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ORIGINAL ARTICLE

Electrocardiographic Patterns of Nigerian Professional Footballers in Gombe State.

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ABSTRACT:

Background: There has being increasing professional sport and also some report of sudden cardiac death among active footballers. **Objective:** To determine the Electrocardiographic patterns among professional footballers, involved in the sport for more than 4 years. **Methodology:** Thirty-four footballers were studied. They were all physically fit and without symptoms. They were age matched with non sportsmen as controls. Their constitutional and cardiovascular parameters were obtained with their Electrocardiographic studies. The study was carried out in 34 Professional Footballers in Gombe State, in active sport for more than four (4) years. **Results:** The age range was from 20 to 38 years with mean age of 26.7 $\pm$ 5.1 years. The mean duration of active sport participation was 8.2 $\pm$ 2.4 years. Electrocardiographic abnormalities were present in 32 (94%) of Footballers and include the followings: Group 1(common and training-related ECG changes) were Sinus Bradycardia (44%), Sinus Arrhythmia (24%) Left Ventricular Hypertrophy by: Araoye's Code System (23.5%), Sokolow-Lyon (61.8%) and Romhilt-Estes Voltage (35.3%) while the Group 2(uncommon and training-unrelated ECG changes) were Right Axis Deviation and Left Axis Deviation were (6%) respectively, Left Atrial Enlargement (85%), First Degree Heart Block (6%) and Prolong QT interval (35.3%), **Conclusion:** Most of the ECG abnormalities remain that of common and training related ECG changes but significant footballers had uncommon and training unrelated ECG changes. We recommend continuing participation in competitive sport with further cardiovascular examination for those with group two changes.

Key words: Electrocardiographic Patterns, Sportsmen, Footballers

INTRODUCTION

Different physical activities produce different cardiovascular responses and consequences. Sedentary and unfit normotensive individuals have increased risk of developing High Blood Pressure (HBP) and Coronary Artery Disease, when compared with their more active and fit peers [1]. Dynamic isotonic exercise lowers Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) [2]. This beneficial effect is used in the management, Control and prevention of HBP [3]. Whilst moderate dynamic exercise is beneficial and recommended for cardiovascular health, sudden death had been associated with sports. Some cardiovascular abnormalities had been associated with long duration of active exercise [4]. Thus, with the increasing population of professional sport, there is the need to further evaluate the cardiovascular effects with the view of providing healthy lifestyle for them. This study was carried out to determine the Electrocardiographic patterns among professional footballers, involved in the sport for more than 4 years duration.

METHODOLOGY

Forty-six footballers, playing for the main club in Gombe state, were studied but 12 were excluded based on the exclusion criteria. The remaining 34 footballers made up the study population. They were all physically fit and without symptoms. They were age matched with normal healthy non sportsmen.

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The exclusion criteria for both groups include: (1) The use of cardiotonic drugs, steroids and sympathomimetic drugs, (2) Current febrile illness, (3) Family history of High blood pressure (HBP), Cardiovascular Disease, Diabetes Mellitus and sudden death, (4) Regular use of alcohol and (5) The use of Tobacco.

The following data were obtained: (a) Weight in Kilogrammes (Kg), (b) Height in metres (m), (c) Body Mass Index (BMI) in Kg/m2 (d) Body Surface Area (BSA) in m2, (e) Heart Rate (HR) and (f) Blood Pressure Indices– Systolic blood pressure (SBP), Diastolic blood pressure (DBP) and Mean arterial pressure (MAP). Normal heart rate was taken as 60 to 100 beats per minutes, while HR < 60 is said to be bradycardia and HR > 100 is tachycardia.

A resting 12 lead Electrocardiogram (ECG) was recorded with a paper deflection of 10 millimeters (mm) per millivolt (mV) and a paper speed of 25mm/sec recording 3 cycles for each lead with a rhythm strip of 11 cycles. The tracing were performed in all the subjects (both groups) in supine position, with the electrodes placement as recommended by the American Heart Association[5] .The ECG were recorded about 4 hours or more postprandial [6] to avoid such postprandial effects.

All the ECG strips were read and the ECG variables calculated for each subjects by the Cardiologist in the study team. The ECG variables calculated include: heart rate (HR), rhythm, mean QRS axis, intervals in seconds (sec), wave amplitude in normal values and interpretation were based on Araoye's study on Nigeria normal population [7, 8]. Left Ventricular Hypertrophy (LVH) determined by Araoye's Code System ACS [7], Sokolow-Lyon SL[9] and Romhilt-Estes Voltage REV [10]. Observation on ST-T segment and T wave morphology were noted. The ECG abnormalities were classified into Group 1 (common and training related ECG changes and Group 2 (uncommon and training unrelated ECG changes using the recommendation for interpretation of ECG in Athlete [11]. Bazett's formula QTc = QT/v RR was used to determine the QTc [12] .

The Epi info (version 5) statistical software was used for data analysis. Quantitative data were presented as mean $\pm$ SD. Proportions and percentages were calculated. Statistical significance was said to have been achieved when the P-value was less than 0.05.

RESULTS

A total of 34 Sportsmen (Footballers) and 34 Non Sportsmen were evaluated. The Age Range of the Sportsmen and the Non Sportsmen were 20 to 38 years. The age mean for the Sportsmen and Non Sportsmen were comparable (26.7 $\pm$ 5.1 Vs 27.8 $\pm$ 4.7years p-value >0.5). (see table 1).

There mean duration of Active Sport participation for the Sportsmen was 8.2 $\pm$ 2.4 years (see table 1).

The means of Weight, Height, BMI and BSA of the Footballers and Non Sportsmen were comparable and no significant difference (72.4 $\pm$ 6.4Kg vs. 70.9 $\pm$ 4.2kg p>0.2, 1.70m $\pm$ 0.07 1.69 $\pm$ 0.06 p>0.5, 23.3Kg/m2 $\pm$ 1.36 vs. 23.1 $\pm$ 1.52 p>0.5, 1.78m2 $\pm$ 0.17 vs. 1.77 $\pm$ 0.13 p>0.5 respectively).

The means of the Blood Pressure Indices of SBP, DBP and MAP for the Footballers and the Non Sportsmen were also not significantly different (table 1). The Heart Rate range for the Footballers and Non Sportsmen were (50 to 70 and 60 to 100 respectively) while that of the axis were (-30 to +120 and 0 to +60 respectively). However, the Heart Rate of the Footballers were significantly lower than that of the Non Sportsmen (60.2 $\pm$ 10.1 vs. 80.8 $\pm$ 14.0 c/min p<0.001) (see table 1).

The ranges and the means of the P amplitudes and QRS intervals of both the Footballers and the Non Sportsmen were in the normal ranges and not significantly different (table 2). However the ranges and the means of PR duration and QTC intervals for the sportsmen were significantly different when compared with that of the non sportsmen (table 2).

Normal Sinus Rhythm occurred in all the Non Sportsmen and in 11 (32.4%) of Footballers (table 3). There were no abnormal rhythm noted in the non sportsmen while Sinus Arrhythmia occurred in 8 (23.5%) and sinus bradycardia in 15 (44.1%) of the Footballers. Normal QRS axis (0 to +90) occurred in 30 (88.2%) while Left axis deviation LAD and Right axis deviation RAD occurred in 2 (5.9%) each of the Footballers (table 3).

Left atrial enlargement occurred in 29(85.3%), First degree heart block in 2(5.9%) and Prolong QTC in 12(35.5%) of the

Footballers while they were absent in the non sportsmen Group (table 3).

Left ventricular hypertrophy occurred significantly more in the Footballers when compared to the non sportsmen {8(23.5%) vs. 1(2.9%) p<0.00 by ACS, 21 (61.8%) vs. 4(11.8%) p<0.001 and by SL, 12 (35.3%) vs. 2(5.9%) p<0.001 by REV}(table 3).

The Electrocardiographic changes in Group 1 were Sinus Bradycardia (44.1%), Sinus Arrhythmia (23.5%) and Left Ventricular Hypertrophy (61.8%) while that of Group 2 were Left Axis Deviation (5.9%), Right Axis Deviation (5.9%), Left Atrial Enlargement (85.3%), 1st Degree Heart Block (5.9%) and Prolong QTc interval (35.5%) and the non sportsmen had no Group 2 Electrocardiographic changes. (table 3).

Table 1: Constitutional and Blood Pressure Indices of The Study Population

Features	Non Sportsmen	Footballers	P-Value
Age mean (yrs)	27.8±4.7	26.7 ± 5.1	0.5
Duration of Active Sport (Yrs)			8.2 ± 2.4
Weight (Kg)	70.9 ± 4.2	72.4 ± 6.4	>0.2
Height (m)	1.69 ± 0.06	1.70 ± 0.07	>0.5
BMI (Kg/m2	23.1 ± 1.52	23.3 ± 1.36	>0.5
BSA (m2)	1.77± 0.13	1.78 ± 0.17	>0.5
DBP (mmHg)	75.6 ± 6.8	74.3 ± 7.4	>0.3
SBP (mmHg)	114.7 ± 9.1	112.3 ± 8.9	0.2
MAP (mmHg)	86.8 ±15.1	85.3 ± 14.5	0.2
HR (c/min)	80.8 ±14.0	60.2 ± 10.1	<0.001

Legend: yrs=years, Kg=Kilogrammes, m=metres SBP=Systolic blood pressure, BSA=Body surface area HR=Heart Rate MAP=Mean arterial pressure, mmHg =millimeter of mercury BMI=Body mass index, DBP=Diastolic blood pressure

Table 2: Comparison of ECG Findings in Footballers and Non-sportsmen

Parameters	Footballers		Non Sportsmen		*p* value
	Range	Mean(SD)	Range	Mean(SD)	
Heart rate	50 to 70	60.2 ± 10.1	60 to 100	80.8 ±14.0	<0.001
Axis		30 to + 120		0 to +60	
PR interval(sec)	0.2 to 0.28	0.24 ± 0.02	0.16 to 0.2	0.18 ± 0.02	0.001
P wave amplitude(mm)	1.0 to 2.5	1.5 ± 0.6	1.0 to 2.5	1.5 ± 0.6	>0.5
P wave duration(sec)	0.04 to 0.16	0.12 ± 0.03	04 to 0.16	0.12 ± 0.03	>0.5
QRS interval(sec)	0.08 to 0.10	0.08 ± 0.01	0.04 to 0.08	0.08 ± 0.01	>0.5
QTc interval(sec)	0.36 to 0.48	0.42 ± 0.03	0.28 to 0.36	0.32 ± 0.03	0.001

Legend: QRC= corrected QT interval. sec= Seconds; mm= Millimetres; ECG= ElectroCardiographic

Table 3: Comparison of ECG Changes in Footballers and Non Sportsmen

Abnormality	Footballers n(%)	Non sportsmen n(%)	*p* value
Group 1			
Normal sinus rhythm	11(32.4)	34(100)	<0.001
Sinus bradycardia	15(44.1)	0(0.0)	<0.001
Sinus arrhythmia	8(23.5)	0(0.0)	<0.001
1st degree AV block	2(5.9)	0(0.0)	<0.001
LVH:			
ACS	8(23.5)	1(2.94)	<0.001
SLI	21(61.8)	1(2.94)	<0.001
REV	12(35.3)	1(2.94)	<0.001
Group 2			
LAD	2(5.9)	0(0.0)	<0.001
RAD	2(5.9)	0(0.0)	<0.001
LAE	29(85.3)	0(0.0)	<0.001
Prolonged QTc	12(35.3)	0(0.0)	<0.001

Legend: LAD=Left axis deviation, RAD=Right axis deviation, LAE=Left a trial enlargement, HB=heart block LVH=Left ventricular hypertrophyACS= Araoye"s Code System.SLI= Sokolow and Lyon Index REV= Romhilt-Estaes Voltage

DISCUSSION

The constitutional features (Weight, BMI and BSA) were all normal; this is in keeping with previous studies [3], and the fact that dynamic exercise maintains normal constitutional features among subjects. Normal blood pressure Indices (SBP, DBP and MAP) found in this study also supports previous studies [3,4].

The predominant rhythm was sinus with a high prevalence of sinus bradycardia (44.1%). This has been observed by other studies [13-,16], This is a consequence of increased vagotonia.

Sinus arrhythmia was recorded in 8 (23.5%) subjects, similar to that observed by other researchers [9,13, 14] and this prevalence could be due to the study population (young footballers) and it's absence in the control group may further support this observation.

Eighty-eight percent had normal QRS axis, which was lower than what was observed from other studies [9,13], and 5.9% each for LAD and RAD were higher than what were obtained in the same studies [9,13]. The difference could be due to the small study population and will need to be further evaluated with a larger study population. The prevalence of 1st degree A-V block was 5.9%, this could be due to the study population as was also observed by a previous researcher [13]. Majority (85.3%) of the Footballers had LAE which was absent in the non sportsmen group.

This finding suggests that this feature may be associated with long duration of the sporting activity. Both the Footballers and non sportsmen groups did not record any right atrial enlargement (RAE). The prevalence of LVH varies with the ECG-LVH criteria used. The highest ECG-LVH was 61.8% while the least was 23.5%. All the subjects with LVH had LAE. LVH had been observed among sportsmen in previous studies [14,17] and ECG-LVH is a proven cardiovascular risk factor [18, 19]. However, Isolated QRS voltage criteria for left ventricular hypertrophy (ECG-LVH) as demonstrated in this study have been shown to be Group 1(Common and training related ECG changes) among sportsmen which are normal physiological change and are harmless [14]. The QTC range was 0.36 to 0.48 sec for the Footballers in this study, however range for normal as suggested by Araoye [8] for this environment is 0.34 to 0.43 sec for male which was also demonstrated among the non sportsmen control group in this study. Thirty five point three (35.3%) of the Footballers had QTC greater than 0.44 sec. Since it is well known and established that prolonged QT interval is a Group 2 (uncommon and training unrelated ECG changes) in sportsmen [14], it occurring in more than 35% of subjects studied may indicate the need for further evaluation of such clients.

The limitations of this study are the small sample of footballers and other sports persons not involved and exclusion of incomplete disease expression of inherited cardiac conditions, such as Hypertrophic Cardiomyopathy, Arrythmogenic Cardiomyopathy or ion channel diseases which require comprehensive investigations for exclusion.

In conclusion, most of the ECG abnormalities remain that of common and training related ECG changes but significant footballers had Group 2, ECG changes. We recommend continuing participation in competitive sport with further cardiovascular examination for those with group two changes.

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