ISSN: 2392-5442 ESSN : 2602-540X		Sport system journal
V/11 N/01 Year/2024		International scientific journal published by: Ziane Achour –Djelfa- Algeria
P 315 - 328		Received: 07-01-2024 A ccepted: 14-02-2024

The Effect of Physical Exertion on Blood Pressure among U17 Football Players of Winner Sporting Club

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Abstract:

The significance of this study lies in elucidating the impact of physical exertion within the training program, based on organized scientific principles, among youth aged 16 to 17 years. The experimental methodology was employed, encompassing pre- and post-measurements. The research sample consisted of 24 volunteer football players from the Winner Sporting Club community. A training program comprising (09) units was implemented over a period of (26) weeks, tailored to suit the characteristics of the research sample. Following both pre and post measurements, the results yielded several significant outcomes, notably that the training program had a positive effect on football players, contributing to improvements in physiological changes. Statistically significant differences were observed in both pre- and post-measurements of blood pressure and heart rate among the experimental group.

Keywords: Physical Exertion; Blood Pressure; Systolic Blood Pressure; Diastolic Blood Pressure.

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1. INTRODUCTION

In Algeria, the leisure time of youth is considered one of the significant challenges, particularly with the rise in school dropout rates and the lack of sports facilities. The absence of many associations guiding them towards safety leads them to engage in physical exertion in an unstructured manner, lacking scientific foundations in fitness programs and exercises that align with the physiological and physical characteristics of that age group.

1.1 Problem Statement:

As known in the sports and scientific arenas, physical exertion contributes to a better life for individuals at any age. Positively, it enhances physical aspects such as balance, coordination, flexibility, endurance, and fall prevention. Numerous studies indicate a lower prevalence of psychological disorders among individuals engaged in physical activity. This study aims to answer the overarching question: Is there a statistically significant effect of physical exertion on heart rate and systolic blood pressure?

1.2 Sub-questions:

- Is there a statistically significant difference in heart rate between pre and post measurements in the experimental group?
- Is there a statistically significant difference in systolic blood pressure between pre and post measurements in the experimental group?

1.3 Hypotheses:

1.3.1 General Hypothesis:

- There is a statistically significant positive effect of physical exertion on increasing heart rate and systolic blood pressure.

1.3.2 Specific Hypotheses:

1.3.2.1 First Specific Hypothesis:

- There are statistically significant differences in heart rate between pre and post measurements in favor of post measurements for the experimental group.

1.3.2.2 Second Specific Hypothesis:

- There are statistically significant differences in systolic blood pressure between pre and post measurements in favor of post measurements for the experimental group.

1.4 Study Objectives:

- Explore and understand the impact of the training program on physiological variables, such as diastolic blood pressure, systolic blood pressure, and heart rate.
- Design and implement a suitable training program for the targeted age group.
- Identify differences between pre- and post-measurements of blood pressure and heart rate in the group.

1.5 Study Importance:

This research holds immense significance in enriching the scientific knowledge in this field and improving the athletic performance of football players, especially the youth category. It aims to precisely and scientifically understand the rules, principles, foundations, and health and logical techniques for the general aspect of sports and specifically for football among the youth.

Additionally, the study focuses on discovering and understanding its impact on physical, technical, and physiological aspects, as well as the functional systems of the human body. The study targets a specific age group to assist them in engaging in physical sports scientifically and healthily, tailored to the characteristics of their age, aiding in the development of a suitable program for the studied group.

2. *Study Concepts*:

2.1 *Physical Exertion:*

Refers to the movement of the human body using skeletal muscles, leading to the expenditure of energy beyond that during rest. This includes all daily physical activities such as walking, movement, and climbing stairs, or physical work at home or in the garden, and any sports or promotional physical activity. Therefore, physical exertion is a behavior performed by an individual for work, promotion, therapy, or prevention, whether spontaneous or planned **(Hazaa , p. 47).**

Procedural Definition:

Physical exertion involves all actions and activities performed by humans, such as running, walking, engaging in organized tasks, and sports activities, requiring effort from the body's energy.

2.2 Elevated Blood Pressure:

The level of blood pressure at which treatment with pressure-regulating drugs is more beneficial than harmful. Elevated blood pressure occurs due to constriction of migratory arteries in all tissues **(De Bieghoz,, 2013, p. 27).**

Procedural Definition:

The force of the impact of circulating blood in blood vessels resisting their walls, leading to an increase in pressure.

2.3 Systolic Blood Pressure:

The higher pressure in the blood vessels and occurs during the contraction or beating of the heart **(World Health Organization, 2013).**

Procedural Definition:

The normal blood pressure for a healthy adult, ranging from 120 to 140 millimeters of mercury, during the heart's contraction.

2.4 Diastolic Blood Pressure:

The lower pressure in the blood vessels and occurs during the relaxation or diastole of the heart **(World Health Organization, 2013).**

Procedural Definition:

The blood pressure in a healthy ordinary person during the relaxation of the heart muscle, ranging from 80 to 90 millimeters of mercury.

3. Previous Studies:

3.1 First Study:

Hamid Abdel Fattah Khachia et al. (1993) conducted a study titled "The Effect of a Proposed Training Program on Some Morphological (Body Weight, Body Mass Percentage, Fat) and Physiological (Heart Rate, Blood Pressure) Variables in the Elderly." The researchers adopted the experimental approach with a single group, measuring before and after. The study aimed to determine the impact of the training program on morphological and physiological rates and indicators. The results indicated an effect on the efficiency of the heart and the respiratory circulatory system among the sample individuals, emphasizing the importance of sports programs for this age group **(Brisan & Al Ansar, 2001, p. 166).**

3.2 Second Study:

Manhal Abdel Hamid Dawood conducted a study on "The Effect of a Training-Rehabilitation Program on Reducing High Blood Pressure in Women Aged 50 to 60." The researcher employed the experimental approach to align with the study's problem. The results showed that regular physical activity improves health fitness levels and certain physiological variables (blood pressure, heart rate). There is no specific age limit for starting exercise. Using multiple energy systems in training is essential for creating rehabilitation programs at all levels.

3.3 Third Study:

Abd Khunjar Al-Rikabi conducted a study titled "The Effect of a Therapeutic Program in Preventing Elevated Blood Clotting Levels in Individuals with High

Blood Pressure Aged 45-55." The researcher employed an appropriate experimental methodology for the study's problem. The study aimed to identify the clotting levels in patients with high blood pressure in the control and experimental groups. The results showed a statistically significant effect on blood clotting levels in the experimental group and a decrease in clotting levels in both the experimental and control groups, with a greater decrease in the experimental group.

4. Methodological Approaches:

4.1 Study Method:

The researcher used the experimental method, conducting pre and post-heart rate and blood pressure measurements, suitable for the nature of this study.

4.2 Study Population and Sample:

The sample included 24 individuals from the study community, specifically U17 football players from Winner Sporting Club. The research sample selection involved several pre-measurements steps, excluding individuals with chronic diseases (obesity, diabetes, smokers, health issues), and obtaining approval from a cardiologist to allow players to engage in physical activity.

4.3 Survey Study:

Pre-measurements for players (blood pressure, resting heart rate, and physical exertion) were conducted on 18/03/2023.

4.4 Scientific Principles of the Study:

The study incorporated physiological tests to ensure their scientific transferability. A random sample from the research community was selected to extract the scientific coefficients used in the study, ensuring the intentions and authenticity of the selection.

5. Tools and Equipment Used in the Study:

5.1 Study Tools:

Physiological tests included measuring blood pressure and pulse before and after physical exertion.

5-1.1. Blood Pressure Measurement:

Using an electronic blood pressure measurement device of the OMRON type, validated by experts. The measurements were taken at the beginning of the sports session (resting state) after its completion. The results of systolic and diastolic blood pressure were recorded for analysis.

5-1.2. Pulse Measurement Before and After Exertion:

Measured using the same blood pressure measurement device.

6. Training Program:

The training program underwent two stages:

First Stage: Preliminary design of the training program.

Second Stage: Presentation to experts (doctors, athletes, professors) for the peer-review process and adjustments, aiming to finalize the program..

7. Study Domains:

7.1 Human Domain:

Football players U17 from Winner Sporting Club, without chronic diseases (e.g., disease, obesity), capable of engaging in physical activity, with an average age of around 17.

7.2 Temporal Domain:

The study lasted from January 14, 2023, to May 5, 2023.

7.3 Spatial Domain:

The study took place at the football field affiliated with the Higher School of Sports Science and Technologies (ESSTS).

8. Statistical Measurements:

The study utilized statistical measures such as the mean, median, standard deviation, Shapiro-Wilk test, paired samples t-test (Shapiro-Wilk and t-test), and the SPSS statistical analysis program.

9. Presentation and Discussion of Study Results:

9.1 Data Distribution Test using Shapiro-Wilk:

Table 1. illustrates the type of data distribution using the Shapiro-Wilk test

Variable	Shapiro-Wilk			Statistical Decision
	Test Value	Degrees of Freedom (DF)	Significance Level (Sig)	
Pre-Exercise Heart Rate	0,953	24	0,317	Normal Distribution
Pre-Exercise Systolic Blood Pressure	0,981	24	0,919	Normal Distribution
Post-Exercise Heart Rate	0,968	24	0,611	Normal Distribution
Post-Exercise Systolic Blood Pressure	0,961	24	0,455	Normal Distribution

Source: The researcher according to the outputs of the statistical program SPSS

Through Table (1), we find that the significance level (Sig) for the Shapiro-Wilk test across all data is greater than (0.05). Therefore, there is no statistical significance for the test, indicating no variation in the data in favor of any direction. This implies that the data follows a normal distribution, allowing the use of parametric statistical tests for data analysis.

9.2 Presentation and Analysis of Results for the First Partial Hypothesis:

- There are statistically significant differences in heart rate between pre and post measurements in favor of post measurements for the experimental group.

9-2-1. Statistical Description of Heart Rate Averages:

Table 2. illustrates the statistical description of heart rate averages in the pre-exercise and post-exercise measurements.

Heart Rate Averages	Sample Size	Measurement	Mean	Standard Deviation
	24	Pre	83.92	8.26
		Post	111.92	14.88

Source: The researcher according to the outputs of the statistical program SPSS

From Table (2), a clear superiority is evident in the mean heart rate for the post-exercise measurement compared to the pre-exercise measurement among individuals in the experimental group. We will verify the statistical significance of these differences by applying a Paired Samples Test.

9.2.2 Differences in Heart Rate Averages Between Pre and Post Measurements for the Experimental Group:

Table 3. illustrates the heart rate averages between pre and post measurements for individuals in the experimental group.

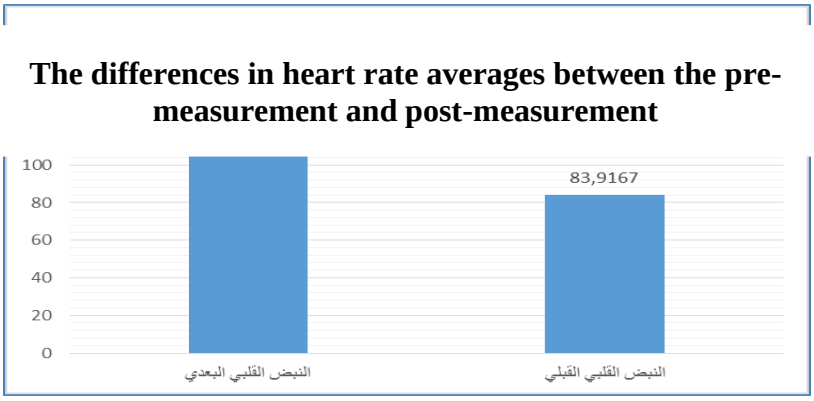
Variable	Measure-ment	Mean	Difference Between Means	Paired Samples Test			Statistical Decision
Heart Rate	**Pre**	83.92	28.000	**Test Value**	**Degrees of Freedom (DF)**	**Significance Level (Sig**	
	Post	111.92		7.175	23	0.000	Significant

Source: The researcher according to the outputs of the statistical program SPSS

Through Table (3), we find that the test statistic (T) is equal to 7.175, and the significance level (Sig) is 0.000, which is less than the significance level of 0.05. Consequently, there is statistical significance for the test, indicating statistically significant differences in heart rates between the pre-exercise and post-exercise measurements for individuals in the experimental group. When comparing the mean values, the differences favor the post-exercise measurement.

Thus, the first hypothesis is supported: There are statistically significant differences in heart rate between pre and post measurements in favor of post measurements for the experimental group. This is further illustrated in the following figure:

Fig.1. illustrates the differences in heart rate averages between the pre-measurement and post-measurement for individuals in the experimental group



Source: The researcher according to the outputs of the statistical program SPSS

Through F **post-measurement heart rate** **pre-measurement heart rate**

When comparing heart rate averages between the pre-measurement and post-measurement for individuals in the experimental group using mean values, the differences favor the post-measurement. In other words, there are differences in heart rate averages between the pre-measurement and post-measurement for individuals in the experimental group, favoring the post-measurement.

9.3 Presentation and Analysis of Results for the Second Partial Hypothesis:

- There are statistically significant differences in systolic blood pressure between pre and post measurements in favor of post measurements for the experimental group.

9-3-1. Statistical Description of Systolic Blood Pressure Results:

Table 4. illustrates the statistical description of systolic blood pressure results in pre-measurement and post-measurement.

Systolic Blood Pressure	Sample Size	Measurement	Mean	Standard Deviation
	24	Pre	114.96	10.90
		Post	122.33	9.77

pre-measurement heart rate

Source: The researcher according to the outputs of the statistical program SPSS

Through Table (4), there is a clear superiority in the mean systolic blood pressure in the post-measurement (after physical exertion) over the mean systolic blood pressure in the pre-measurement (before physical exertion) among individuals in the experimental group. We will confirm the statistical significance of these differences by applying the Paired Samples Test.

9-3-2. Differences in Systolic Blood Pressure Rates between Pre-Measurement and Post-Measurement in the Experimental Group:

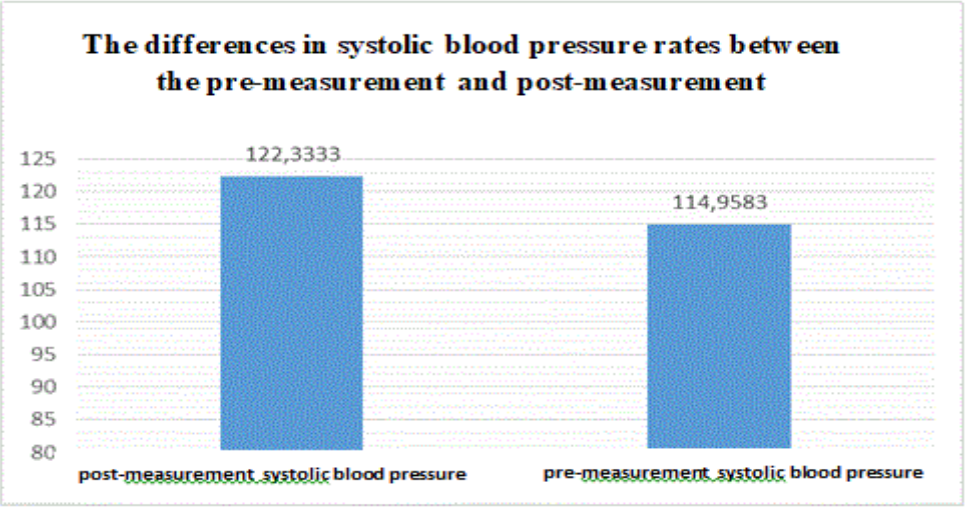
Table 5. illustrates systolic blood pressure rates between pre-measurement and post-measurement in the experimental group.

Variable	Measurement	Mean	Difference Between Means	Paired Samples Test			Statistical Decision
Systolic Blood Pressure	**Pre**	114.96	7.38	Test Value	Degrees of Freedom (DF)	Significance Level (Sig	
	Post	122.33		6.045	23	0.000	Significant

Source: The researcher according to the outputs of the statistical program SPSS

Through Table (5), the T Value is 6.045, and the Significance Level (Sig) is 0.000, which is less than the significance level (0.05). Therefore, there is statistical significance in the test, indicating statistically significant differences in systolic blood pressure rates between pre-measurement and post-measurement among individuals in the experimental group. When comparing the mean values, the differences favor post-measurement, confirming the second hypothesis (there are statistically significant differences in systolic blood pressure rates between pre-measurement and post-measurement in favor of post-measurement). This is further illustrated in the following figure:

Fig.2. illustrates the differences in systolic blood pressure rates between the pre-measurement and post-measurement among individuals in the experimental group.



Source: The researcher according to the outputs of the statistical program SPSS

Through Figure 2, we observe:

When comparing the averages of systolic blood pressure rates between the pre-measurement and post-measurement among individuals in the experimental group, we find that the differences favor the post-measurement. This indicates that there are differences in systolic blood pressure rates between the pre-measurement and post-measurement in favor of the post-measurement among individuals in the experimental group.

9.4 Presentation and Analysis of Results for the General Hypothesis:

- There is a statistically significant positive effect of physical exertion on increasing heart rate and systolic blood pressure.

Through the presentation and analysis of the results for the first and second sub-hypotheses, we have reached the following conclusions:

A. Regarding the impact of physical exertion on heart rate:

There is a clear superiority in the mean value of heart rate in the post-measurement (after physical exertion) over the mean value of heart rate in the pre-

measurement (before physical exertion) among individuals in the experimental group. Statistical significance in the differences in heart rate between pre-measurement and post-measurement in favor of post-measurement has been confirmed through the Paired Samples Test. This indicates that physical exertion has a statistically significant positive effect on increasing heart rate.

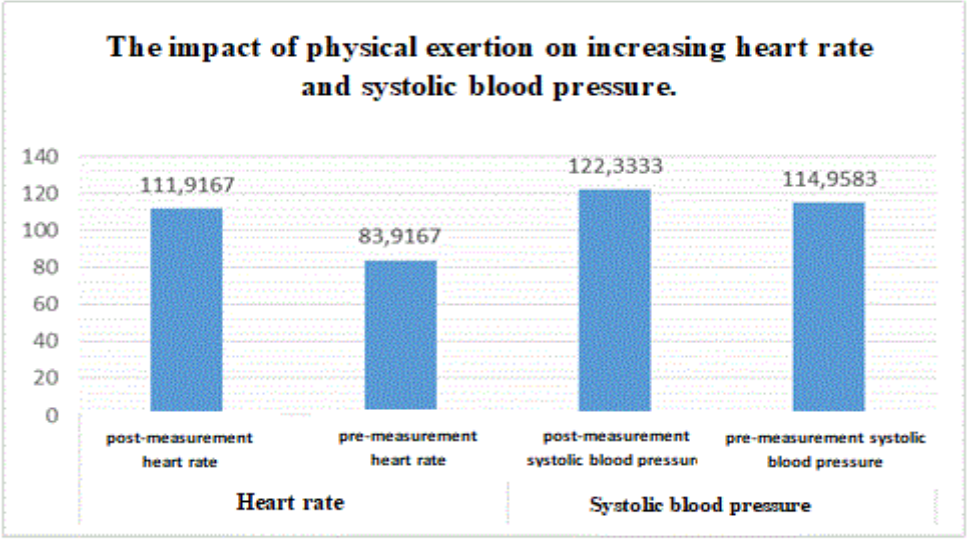
B. Regarding the impact of physical exertion on systolic blood pressure:

There is a clear superiority in the mean value of systolic blood pressure in the post-measurement (after physical exertion) over the mean value of systolic blood pressure in the pre-measurement (before physical exertion) among individuals in the experimental group. Statistical significance in the differences in systolic blood pressure between pre-measurement and post-measurement in favor of post-measurement has been confirmed through the Paired Samples Test. This indicates that physical exertion has a statistically significant positive effect on increasing systolic blood pressure.

From these results, we can conclude that the general hypothesis (There is a statistically significant positive effect of physical exertion on increasing heart rate and systolic blood pressure.) has been confirmed.

This is further illustrated in the following figure (Figure 2).

Fig.3. illustrates the impact of physical exertion on increasing heart rate and systolic blood pressure.



Source: The researcher according to the outputs of the statistical program SPSS

Through Figure 3, we find:

Differences in heart rate and systolic blood pressure rates between the pre-measurement and post-measurement favor the post-measurement among individuals in the experimental group. This indicates a positive effect of physical exertion on increasing heart rate and systolic blood pressure.

10. CONCLUSION

Based on the results obtained during this study, the following conclusions can be drawn:

- There is no variation in the data in favor of any direction, meaning that the data follows a normal distribution, and thus parametric statistical tests can be used to analyze this data.
- There is a clear superiority in the mean heart rate in the post-exercise measurement over the pre-exercise measurement among individuals in the experimental group. We will confirm the statistical significance of these differences by applying the Paired Samples Test.
- There is a clear superiority in the mean systolic blood pressure in the post-exercise measurement over the pre-exercise measurement among individuals in the experimental group. We will confirm the statistical significance of these differences by applying the Paired Samples Test.
- From the above, we conclude that the general hypothesis (There is a statistically significant positive effect of physical exertion on increasing heart rate and systolic blood pressure) is supported.

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