statistically significant.

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III. RESULTS

Figure 1: Age Distribution of Participants of the study

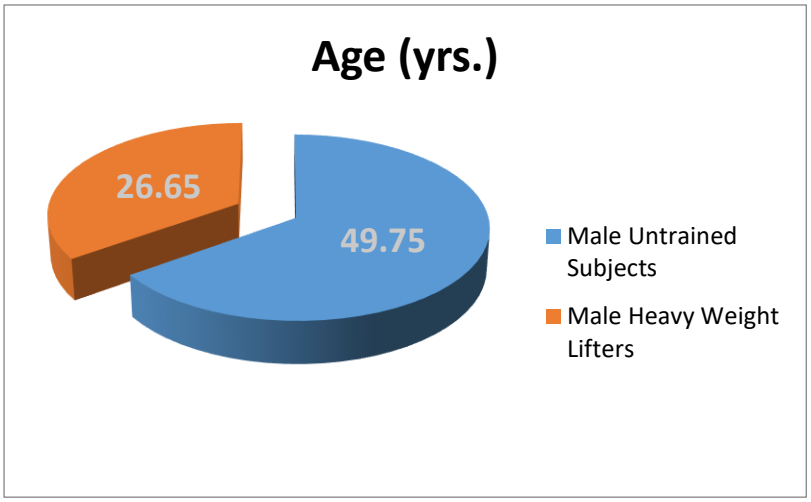

Figure 2: Mean Body Weight Values of Male Heavy weightlifters and their Untrained Counterparts.

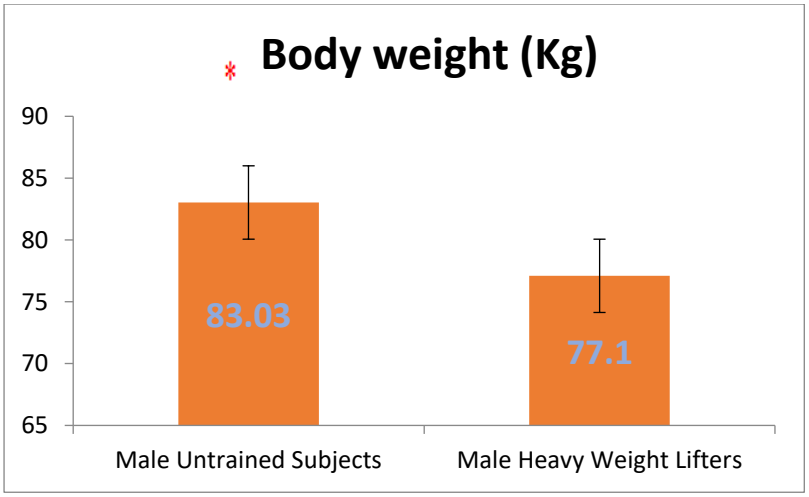

Figure 3: Mean Height Values of Male Heavy weightlifters and their Untrained Counterparts.

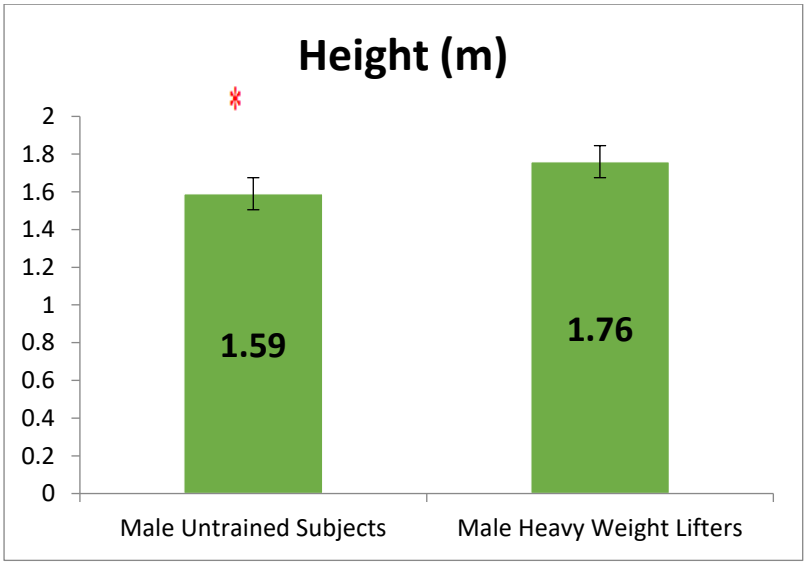

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Figure 4: Mean Body Mass Index (BMI) Values of Male Heavy weightlifters and their Untrained Counterparts.

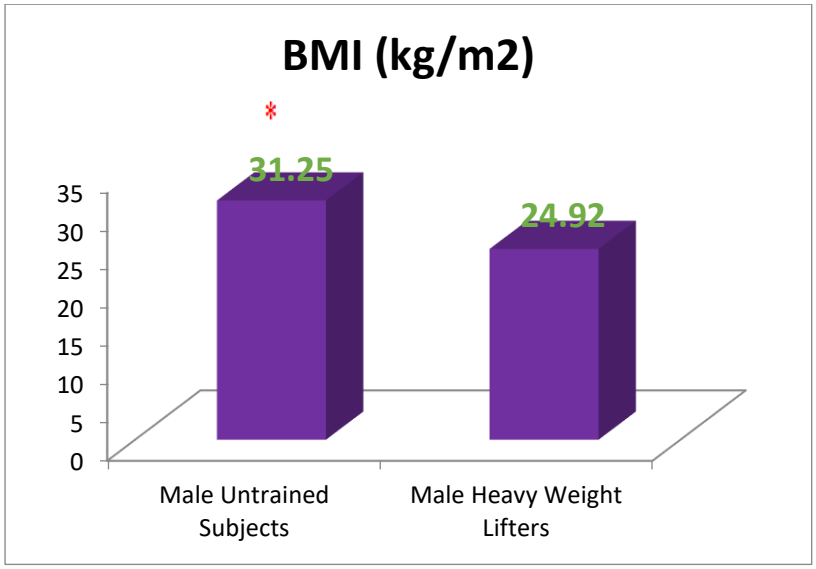

Figure 1 shows the age distributions of the study Subjects, the mean age of the heavy weightlifters was 26.65 ± 7.93 whereas that of the Untrained Subjects was 49.75 ± 13.46.

The results in Figures 2, 3, and 4 show the comparisons of the mean body weight, height and BMI values of Male Heavy weightlifters and their Untrained counterparts. The mean body weight and height values of the Male Heavy weightlifters were found to be significantly ($p<0.05$) higher than that of the Untrained Subjects.

However, the BMI value of the Male Heavy weightlifters was significantly lower than that of the Untrained Subjects.

Table 1: Blood Pressure Parameters of Male Heavy weightlifters and Male Untrained Subjects in Port Harcourt.

Parameters	Study Groups		T-test (p-value)
	Untrained Subjects	Heavyweight Lifters	
SBP (mmHg)	122.76 ± 15.13	122.25 ±16.05	0.231
DBP (mmHg)	75.71 ± 10.92	74.05 ± 10.07	0.041*
MAP (mmHg)	91.67 ±10.47	90.12 ±11.04	0.084
Pulse pressure (mmHg)	48.20 ±11.93	47.06 ± 14.33	0.011*

**statistically significant (p <0.05)*

The result in Table 1 represents the blood pressure parameters of the Male Heavy weightlifters and Male Untrained Subjects in Port Harcourt. The mean values of systolic and diastolic blood pressures (SBP and DBP) mean arterial pressure (MAP) and the pulse pressure (PP) of the Male Heavy weightlifters were all seen to be marginally ($p<0.05$) lower than those of the Untrained Subjects.

Table 2: Prevalence of T- wave and ST-Segment abnormalities in Heavy weightlifters in Port Harcourt.

ECG Variables	Study Groups			
	T- Wave Abnormalities		ST- Segment Abnormality	
	Frequency	Percentage (%)	Frequency	Percentage (%)
ST-Segment Elevation	-	-	10	25
Inverted T-Wave	5	12.5	-	-
Flat T-Wave	2	5	-	-
Hyper Acute T-Wave	1	2.5	-	-

The result in Table 2 shows the prevalence of T- wave and ST-Segment abnormalities in Heavy weightlifters in Port Harcourt. Twenty-five (25%) of the Heavy weightlifting Subjects presented with ST-Segment elevations. On the other hand, different forms of T-wave abnormalities were recorded amongst Heavy weightlifting Subjects. Exactly 12.5%, 5% and 2.5% of the heavy weightlifters had inverted T-Wave, flat T-Wave, and hyperacute T-Wave respectively.

Figure 5: Left Ventricular Hypertrophy Prevalence amongst the Heavy weightlifting Subjects.

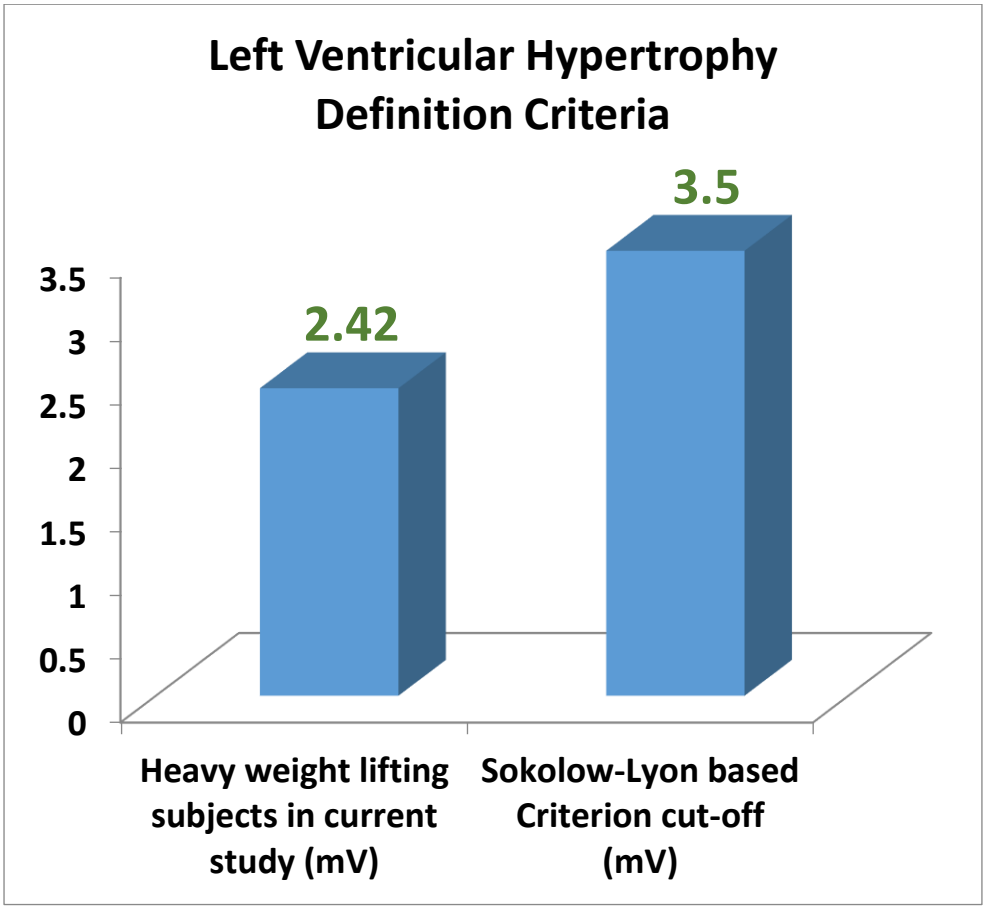

Figure 5 indicated the Left Ventricular Hypertrophy Status of the heavy weightlifting Subjects of the present study. The mean SV1+RV5 value of the heavy weightlifting Subjects was 2.42mV

which was found to be lower than the reference cut-off values of the Sokolow-Lyon voltage cut-off of ≥3.5mV for men.

IV. DISCUSSION

The health benefits of exercise have been established, however, cases of Professional athletes or patients with cardiac conditions who engage in exercise and athletic competition, may on rare occasions, experience sudden cardiac death (SCD)[5]. There is an ongoing debate about the optimal mechanism for SCD prevention, specifically regarding the inclusion of the ECG and/or cardiac imaging in routine pre-participation sports evaluation[5]. Electrocardiography (ECG) is one of the most vital and readily used physiological screening tools in clinical practice[6]. It is inexpensive and easily obtained in both the inpatient and outpatient settings. The ECG is used to diagnose numerous cardiac conditions, including prior infarction and active cardiac ischemia, as well as conduction abnormalities such as atrial fibrillation and life-threatening tachycardias[6].

The present study recorded a remarkably lower mean age of the heavy- weightlifters compared to that of the Untrained Subjects. Aging leads to a progressive decrease in muscle strength and flexibility. Strength peaks around 25 years of age, plateaus through 35 or 40 years of age, and then shows an accelerating decline, with a 25% loss of peak force by the age of 65 years[7]. One big reason we see declines in aerobic (or endurance) athletic performance with age is that the body cannot use oxygen as effectively as it does in young people in older age. In fact, the higher the VO_2max (maximal oxygen consumption), the more "aerobically fit" a person is. That is, they can do more endurance work for their body weight[8]. Considering the established effects of age on physical performance/exercise, it is therefore suggestive to state that age is a factor that can affect the achievement of sports success as can be seen with the heavy weightlifting Subjects of the present study. Another finding of the present study revealed that the mean BMI value of the Male Heavy weightlifters was

significantly lower than that of the Untrained Subjects. This finding is consistent with previous studies [9, 10]. Exercise is one of the key ways in which BMI (Body Mass Index) can be actively reduced. Note that to ensure the individual does lose weight as a result of exercise, the fellow will need to ensure that his or her diet does not contain excess calories which could prevent the exercise from bringing the body weight down[11, 12].

Thus, from the foregoing, it can be submitted that physical activity like heavy weightlifting may have significantly reduced the risk of overweight and high body fat percent in the studied population. Further, the result of the current study on blood pressure parameters indicated marginally reduced mean values of systolic and diastolic blood pressures (SBP and DBP), mean arterial pressure (MAP), and the pulse pressure (PP) of the Male Heavy weightlifters compared to their male untrained counterparts. This finding validates earlier submissions that regular exercise is beneficial for cardiovascular health indicating that that physically active individuals not only have lower blood pressure but higher insulin sensitivity, and a more favorable plasma lipoprotein profile [11].

The present study also found that the limits of P-wave, QRS-complex, PR, and QT intervals of the male-heavy weightlifting Subjects were found to be within their normal limits. These normal ranges are known to be as follows: P wave: 80 milliseconds. PR interval: 120-200 milliseconds. PR segment: 50-120 milliseconds. QRS complex: 80-100 milliseconds[13, 14] These normal ECG values are indicative that the functionality of the hearts of the heavy lifting Subjects is efficient. It also implies that mild to moderate forms of regular exercise (like in the Subjects of the present study) can be of great benefit to the individual's cardiovascular health.

A very interesting finding of this study reveals incidences of T- wave and ST-Segment abnormalities in some of the Heavy Weightlifting Subjects. It was noticed that 25% of the Heavy Weightlifting Subjects presented with ST-Segment elevations. On the other hand, different forms of T-wave abnormalities were recorded amongst them, which included 12.5%, 5%, and 2.5% of the heavy weightlifters presenting with inverted T-Wave, flat T-Wave, and hyperacute T-Wave respectively. This outcome of the present study agrees with earlier reports which stated that, acutely, exercise increases cardiac output and blood pressure, but individuals adapted to exercise showed lower resting heart rate and cardiac hypertrophy[13].

Usually, the ST segment represents the interval between depolarization and repolarization of the ventricles (with the T wave specifically indicating ventricular repolarization) as research indicates also that the earliest manifestations of myocardial ischemia typically interest T waves and ST segment [15]. In the present study's incidence of the flat T wave, as similar research clarifies that the T wave can be considered flat when the wave varies from -1.0 mm to + 1.0 mm in height. And that hypokalemia or digitalis therapy may be responsible for the flattened T wave with a prominent U wave[16].Hanna and Glancy [16] indicated that as hypokalemia progressively worsens; the T wave becomes more flattened while the U wave becomes more prominent, with progressively deeper ST segment depression. For digitalis toxicity, there will be a sagging QT interval, flattened T wave, and prominent U wave with a shortened QT interval.

Owing to the present study's finding on the percentage of heavy weightlifters with T wave and ST segment anomalies and the various submissions of previous relevant literature, it is therefore suggestive to say that, the aforementioned conditions may be indicative of imminent ST-segment myocardial infarction (STEM) which may precede sudden cardiac death (SCD). To prevent such incidence in these Subjects, they should be screened for differentials by the physician as it may help prevent sudden cardiac death amongst them.

Lastly, the outcome on the prediction of the prevalence of Left Ventricular Hypertrophy amongst the Heavy Weightlifting Subjects using the Sokolow-Lyon voltage cut-off of ≥3.5mV for men indicated a mean SV1+RV5 value of the Subjects as 2.42mV which is lower than the cut-off value of ≥3.5mV for men. This finding is also consistent with the earlier findings of the present study on the comparatively improved blood pressure parameters and virtually normal ECG records of heavy-weight lifters. Thus, buttressing the fact that, mild to moderate forms of regular exercise (like in heavy weightlifting Subjects of the present study) can be of great benefit to the individual's cardiovascular health; as there appears to be a generally reduced tendency of incidence of severe cases of left ventricular hypertrophy.

V. CONCLUSION

With the comparatively younger age of the heavy weightlifting Subjects of this study, it is instructive to state that age is a factor that can affect the achievement of sports success. The finding of the present study indicates that physical activity like heavy weightlifting may have appreciable reductive effects on the risk of overweight and high body fat percent in the

studied population. The decreased levels of blood pressure parameters observed in the weightlifters validate the fact that regular exercise may be beneficial for a healthy and efficient cardiovascular system. The study also found a generally reduced tendency of incidence of severe cases of left ventricular hypertrophy in the heavy-weight study Subjects.

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