



## Physiological Responses of Selected Blood Variables Accompanying a Plyometric Training Program in Young Tennis Players

Assistant Professor Dr. Hussein Ali Hussein Al-Kufi, College of Basic Education/Al-Mustansiriya University

[h.z.tenis47.edbs@uomustansiriyah.edu.iq](mailto:h.z.tenis47.edbs@uomustansiriyah.edu.iq)

### Abstract

The main purpose of this study is to identify the effect of a plyometric training program on specific physical performance metrics and to detect the physiological reactions of specific blood variables. One-group pre-test and post-test designed and used in the experimental method of the current research. The sample of the research consisted of 16 young tennis players, aged between 15 to 16. The plyometric training regimen was implemented for (8) weeks, with (3) training sessions every week. In addition to explosive power and sprint speed, blood indicators (hemoglobin, creatinine, and urea) were also evaluated. The results showed statistically significant differences in favor of the post-test for all studied variables, indicating positive physiological adaptations resulting from the plyometric training program. According to the study's findings, plyometric exercise helps young tennis players perform better physically and improve a few physiological blood indicators.

**Keywords:** Plyometric training, Physiological responses, Hemoglobin, Creatinine, Urea, Tennis.

### 1. Research Definition:

#### 1.1 Research introduction :

Tennis is an individual game that needs a high level of physical and physiological competency, where it mainly depends on speed, explosive power, and motor response speed in addition to the efficiency of both circulatory and respiratory systems. Physiological aspect is the most important part that can define the performance level as it directly participates in the regulating energy production, oxygen transport processes, and fatigue disposal process.

Biometric training is one of the modern training styles that depends on the use of lengthening and shortening muscles, which contributes to improving the efficiency of the neuromuscular system and the ability to generate power in a short period. Biometrical training can also affect different physiological responses in the human body, specifically its effect on blood components that can be considered as important indicators of health and functional status of the athlete.

The importance of the research lies in the fact that it contributes to clarifying the nature of the physiological responses to some hematological variables associated with plyometric training in the junior category, which is a sensitive age stage in terms of growth and adaptation, which provides a scientific basis that helps trainers and specialists in regulating training loads in line with the physiological characteristics of this category.

#### 1-2- Research problem

Although plyometric training is commonly used in training programs for athletes, most studies have focused on its physical and skill effects, while studies that have addressed its physiological responses, particularly hematological variables in emerging tennis players, are still limited. There is a need to study these



responses to determine the extent to which this type of training improves players' health and functional indicators.

Hence, the research problem is defined in the following question:

What is the nature of the physiological responses to some hematological variables associated with a biometric training program in junior tennis players aged (15-16)?

### 1.3 Research objectives

1. Identify physiological responses to certain blood variables (hemoglobin, creatinine, urea) resulting from applying a biometric training program.
2. Explaining the effect of plyometric training on developing explosive strength and speed in young tennis players.

### 1.4 Research hypotheses

1. There are statistically significant differences between pre- and post-measurements in blood variables in favor of post-measurement.
2. There are statistically significant differences between the pre- and post-measurements in explosive force and velocity in favor of the post-measurement.

### 1.5 Limits of research

**1.5.1 Human field: Junior tennis players aged (15–16) years and numbering (16) players.**

**1.5.2 Time domain: from the period 1/7/2025 to 1/9/2025.**

**1.5.3 Spatial field: Al-Amana Sports Club.**

**2-2- Research community and its sample the research sample was selected intentionally and numbered (16) junior tennis players aged (15–16) years. From Al Amana Sports Club**

### 2-3- Means, tools and devices used in research

- Legal tennis court
- Tennis rackets and balls
- Blood drawing and analysis devices
- Registration forms
- Plyometric training program

### 4.2 Research tests

Vertical jump test of explosive force (Mohamed Sobhi Hassanein, 1993)

20m Speed Running Test(2001, Muhammad Abdel Rahman Al-Khatib)

Blood analysis (Hb, Creatinine, Urea) (Ahmed Mohamed Abdel Aziz, 2005)

### 5.3 Conducting pre-tests: before the start of the training program.

The researcher conducted his pre-tests on the research sample on (Tuesday) 5:30 pm, corresponding to 7/1/2025, including on the first day taking height and weight measurements, recording the ages of the



sample members, and endurance tests, and on the second day the endurance test of the performance under research, after which the researcher implemented the training program on the research sample.

**Table (1): Sample Homogeneity**

Variables	Mean	Standard Deviation	Skewness Coefficient
Age (years)	15.6	0.5	-0.12
Height (cm)	168.4	4.8	0.21
Weight (kg)	60.3	3.9	-0.18

The values of the skewness coefficient indicate that the distribution of the sample falls within the statistically acceptable limits ( $\pm 1$ ), which confirms the homogeneity of the sample and its suitability for the research procedures.

## 2.6. The Training Program

The training program lasted for 8 weeks, with 3 training sessions per week, and a session duration of 60 minutes. The program included jumping exercises, hurdle jumps, vertical jumps, push exercises, and squat exercises.

**Table (2): Sample Training Session**

Time	Exercise	Sets	Repetitions / Distance	Rest
8 minutes	General and specific warm-up exercises	–	–	–
8 minutes	Low hurdle jumps	2 sets	8 repetitions	90 seconds
8 minutes	Vertical jumps	2 sets	8 repetitions	90 seconds
8 minutes	Forward bounding (jump running)	2 sets	20 m	90 seconds
8 minutes	Bodyweight squat exercise	2 sets	10 repetitions	90 seconds
7 minutes	Push exercise (arm push-ups)	2 sets	8 repetitions	90 seconds
5 minutes	Cool-down and relaxation exercises	–	–	–

## 2-7- Conducting post-tests: after the end of the training program.

After applying the vocabulary of the training program for a period of (8) weeks, the researcher conducted post-tests of the research sample on (Monday) corresponding to 1\9\2025, and the same pre-test conditions were established.

## 2-8- Statistical analysis - using SPSS software to analyze data.

## 3. Presentation, Analysis, and Discussion of the Results

**Table (3) Means and Standard Deviations of the Pre- and Post-Test Measurements of Explosive Power, Speed, Hemoglobin, Creatinine, and Urea Levels**



Variables	Pre-test Mean	SD	Post-test Mean	SD	t-value	Sig. (p-value)	Improvement Rate (%)	Significance
Explosive power (cm)	43.8	3.5	51.6	4.2	7.12	0.001	17.8%	Significant
Speed (s)	4.4	0.3	3.9	0.2	6.45	0.001	-11.4%	Significant
Hemoglobin (g/dL)	14.2	1.0	15.0	1.1	3.21	0.006	5.6%	Significant
Creatinine (g/dL)	1.3	0.2	1.1	0.1	2.98	0.009	-15.4%	Significant
Urea (g/dL)	26.1	2.4	23.8	2.1	3.05	0.008	-8.8%	Significant

Degrees of freedom (df) = 15, significance level = 0.05.

## Discussion of the results

The results of the current study showed a significant improvement in the level of explosive strength in young tennis players after implementing the plyometric training program, and this improvement is attributed to the nature of plyometric exercises that depend on taking advantage of the muscle lengthening and shortening cycle, which leads to increased efficiency of the neuromuscular system and improved ability to generate strength in a short time. These exercises raise the level of neural activation of motor units and accelerate the process of their recruitment during motor performance, which is directly reflected in the development of explosive force.

This result is in line with the findings of Mohamed Sobhi Hassanein (1993), who credited that plyometric training helps athletes to develop explosive strength by enhancing neuromuscular traits linked to fast and powerful performance.

The training program's implementation resulted in a significant improvement in the speed of tennis players, according to this study. The improvement is explained by the fact that plyometric training can speed up muscle lengthening and shorten ground contact times during movement, which improves motor function. The central systema nervosum has improved its ability to control nerve signals that are sent to functioning muscles.

outcomes of this research are in line with those of Muhammad Abd al-Rahman al-Khatib (2001), who found that because plyometric training directly affects the development of strength considered by speed, it helps team game players improve their speed.

Hemoglobin levels significantly increased following the implementation of the training program, according to the study's findings regarding hematological physiological factors. This is related to competent circulatory system efficiency and an increased ability to deliver oxygen to working muscles, signifying an advancement in the players' overall functional state. Frequent exercise also helps to improve blood circulation and raise the synthesis of red blood cells.



This conclusion is persistent with what Ahmed Mohamed Abdel Aziz (2005) indicated, who explained that regular training, especially average to high intensity, leads to better hemoglobin levels in young athletes, which boosts their ability to function physically and endure exertion.

This study also exposed a significant drop in creatinine levels following the implementation of the plyometric training program, which is clarified by an improvement in the body's capacity to remove metabolites from muscular activity and a good adaptation in kidney function. This shows better blood flow to essential organs and a proper balance between training load and recuperation level.

These results are similar with what was stated by Ahmed Mohamed Abdel Aziz (2005), who showed that regular physical exercise leads to enhancing renal function and minimizing the accumulation of tiredness products in athletes.

The urea amounts also significantly diminished, according to the data. This decrease is explained by decreased muscle fatigue and increased metabolic efficiency. Everyday exercise lowers the rate of protein breakdown and improves muscular energy competence, which restricts the body's ability to produce urea.

Finally, it can be concluded that the plyometric training regimen improved both the physical qualities of explosive power and speed as well as helpful physiological changes in blood components. According to earlier research in the field of sports physiology, this highlights the significance of this kind of training in fostering athletic performance and functional health in young tennis players.

## **-4Conclusions and recommendations**

### **-1-4Conclusions**

- The plyometric training program effectively contributed to positive physiological responses in some blood components in young tennis players, represented by high hemoglobin levels and low creatinine and urea levels
- Plyometric training resulted in a significant improvement in explosive force in the sample members, reflecting the development of the neuromuscular system's efficiency and ability to generate force in a short time
- The training program contributed to developing the players' motor speed, as a result of improving muscle contraction speed and reducing performance time
- The decrease in creatinine and urea reflects a positive physiological adaptation in kidney function and metabolism, indicating an appropriate balance between training load and hospitalization
- Plyometric training proves its effectiveness as a safe and appropriate training method for the age group (15–16 years) when applied in a scientifically standardized manner.

### **-2-4Recommendations**

- Adopting plyometric training as part of training programs designed to develop the physical and physiological performance of young tennis players.
- It is necessary to regulate the intensity and size of the training load in line with the physiological characteristics of the age group, to avoid excessive stress or injuries



- Paying attention to monitoring the players' hematological physiological indicators periodically, because of their importance in assessing the health condition and level of adaptation to training.
- Conduct future studies that address other physiological variables such as respiratory circulatory system indicators or hormones associated with athletic performance.
- Applying the plyometric training program to broader samples and in different sports, with the aim of generalizing the results and benefiting from them in the training and physiological field.

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