

# The Effect of Cool-Down and Relaxation Exercises on Lactic Acid Concentration and the Dribbling and Passing Skills of Advanced Football Players

*Asst. Prof. Dr. Abdullah Mohammed Tiyawli, College of Physical Education and Sports Sciences Tikrit University, Iraq .  
[dr.t.ay1970@tu.edu.iq](mailto:dr.t.ay1970@tu.edu.iq)*

## Abstract

The research focused on the following objectives:

- the impact of relaxation and cool-down techniques on lactic acid levels as well as advanced football players' dribbling and passing abilities.
- the variations in the lactic acid concentration post-tests and the advanced football players' dribbling and passing abilities between the experimental and control groups.

To achieve the study's objectives, the researcher hypothesized:

- There are statistically significant differences in lactic acid concentration and the dribbling and passing skills of advanced football players.
- There are statistically significant differences between the post-test results of the experimental and control groups in lactic acid concentration and the dribbling and passing skills of advanced football players.

Because it was suitable for the nature of the study, the researcher employed the experimental method with two groups (experimental and control). Advanced football players from Al-Elm Sports Club for the 2023–2024 season made up the research population. There were thirty players in the population, which was purposefully chosen. Twenty participants, or 66% of the research population, made up the randomly selected sample. They were split into two groups of ten players each.

The researcher reached several conclusions, the most important of which are:

- The use of cool-down and relaxation exercises.
- The repetition of cool-down and relaxation exercises with a combined physical and skill-based nature, through low-intensity interval training, showed a positive effect on the research variables for advanced football players.

**Keywords:** Cool-Down and Relaxation Exercises – Lactic Acid – Football Players – Interval Training

## 1- Research Definition

### 1-1 Introduction and Importance of the Research

In addition to the intensity of training loads, a player's capacity to withstand fatigue, training demands, and contests is also influenced by how well they make use of recovery times and recovery procedures. These recuperation times are important for improving the player's performance; thus, coaches should not overlook them. The volume and intensity of workouts, together with recovery (cool-down and relaxation) periods at the conclusion of training sessions, are key components of a football player's holistic training regimen.

A football player's body must quickly return to its normal or almost normal state, which requires the right balance of training volume and intensity as well as effective recovery period management. This gives the athlete the chance to develop their skills, accomplish their objectives, and triumph in tournaments. Additionally, utilizing rest intervals protects players from harm and overtraining by acting as a preventive precaution.

The research's significance stems from the fact that cool-down and relaxation techniques aid in the player's body's removal of metabolic waste products and return to a normal or normal state, hastening the healing process. The player's abilities during games are subsequently impacted as they achieve the supercompensation level, which improves performance in the physical domains that constitute the basis of both skill and movement execution. Additionally, after these activities, a large amount of lactic acid concentration is decreased because it is transformed into lactate salts, which provide a rapid energy source for the brain and slow-twitch muscle fibers, among other bodily systems. The results of Risaan Khuraibet and

Abu Al-Ola (2016) corroborate this, who pointed out that "lactic acid is not just a byproduct of anaerobic energy but is used as an energy source during light physical activity, where hydrogen is separated from it, leaving lactate, which serves as a quick and favorable fuel for the body and is utilized by its functional systems, such as the brain, heart, and most slow-twitch muscle fibers."<sup>1</sup>

According to the aforementioned, the importance of this study resides in the creation of relaxation and cool-down activities following the primary training session and the comprehension of their effects on lactic acid concentration as well as the dribbling and passing abilities of professional football players. This is a sincere effort to connect the scientific and practical facets of football player training to enhance performance.

### **1-2 Research Problem:**

The philosophy of sports training is guided by fundamental ideas, scientific systems, and rules. It guarantees that the training process remains on the right course when followed by the coach. It was discovered via the researcher's practical experience as a football coach and academic expert that many sports clubs overlook the cool-down and relaxation portion of the training session. This disregard creates a gap in the training unit's scientific and practical integration, particularly when performance lasts for a considerable amount of time. Based on high metabolic outputs and the training unit exercises depleting energy reserves, the researcher theorizes that cumulative tiredness may be the reason of the drop in skill levels. Thus, the researcher made the decision to investigate this vital component of the training session by creating and executing a series of low-intensity workouts to track variations in lactic acid concentration as well as the expert football players' dribbling and passing abilities. To benefit football players and coaches in the Salahuddin Governorate, this study aims to determine the scientific significance of this portion of the training session.

### **1-3 Research Objectives:**

- to investigate how advanced football players' dribbling and passing abilities, as well as their lactic acid concentration, are affected by cool-down and relaxing exercises.
- to determine how advanced football players' dribbling and passing abilities differed from the experimental and control groups' post-test outcomes in terms of lactic acid concentration.

### **1-4 Research Hypotheses:**

- Advanced football players' lactic acid concentrations and dribbling and passing abilities differ statistically significantly.
- The lactic acid concentration post-test results for the experimental and control groups, as well as the advanced football players' dribbling and passing abilities, differ statistically significantly.

### **1-5 Research Fields:**

**1-5-1 Human Field:** Advanced football players of Al-Elm Sports Club in Salahuddin Governorate (2023-2024).

**1-5-2 Time Field:** From January 27, 2023, to April 1, 2023.

**1-5-3 Place Field:** Al-Elm Sports Club Stadium / Salahuddin.

## **2. Theoretical Studies and Previous Research**

### **2-1 Theoretical Studies**

#### **2-1-1 Cool-Down and Relaxation Exercises:**

Football coaches and other sports experts are always looking for methods to improve players' skills, particularly in the areas of physical, technical, and tactical development. Through a variety of activities used at the conclusion of training sessions (cool-down), this progress results in improved performance during contests. According to Mohammed Mahmoud and Risaan Khuraibet (2022), "Continued exposure to pressure without adequate attention to recovery processes results in a higher risk of injuries and may lead athletes to a state of overtraining" (overtraining).<sup>2</sup>

<sup>1</sup> Risaan Khuraibet and Abu Al-Ola Abdelfattah, *Sports Training*, first edition (Cairo: Markaz Al-Kitab for Publishing, 2016), p. 195.

<sup>2</sup> Risaan Khuraibet and Mohammed Mahmoud Abdel Zaher, *Training Loads and Sports Recovery*, first edition (Cairo: Markaz Al-Kitab for Publishing, 2022), p. 19.

Players' performance changes both technically and physiologically because of the development of various physical and technical characteristics brought about using cool-down exercises. This is confirmed by Wamid Tarek Star (2012), who quotes Mohammed Reda Ibrahim (2008), who said: "Physiological alterations connected to the necessary requirements of that sport are caused by performing workouts particular to the game or physical activity practiced. The physical exercise that is done causes the human body to adjust. Such adaptation results in changes in skill, physical performance, and tactical performance in addition to physiological changes.

Reducing the load in the last phase of the training units is referred to as cool-down. Without sacrificing the physiological adaptations, the body has acquired; the cool-down aims to lessen or completely eradicate the weariness that may arise from prolonged performance (increased physical effort throughout the training unit). According to Mohammed Al-Qatt (2013), "The goal of cool-down is to reduce the accumulated fatigue in the body without losing the physiological adaptations gained through the training programs."<sup>3</sup>

The significance of recovery training, which is seen to be a necessary component for attaining exceptional performance, is still evident even when athletes spend more time unwinding than training. An athlete's capacity to perform well can be improved by striking a healthy balance between the demands of training, competition, and everyday life, as well as by getting enough sleep. Thus, the topic of relaxation or recuperation in sports and the athlete's return to their natural state has emerged as one of the most important ones—not only to attain peak performance but also to preserve the athlete's health, avoid overtraining, and prevent sports injuries.

Rest moments throughout training, transitional periods, and before and after contests are all examples of when relaxation is crucial, in addition to the times after training loads are completed. This has been verified by Risaan Khuraibet and Mohammed (2022): "Recovery does not only refer to the period immediately following the training load but also includes the rest intervals between repetitions of exercises within different training units, as well as rest periods during the training week and in the transitional periods between training seasons, before and after competitions."<sup>4</sup>

### 2-1-3 Lactic Acid

By converting sugar into glucose and producing ATP anaerobically (anaerobic glycolysis), this anaerobic mechanism uses the energy generated from glycogen in the absence of oxygen. Lactic acid builds up in the muscles and blood because of this vital process for supplying the required energy. Lactic acid is created when glycogen breaks down because there is not enough oxygen present. This system uses "the energy released from the breakdown of glycogen in the absence of oxygen to regenerate ATP after energy is released through the phosphagen system (ATP-PC)," according to Ahmed Al-Hasnawi (2014). Lactic acid is a consequence of the lack of oxygen during glycogen breakdown, which occurs 8–10 seconds after the start of effort.<sup>5</sup>

## Methodology of the Research and Field Procedures

### 3-1 Research Method

The researcher used the experimental method due to its appropriateness to the nature of the research and its problem.

### 3-2 Research Community and Sample

Intentionally, the research community was defined as the thirty football players who played for Al-Alam Club in 2023–2024. Additionally, the study sample was purposefully chosen and included twenty gamers, or 60% of the research community. By lottery, they were split into two groups, experimental and control, each consisting of ten players. Following the researcher's exclusion of ten players—goalkeepers, players with injuries, and players who were absent—this division took place. This is shown in Table (1).

Community	Number	Percentage
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<sup>3</sup> Mohammed Ali Al-Qatt, *The Optimal Cool-Down for Athletes*, (Cairo: Markaz Al-Kitab for Publishing, 2013), p. 5.

<sup>4</sup> Risaan Khuraibet and Mohammed Mahmoud Abdel Zaher, *Training Loads and Sports Recovery*, 1st ed. (Cairo: Markaz Al-Kitab for Publishing, 2022), p. 405.

<sup>5</sup> Ahmed Youssef Mutaab Al-Hasnawi, *Sports Training Skills*, (College of Physical Education / University of Babylon, 2014), p. 66.

Research Sample	20	66.6%
Excluded Players	6	20%
Exclusion of Goalkeepers	4	13.4%
<b>Total</b>	<b>30</b>	<b>100%</b>

### 3-3 Homogeneity and Equivalence of the Research Groups:

#### 3-3-1 Homogeneity of the Research Groups:

Homogeneity was conducted for the research sample concerning the variables (mass, height, chronological age, training age). Table (2) illustrates this.

No.	Variables	Unit	Research Sample		Mode	Skewness
			M	SD		
1	Weight	KG	67.50	0.89	65	1.55
2	Height	CM	175.33	5.81	170	0.05
3	Chronological Age	Year	23.98	0.99	22	1.70
4	Training Age	Year	6.16	0.81	5	2.20

The skewness coefficient values in Table (2) range from ( $\pm 1$ ), suggesting that the research sample has a normal distribution. This indicates that, in terms of the previously indicated variables, the sample is homogeneous.

#### 3-3-2 Equivalence of the Research Groups:

The researcher conducted an equivalence assessment between the research groups concerning the research variables under study. Table (3) illustrates this.

Variables	Unit	Control Group Pre-test		Experimental Group Post- test		Calculated (T) Value	Value (sig)	Sig
		M	SD	M	SD			
Lactic Acid	mmol/L	16.322	19.74	15.957	17.99	-1.19-	.30	Un sig

Table (3) makes it clear that there are no statistically significant differences between the experimental and control study groups because the significance levels are higher than 0.05. This implies that, in terms of the variable, they are equal.

### 3-5 Means, Devices, and Tools Used in the Study

#### 3-5-1 Means Used in the Study:

- Tests
- Personal interviews
- Observation
- Scientific references and sources (both Arabic and foreign)
- A questionnaire form for expert and specialist opinions on the most suitable tests according to the study requirements
- The Internet

#### 3-5-2 Devices Used in the Study: The researcher used the following devices:

- One HP computer

- An electronic scale for measuring weight and height.
- A device for measuring lactic acid.

**3-5-3 Tools Used:**

- Two measuring tapes
- Twenty markers in assorted colors
- Fifteen official footballs
- Four whistles
- Stopwatch for measuring time with precision up to 1/10 second.

**3-6 Determining the Tests Used in the Research:**

Following an examination of scientific references and sources, the researcher created a questionnaire with multiple tests. These were then given to testing and measurement experts and specialists to determine which tests best fit the study's needs. Benjamin Bloom confirmed that "a selection rate of (75%) for the required variable is the most appropriate for its selection, and anything below this percentage disregards the choices of the remaining variables." As a result, the tests selected were those that obtained an acceptance rate of 75%.<sup>6</sup>

Table (4) shows the agreement rate of the opinions of the esteemed specialists on the skill tests.

Basic Skills	Tests	Approvals	Percentage	Selection
Ball Rolling	Rolling the ball for twenty meters based on time	7	63%	×
	Rolling the ball between five markers	5	29%	×
	Rolling the ball between ten markers back and forth	11	100%	√
Passing	Kicking the ball to the farthest distance from a 1-meter radius circle	6	54%	×
	Testing the rebound pass against the wall for 20 seconds	10	90%	√
	Passing towards a small target twenty meters away	7	63%	×

**3-6-1 Basic Skills in Football:**

Test for rolling the ball in a zigzag line between markers.<sup>7</sup>

**Purpose:**

To measure the player's ability to control the ball while rolling it between the markers.

**Materials Used:**

ten markers, a football, a stopwatch.

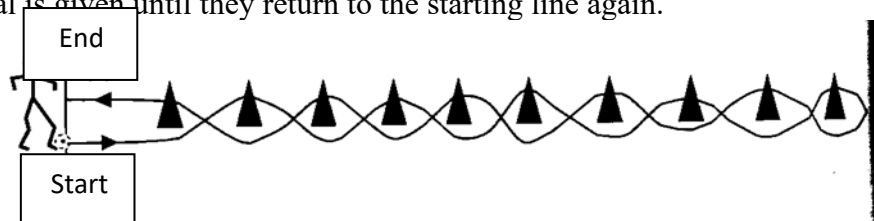
**Performance Description:**

Following the installation of ten markers in a straight line on the field, as indicated in Figure 2, with one meter separating each marker and one meter separating the starting line from the first marker.

When the start signal is given, the player stands with the ball at the starting line, runs with the ball in a zigzag pattern between the markers until they reach the final marker, circles it, and then starts over (i.e., the distance that is covered from the starting line to the return to the starting line).

**Evaluation:**

The time taken by the player is recorded in seconds, rounded to the nearest hundredth of a second, from the moment the start signal is given until they return to the starting line again.



<sup>6</sup> Benjamin et al. (translated by Muhammad Amin Al-Mufti et al.); Evaluation of Summative and Formative Student Learning, (Cairo, McGraw-Hill Publishing, 1983), p. 126.

<sup>7</sup> Ibrahim Mufti; The New in Technical and Tactical Preparation for Football Players, (Cairo: Arab Thought House, 1994) p. 261.

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**First: Passing**

**Test Name:** "Wall Pass Test for 20 Seconds."<sup>8</sup>

**Purpose of the Test:**

To measure the accuracy of passing.

**Materials Used:**

A smooth wall marked with an area of 1.30 meters × 2.20 meters, a line marked 5 meters in front of the wall, 3 official footballs, and an electronic stopwatch.

**Performance Description:**

The player behind the starting line hears the start signal, kicks the ball against the wall, and then kicks it again once it bounces off the wall. This process is repeated until the 20-second test is over.

**Test Instructions:**

- The ball must not be kicked after rebounding from the wall until it is behind the starting line.
- If the ball goes out of the player's control, they can take one of the other two balls without stopping.
- The ball can be kicked with either foot or any part of the foot.

**Scoring:**

The number of successful kicks toward the wall during the 20 seconds is recorded.

**3-6-2 Measurement of Lactic Acid (C<sub>3</sub>H<sub>6</sub>O<sub>3</sub>)<sup>9</sup>**

Inserting the check strip into its corresponding slot is the first step after the lithium batteries have been placed in their respective compartments within the device. Since there are no buttons on the device to turn it on, this strip is used to activate it. A measurement between 2.1 and 2.6 mmol/L should show up when the strip is inserted, indicating that the instrument is ready to begin monitoring and is sensitive to temperature and humidity. A measurement of 2.3 mmol/L is typically displayed by the instrument. The device should be left for twenty minutes to allow the sensors at the front of the device to adapt to the surroundings if the reading is either above or below the check strip's specified range. This indicates that the gadget is not suitable with the ambient temperature and humidity.

The third strip—the Test Strip—for detecting lactic acid is then placed once the calibration strip has been taken out. The lancet device needs to be ready, and one finger needs to be well cleaned with alcohol and dried before the third strip is inserted. After pressing the lancet against one of the fingertip's edges, the lancet device's side button is pressed. A drop of blood should be placed immediately on the test strip, which is situated in the front slot of the device for the three strips, because of the lancet extending and puncturing the skin. The drop of blood must go from the beginning of the strip to the location denoted by the (+) sign, and the end of the strip will be visible. When the blood reaches this point, the device's screen will show a countdown in seconds, beginning at (59) seconds and ending at (1) second. The reading for the lactic acid concentration will then be shown.

*Note: A rest period of (5) minutes was provided for each player after completing the cool-down and relaxation exercises. The figure below illustrates the (IQ Sport) device used for measuring lactic acid.*

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<sup>8</sup> Ismail Saleem Abdul Aithawy; Determining the Most Important Physical and Skill Capacities for Testing Young Football Players, (master's Thesis, College of Physical Education, University of Baghdad, 2002) p. 62.

<sup>9</sup> Bishop, D. (2001). *Evaluation of the Accusport® Lactate Analyser. International Journal of Sports Medicine*, 22(7), 525–530. doi:10.1055/s-2001-17611



IQ Sport Device for Measuring Lactic Acid

### 3-9 Field Procedures Used in the Study:

#### 3-9-1 Preparation and Design of Exercises

Following an examination of scholarly sources and references in the domains of football, training physiology, and training science, the researcher created and developed cool-down and relaxation exercises. To decide which exercises were appropriate for the study, the researcher created a total of twelve.

### 3-10 Final Procedures of the Study:

#### 3-10-1 Pre-tests

The pre-tests for both groups (control and experimental) were conducted on Friday, January 27, 2023, at the Al-Alam Sports Club football field.

The sequence of tests was as follows:

- Rolling
- Passing
- Measuring Lactic Acid

After completing the pre-tests for both research groups, the researcher implemented the cool-down and relaxation exercises on the experimental group, considering several points:

- The intensity of the exercises should be between **30-50%**.
- The number of exercises used in each training unit should be between **4-5 exercises**.
- The average duration of the exercises should be between **15-30 minutes**.
- The exercises (cool-down and relaxation) were implemented **six times a week**.
- The rest periods between repetitions were based on the training method used (low-intensity interval training), depending on the pulse rate, which was around **120-130 beats/min**.
- All exercises were performed in the concluding part of the training unit.

#### 3-10-2 Post-tests:

On Saturday, April 1, 2022, at the Al-Alam Sports Club field, the researcher administered the post-tests for both research groups (control and experimental) following the experimental group's cool-down and relaxation exercises, making sure that the sample was subjected to the same conditions and requirements as during the pre-tests.

### 3-11 Statistical Methods:

The researcher used the Statistical Package for the Social Sciences (SPSS).

Table (5) shows the means, standard deviations, and calculated t-values for the control group in the pre-test and post-test.

Variables	Unit	Control Group Pre-test	Experimental Group Post- test	Calculated (T) Value	Value (sig)	Sig

		M	SD	M	SD			
Lactic Acid	mmol/L	16.322	19.74	13,145	17,8	1,627	0,138	Un sig
Passing	Degree	10,2	1,95	10,9	1,6	1,809	0,104	Un sig
Rolling	Sec	14,4	1,26	14,7	1,14	1,730	0,118	Un sig

• Significant at a significance level of  $\geq (0.05)$  with a degree of freedom of (9), the t-value = 2.26.

Table (13) makes clear that the pre-test mean values for the control group's lactic acid concentration and fundamental skills (rolling, passing) were 10.2 – 14.4 – 16.323, with a standard deviation of 1.95 – 1.26 – 19.74. The post-test mean was between 10.9 and 14.7 and 13.145, while the standard deviation was between 1.6 and 1.14 and 17.8. The significance level (sig) was between 0.104 and 0.118 and 0.138, while the computed t-values were between 1.809 and 1.730 and 1.627. This suggests that while the lactic acid variable shows significant differences between the pre and post-tests, the rolling and passing skills for the control group show non-significant differences. Because the coach disregarded these methods and exercises, the concentration on load and intensity was noticeably elevated, which resulted in minimal skill growth in the control group. The researcher ascribes this lack of improvement to the failure to employ recuperation techniques and exercises. For these reasons, the skills (lactic acid concentration, passing, rolling) did not improve.

#### 4-2 Display, Analyze, and Discuss the Results of the Pre and Post Tests for the Experimental Group's Research Variables:

**Table (6): Statistical Parameters in the Pre-Test and Post-Test for the Research Variables of the Experimental Group**

Variables	Unit	Control Group Pre-test		Experimental Group Post- test		Calculated (T) Value	Value (sig)	Sig
		M	SD	M	SD			
Lactic Acid	mmol/L	15.957	17.99	10,121	14.77	5,075	0,001	Un sig
Passing	Degree	11,14	1,49	15,71	1,12	3,857	0,003	Un sig
Rolling	Sec	15,14	1,13	12,12	3,12	2,486	0,004	Un sig

• Significant at a significant level of  $\geq (0.05)$  and with degrees of freedom (9), the t-value = 2.26.

From Table (6), the following is evident:

The mean value for the pre-test of the experimental group (lactic acid concentration, passing, rolling) was (15.657 – 11.14 – 15.4), and the standard deviation was (17.99 – 1.49 – 1.13). The mean values for the post-test were (10.121 – 15.71 – 12.12), with standard deviations of (14.77 – 1.12 – 3.12). The calculated value of (t) was (5.075 - 3.857 - 2.486), while the significance level (sig) was (0.001, 0.003, 0.004). This indicates that there are statistically significant differences between the means of the pre-test and post-test, favoring the post-test in the research variables (passing, rolling, lactic acid concentration) for the experimental group.



The researcher ascribes this development to the experimental group's use of cool-down and relaxation techniques that she devised. After finishing the training unit, the athlete's performance in cool-down and relaxation exercises, including walking and light jogging, aids in the player's quicker transition back to a natural or semi-natural condition. This leads to an increase in the recovery process and allows the player to reach an optimal recovery phase. As noted by (Risan Khreibat, Muhammad Mahmoud, 2022), "Focusing on cool-down exercises during specified training and recovery periods provides an opportunity for both the coach and the athlete to evaluate performance and review the objectives of the training units and the methods of achieving them, whether related to observing the results of implementing the training method used in relation to the content of the training unit and the athletes' responses."<sup>10</sup>

Based on the aforementioned, the researcher thinks that cool-down and relaxation exercises are essential to the adaptation process and to helping players achieve elevated levels because, in addition to improving recovery, they aid in reestablishing energy sources and getting rid of metabolic waste products like lactic acid. Without considering recuperation, inter-set rest, or the cool-down and relaxation period after the main training session, the players' capacity to tolerate training loads in terms of volume and intensity is just as crucial as the recovery process. This is supported by Atheer Muhammad Sabri and Ahmed Abdul Amir Al-Alwani (2023), who stated, "Some energy sources consumed during performance, such as phosphate sources, can be replenished in a period of (3-5) minutes, which are responsible for speed, and the elimination of lactic acid requires a duration of (30 minutes to a full hour) when performing cool-down exercises."<sup>11</sup> The results obtained by the researcher in the pre-test and post-test for the experimental group confirm the importance of the final part of the training unit. It was clear that the skills of rolling and passing have improved, and their results were statistically significant. Additionally, the results for the level of lactic acid also showed significance, indicating the importance of cool-down and relaxation exercises for both skill and physiological aspects.

#### 4-3 Presentation, Analysis, and Discussion of Post-Test Results for Research Variables of Both Research Groups

**Table (7)** Statistical Characteristics of the Post-Test for Research Variables of Both Research Groups (Control and Experimental)

Variables	Unit	Control Group Pre-test		Experimental Group Post- test		Calculated (T) Value	Value (sig)	Sig
		M	SD	M	SD			
Lactic Acid	mmol/L	16.322	19.74	10,121	14.77	2,224	0,005	Un sig
Passing	Degree	10,9	1,6	15,71	1,12	2,739	0,003	Un sig
Rolling	Sec	14,7	1,14	12,12	3,12	2,393	0,004	Un sig

Significant at Error Level  $\geq (0.05)$  with Degrees of Freedom (18) Value (t) = 2.10

According to Table (7), the control group's post-test mean score in the areas of lactic acid concentration, passing, and rolling was 16.322 – 10.6 – 14.7, with standard deviations of 16.74 – 1.6 – 1.14. On the other

<sup>10</sup> Risan Khreibat and Muhammad Mahmoud Abdul Dahr; *Training Loads and Sports Recovery*, first edition: (Cairo, Dar Al-Fikr Al-Arabi, 2021), p. 579.

<sup>11</sup> Atheer Muhammad Sabri and Ahmed Abdul Amir Hamza Al-Alwani; *Modern Sports Training Science (Methods and Application Techniques)*, first edition: (Amman, Dar Al-Wifaq for Publishing and Distribution, 2023), p. 276.

hand, the experimental group's post-test mean scores were 10.121 – 15.71 – 12.12, with standard deviations of 14.77 – 1.12 – 3.12. The significance values (sig) were 0.005 - 0.003 - 0.004, while the computed t-values were 2.224 - 2.739 - 2.393. This suggests that the experimental group's post-test results differ significantly from those of the control group. Because the cool-down and relaxation activities produced and performed by the experimental group have the potential to aid in recovery, the researcher credits this notable difference to their use. The results of performing these exercises led to a decrease in the player's body temperature and an increase in oxygen consumption, which contributes to the speed of recovery processes and allows players to reach the level of super compensation, which is an increase in energy stores and a decrease in feelings of fatigue. Recovery is considered one of the essential components of the training process because players need recovery just as much as they need effort for the training process to be complete, according to the specifics of the functional systems. The level of adaptation is directly related to the intensity and volume of the stimulus and the level of rest. As mentioned by (Risan and Muhammad Mahmoud, 2022), "Sports training is one of the natural stimuli that affect the human body to improve its physiological responses, and the implementation of training causes changes in physiological, biochemical, and psychological functions, although most adaptations occur during recovery."<sup>12</sup>

The player's ability to reach the super compensation threshold is aided by the last portion of the training unit, particularly if it involves a certain kind of easy exercise that ranges in intensity from 30% to 50%. This emphasizes the significance of good recovery, which enables the body to replenish energy storage and get rid of metabolic waste. As a result, this will have a favorable effect on how tasks, whether tactical or skill-based, are executed. Eyad Mohammed Abdullah (2019) pointed out the objectives of recovery after athletic exertion and its benefits, stating, "Restoring the body to its normal or near-normal state, replenishing energy stores depleted during physical exertion, and compensating for the oxygen deficit that occurred during exercise can be achieved through what are called 'cooling and relaxation exercises.'"

From this perspective, the researcher believes that recovery (cooling and relaxation exercises) is of immense importance, whether after intense training or after matches. Risan Khreibat and Muhammad Mahmoud (2022) mention, "The athlete's performance of positive recovery exercises, such as walking and light jogging after competition or intense training, can help restore recovery faster than using passive recovery." This indicates that the recovery process and returning to a normal state occurs more rapidly when the athlete engages in a series of cooling exercises<sup>13</sup>.

When compared to the control group, the experimental group showed notable improvements in their rolling and passing abilities as well as their lactic acid concentration. The significance of cooling and relaxation exercises in football players' sports training is thus made evident by their key role in skill and physiological aspects, emotional balance, and allowing players to perform at an elevated level and win games.

## 5- Conclusions and Recommendations

### 5-1 Conclusions

- The cool-down and relaxation exercises have a positive impact on the research variables for football players.
- The use of cool-down and relaxation exercises, combined with low-intensity interval training, demonstrated a positive effect on the research variables for football players.

### 5-2 Recommendations

- Emphasize the use of cool-down and relaxation exercises in training sessions for football players.
- Stress the importance of incorporating various recovery methods alongside cool-down and relaxation exercises.
- Conduct similar studies focusing on female players and different age groups.

## References

- Jabbar Rahima Al-Kaabi; *The Physiological and Chemical Foundations of Sports Training*, 1st ed. (Doha, B.M., 2007).

<sup>12</sup> Risan Khreibat and Muhammad Mahmoud Al-Daher; *Sports Training and Recovery*, 1st Edition: (Cairo, Center for Publishing, 2022), pp. 305-306.

<sup>13</sup> Risan Khreibat and Muhammad Mahmoud Al-Zahir; same source, p. 578.

- Mohannad Hasan Al-Bashtawi, Ahmed Ibrahim Al-Khawaja; *Principles of Sports Training*, 1st ed. (Amman, Dar Al-Wail Publishing, 2005).
- Shahd Marzouk Mohammed Jassem Al-Khazali; "The Effect of Anaerobic Exercises on the Development of Certain Special Physical Capacities and the Concentration Ratio of Hexokinase Enzyme in the Blood of Youth Football Players Aged 15-17 Years," (College of Physical Education, University of Baghdad, 2016).
- Risan Khreibat, Muhammad Mahmoud Abdul Dahr; *Training Loads and Athletic Recovery*, 1st ed. (Cairo, Center for Book Publishing, 2022).
- Benjamin et al., translated by Muhammad Amin Al-Mufti et al.; *Assessing Student Learning: Summative and Formative*, (Cairo, McGraw-Hill, 1983).
- Jabbar Rahima Al-Kaabi; *The Physiological and Chemical Foundations of Sports Training* (Doha, B.T., 2007).
- Wameed Tarek Star; "The Effect of Specific Skill Exercises on the Development of Certain Physical and Motor Capacities for Youth in Boxing," (Unpublished Master's Thesis, University of Diyala/College of Physical Education, 2012).
- Iyad Mohammed Abdullah Al-Zubaidi; *Scientific Foundations in Sports Training* (Mosul, Dar Noon for Printing, Publishing, and Distribution, 2019).
- Atheer Muhammad Sabri and Ahmed Abdul Amir Hamza Al-Alwani; *Modern Sports Training Science (Methods and Application Techniques)*, 1st ed. (Amman, Dar Al-Wifaq for Publishing and Distribution, 2023).

Appendix (1): Model for the Final Part of the Training Unit (Cool Down and Relaxation)

Duration of Exercises	Exercises
Jogging for (5) minutes	1
Stretching exercises for (5) minutes	2
Walking for (2) minutes	3
Jogging with arm swings for (3) minutes	4
Stretching exercises for (4) minutes	5
<b>Sunday</b>	
Walking for (3) minutes	1
Light jogging for (4) minutes	2
Torso twists and arm rolls for (5) minutes	3
Stationary bike from a lying position, stretching, and raising legs while doing cycling movements	4
Light jogging with alternating walking for (3) minutes	5