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COMPARATIVE VECTOR ANALYSIS OF THE ELECTROCARDIOGRAPH OF FEMALE ATHLETES AND NON-ATHLETES AT THE UNIVERSITY OF PORT HARCOURT

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ABSTRACT

The purpose of this study was to compare the vector variables of the ECG components of female Athletes and Non-athletes at the University of Port Harcourt. The vector technique for analysis used showed significantly greater amplitude in T vector of Athletes. A height/width ratio correlation with T vector degrees showed that there is a relationship between body build and axis deviation. The highly significant lower pulse rate in the combined group tends to support the previous literature dealing with exercise and training.

Keywords: Comparative Vector Analysis; Electrocardiograph; Female Athletes; Non-athletes.

Introduction

It has been shown in the past that the cardiovascular function of the heart is improved with exercise. Many investigations have led to this conclusion included pulse rate, blood pressure, cardiac output ratio and heart rate as determined by the electrocardiogram (American Heart Association (2000). There have also been numerous studies on the comparism of the effects of training and exercise on the electrocardiogram of Athletes and Non-athletes. It is hoped that this study will contribute further to the knowledge of the effect of exercise and training on athletes.

Statement of the Problem

The purpose of this study is to compare the Electrocardiogram of female athletes and non-athletes. A vector analysis will be used to help determine if body build is a factor in any differences found.

Importance of the Study

The use of vector cardiography has not yet been applied to the field of athletics. It is the hope of the researcher to find out the value of exercise and training on vector points. The process of vector cardiography offers a truer and more objective picture of the heart and its location which is also importance as it is one of the biggest health problems associated with athletics training and fitness evaluation in.

Limitation

1. The element of human error in the measurement of the ECG may cause inaccurate figure from which to work.

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2. The small number of subjects used limits the interpretation of the data from this study.

3. The lack of precision of the vector measuring instrument within five degrees limits the accuracy of the results of this study.

Procedure

Instrumentation

A Sanborn ECG two channel direct writer (model 60-200) was used for recording. A caliper was necessary for more precise measurement of the waves from the baseline. All of the measurements were taken from the baseline. Vector amplitude and degrees were determined by the standardised method of measurement.

Selection of Subjects

The Athletes were selected from the university regular team representative in Athletes, seventeen who were in seasonal training at the time of the study. These athletes were chosen because of their physical condition and training during the sports seasons. The athletes participated in the following sports: Track (4), Basketball (3), Hockey (5), Wrestling (1), Swimming (4).

Seventeen non – athletes females were chosen from the students at the same University. They were normal males as far as the examiner could determine. The non–athletes were matched with the athletes according to a chest – width and sitting – height ratio.

Measurement Procedure

Two ECGs were taken of each subject. The second record was used for making all measurement for the analysis. The first test was an orientation and served the purpose of eliminating the novelty of the instrument in the minds of the subjects. The method of determining the frontal vectors was by Jackson and Winsor.

Each individual who was tested and asked to walk slowly or to ride in an automobile when reporting for his examination. He was also asked to refrain from drinking any alcoholic and cold beverages at least two hours prior to the examination. Upon arrival, the examinee was asked to lie quietly on a cot for a period of fifteen minutes. The cot was within a few steps of the testing area so that a minimum of steps would be taken just previous to the examination.

Statistical Analysis

An analysis was done to find any significant differences between the groups. Correlation coefficients were computed between the sitting – height, chest – width ratio and the ECG measurements. The subjects were matched by the sitting – height, chest – width ratio and the "t" test were used to determine if differences were significant. Correlations were computed between age and ECG measurement.

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Results

The following tables contain the results of the statistical analysis

TABLE 1: Pearson Product Moment Correlation Coefficient Between Age and Statistically Significant Electrocardiogram Measurements

ECG Measurement	r*
T Amplitude Lead I	.162
PR Interval	.01
T Vector Amlitude	.06
QRS Interval	-.019

*None of the r/s were statically significant

TABLE II: Pearson Product Moment Correlation Coefficient Between Sitting Heights And The Chest Width Ration And The Electrocardiogram Measurements

ECG Measurement	r
T Amplitude Lead I	.11
T vector degrees	.27*
QRS Interval	-.23
PR Interval	-.05

*Significant at a probability of .01.

TABLE III: Statistical Analysis of The Difference Between Matched Pairs of Subjects

ECG Measurement	Mean Difference	Student "t"
Pr interval	.35	2.06
QRS Interval	.23	2.30*
QT Interval n	.37	1.42
T Amplitude Lead I	1.26	3.09*
T Amplitude Lead III	.45	1.15
QRS Amplitude Lead I	.62	.64
QRS Amplitude Lead III	1.64	1.43
T Vector Degrees	9.79	1.34
T Vector Amplitude	.91	2.63*
QRS Vector Degrees	3.53	.42
QRS Vector Amplitude	1.76	1.32
Heart Rate	13.69	5.92*

*Significant at a probability of 0.01.

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TABLE IV : Statistical Analysis of The Differences Between the First and The Second Records of The Athletes

Measurement	Coefficient of Reliability
Pr interval	.89
QRS Interval	.89
QT Interval	.96
T Amplitude Lead I	.90
T Amplitude Lead III	.99
QRS Amplitude Lead I	.93
QRS Amplitude Lead III	.94

TABLE V: Statistical Analysis of The Differences Between the First and The Second Records of The Non-Athletes

Measurement	Coefficient of Reliability
Pr interval	.90
QRS Interval	.82
QT Interval	.84
T Amplitude Lead I	.99
T Amplitude Lead III	.99
QRS Amplitude Lead I	.99
QRS Amplitude Lead III	.99

TABLE VI

Measurement	Conditioned Subject Mean	Non – Conditioned Subjects Mean	Student "t"
Age	20.88	19.70	2.37*
Weight	156.50	157.90	.28
Sitting height	90.29	90.65	.45
Chest Width	30.78	30.47	.54
Chest Depth	19.97	19.56	1.05
Ratio (sitting height Chest width)	2.95	2.98	.64
PR Interval	4.26	2.98	.64
QRS Interval	1.58	1.81	2.06*
QT Interval	7.75	7.38	2.30*
T Amplitude – Lead I	3.46	2.20	1.29
T Amplitude – Lead III	1.21	1.66	2.90*
QRS Amplitude – Lead I	4.06	3.44	.86
QRS Amplitude – Lead III	9.31	7.67	.72
T Vector Degrees	43.10	52.89	1.26
QRS Vector Degrees	71.13	67.60	1.46
T Vector Amplitude	5.05	4.14	2.52*
QRS Vector Amplitude	14.08	12.32	1.20
Heart Rate	56.89	70.75	5.41*

*Significant at a probability of 0.01.

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Analysis and Discussion

In this study, the fitness of the athletes may be readily seen by the low pulse rate. Angle, (1954), reported that "the effect of training on the heart rate may be well observed during physical reconditioning of convalescents. With the regaining of physical fitness, their pulse rates, in response to a standard exercise, gradually decrease." Gwotmut and Agbayim (2023), Cureton (1953) reports a significantly lower pulse rate in well-conditioned champion athletes, with the normal pulse rates ranging from thirty–eight to one hundred and ten, and the average about sixty – four beats. Champion Track and Field athletes have slower pulse rates than swimmers and divers or the controls. It may, therefore, justify the separation of conditioned and non-conditioned subjects. Chandra et Al (2014) found a longer PR interval in Sportsmen. Corridor et Al (2006), in observing records of professional athletes found the same phenomenon in approximately 60 per cent of the cases. Gwotmut and Agbayim (2023) observed a much-prolonged PR interval in one athlete and also witnessed analogous evidence of prolonged PR interval on a large number of athletes and found several examples of it. Longdeau et al (2001) explains, "A PR interval of .24 seconds is not at all unsual in athletes which the author believes is due to strong vagus tone. Increased vagus tone exerts its influence be decreasing the rate of transmission of the contractile wave and also by slowing down the rate of propagation in the bundle of His. "As may be seen in Table I, there is significantly higher T amplitude in lead I. Gwotmut and Okonkwor (2021) reported higher T wave in exercise groups. Maron and Culasso (2000) also reports that athletes are also seen to have a higher T wave.

It was the purpose of this study to determine whether higher T waves are present in athletes and if so, was it possibly due to body build or chest configuration, the vector technique of analysis used to show a significantly greater amplitude in the T vector of athletes. A heights/width ratio correlation with the T vector degrees showed that there is a relationship between body build and axis deviation; this is shown in Table III. Gwotmut and Agbayim (2023), in their study of "Axis Deviation and Body Build." reported that coefficients of correlation between measurable variations of physique and axis deviation have been established. In the subjects studied they found an association between the degrees of compactness of the individual and the tendency to a left axis deviation. Table IV, which compares matched pairs of subjects of athletes and non – athletes, shows significant differences in the same measurements as those found in Tables V and VI, which are a statistical analysis of the difference in the first and second records of the athletes and non – athletes, show a reliability coefficient ranging from .82 .99. Table VIEW l shows a significant difference in the age of the two groups. This may be explained in that the conditioned athletes tended to be the juniors and seniors while the non – conditioned group were mainly freshman and sophomers.

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Summary

The statement of the problem of this study was: "Do the electrocardiograms of conditioned athletes differ significantly from those of non-conditioned students?" A vector analysis as well as matching by sitting height – width ratio was used to help determine whether the differences were due to conditioning rather than body build. Significant differences have been found in electrocardiograms of athletes as compared to those of non – athletes. Previous studies that compared the ECG of athletes to non-athletes, factors of chest size and configuration were not considered in this study.

There have been studies in the field of electrocardiography which have shown the influence of age and body build on electrocardiograms of normal individuals, Age and body build have been found to be significant on the frontal vectors' measurement. The frontal vectors in turn influence the amplitude measurement. Each subject was given two electrocardiograms. Three climb leads and six precordial leads were used for each test. A caliper was used to determine more precise measurements of the electrocardiograms from the base line. Vector amplitude and degrees were determined by methods found in the literature on vectorcardiography.

All subjects used were students at the Michigan State University. The conditioned subjects were the varsity athletes training for in season sport which required vigorous conditioning. The Pearson – Product Moment Correlation and the student's "t" were used to determine the statistical analysis.

Conclusions

The following are the conclusions reached by this study:

1. The highly significant lower pulse rate in the conditioned group tends to supports tends to supports the previous literature dealing with exercise and training. It may also show the benefits of athletic conditioning in this group. The results agree with previous studies.
2. The significantly slower conduction (PR Interval) and the significantly faster depolarization (QRS Interval) may be an indication of increased cardiovascular efficiency.
3. The highly significant difference found in the amplitude of the T wave and T vector is an indication of a stronger depolarization of the ventricle. `The difference helps to substantiate the findings of studies of other researchers.

Recommendations

1. This study should be repeated using a larger number of subjects.
2. Further studies may be done between active non-athletes' groups of students.
3. Further studies may be done between athletes of different sports.
4. The use of X – rays to determine a true anatomical position of the heart

would aid the precision of measurement.

A longitudinal study of a group of non – athletes undertaking an exercise program using the electro – cardiogram and vector measurements to determine if any changes have taken place.

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