

The Effect of Proposed Exercises According to Aerobic and Anaerobic Systems on Certain Biomechanical Variables, Fatigue Index, and Passing International Physical Fitness Tests for Football Field Referees

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Abstract

The aim of this research is to develop proposed exercises based on aerobic and anaerobic systems to improve certain biomechanical variables and the fatigue index. The researcher employed the experimental approach with a one-group pretest-posttest design, which aligns with the study's nature. The research population was identified as field referees from the northern region (Kirkuk, Mosul, Erbil, Sulaymaniyah, Dohuk), totaling twenty-five referees. The research sample consisted of field referees from Kirkuk, totaling eight referees, representing 32% of the research population. The researcher utilized statistical tools, including mean, standard deviation, skewness, and the t-test for paired samples.

Keywords: Proposed Exercises, Aerobic and Anaerobic Systems, Biomechanical Variables, Fatigue Index, International Physical Fitness Tests

1- Introduction

1.1 Research Introduction and Importance:

Football holds significant interest among experts in the field, coaches, and fans due to its excitement, thrill, and popularity among global audiences, making it the most popular sport worldwide for all genders. Referees serve as a fundamental pillar in developing football, as successful officiating often equates to the overall success of the match. Through the physical fitness and movement tests established by the International Federation (FIFA) for football referees, which emphasize both aerobic and anaerobic systems and biomechanical variables, key physical attributes are measured. These include physical qualities (strength, endurance, speed, flexibility), physical abilities (explosive power, speed-strength, strength endurance,

speed endurance, power endurance, performance endurance), and motor abilities (coordination, agility, balance, and motor flexibility).¹

Researcher observe that the field referee constantly moves throughout the entire game duration (90-120 minutes), especially when there are extra time periods. Including these intervals, a match can last over 120 minutes. This requires an elevated level of both aerobic and anaerobic endurance from the referee, who typically covers 8-12 km in most matches, often at a low intensity. The referee frequently shifts between short distances of 20-60 meters to be in the optimal position for making accurate decisions, with intermittent breaks of varying lengths during the game. This movement demands an elevated level of speed and speed endurance from the referee.

All referees, regardless of their ranking (international, first, second, third) and gender, whether field or assistant referees, undergo the physical fitness test set by FIFA more than four times a year. This necessitates an elevated level of readiness for the recognized international tests. Therefore, the training programs developed by fitness coaches for referees must be scientifically grounded to improve aerobic, anaerobic, and biomechanical variables, such as speed, speed-strength, speed endurance, agility, and fatigue index, which would enable referees to pass international fitness tests more easily.

1-2 Research Problem:

Based on the researcher's experience in football as referees and coaches for clubs and university teams, they observed that many referees face significant difficulty in passing the international tests set by FIFA. The researcher attributes this to the fact that most referees do not follow scientifically grounded training principles and rely on self-designed exercises, which often lead to difficulties in passing the required tests. This brings forth the research question:

- Do the proposed exercises, based on aerobic and anaerobic systems, impact the development of certain biomechanical variables and the fatigue index for passing international physical fitness tests?

1-3 Research Objectives:

- To design proposed exercises according to aerobic and anaerobic systems to enhance certain biomechanical variables and the fatigue index for passing physical fitness tests.
- To identify the impact of the proposed exercises, based on aerobic and anaerobic systems, on improving biomechanical variables and the fatigue index for passing physical fitness tests.

¹ Jamal Sabri Faraj; *Sports Training Lectures for PhD Students*: (Babylon, College of Physical Education and Sports Sciences, 2015).

1-4 Research Hypotheses:

- There are statistically significant differences between pre- and post-tests for the biomechanical variables and the fatigue index.
- There are statistically significant differences between pre- and post-tests for the international physical fitness tests.

1-5 Research Fields:

1-5-1 Human Field: Eight field referees from Kirkuk, recognized by the Iraqi Central Football Federation.

1-5-2 Time Field: From May 24, 2024, to June 15, 2024.

1-5-3 Spatial Field: Northern Gas Club fields in Kirkuk.

3- Research Methodology and Procedures:**3-1 Research Method:**

The researcher employed an experimental method with a one-group pretest-posttest design.

3-2 Research Population:

The population consists of first-division field referees from the northern region (Kirkuk, Mosul, Erbil, Sulaymaniyah, Dohuk), totaling twenty-five referees, recognized by the Iraqi Central Football Federation.

3-3 Research Sample:

The researcher purposefully selected the sample of eight field referees from Kirkuk, representing 32% of the research population. The sample was standardized based on key variables (chronological age, refereeing experience, body mass, and height).

Table (1): Research Sample Homogeneity

Research Variables	Unit of Measurement	Mean	Standard Deviation	Mode	Skewness Coefficient
Age	Years	29	2.390	27	0.836
Refereeing Experience	Years	9	2.000	8	0.500
Body Mass	kg	69.125	7.140	62	0.997
Height	cm	175.500	7.874	170	0.635

3-4 Data Collection Methods:

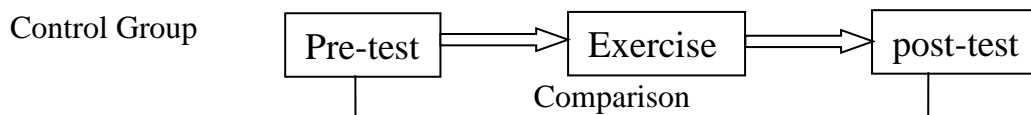
- Content analysis of Arabic and foreign sources.
- Forms for analyzing results.
- Internet resources.

3-5 Equipment and Tools Used:

- Football field.
- Three stopwatches.
- Measuring tape.
- Medical scale.
- Heart rate monitor (German-made).
- Two assistant referee flags.

3-6 Experimental Design:

The researcher used an experimental design with a particular group, employing pre- and post-testing, as illustrated in Figure (1).



3-7 Biomechanical Variables, Fatigue Index, and International Physical Fitness Tests:

After analyzing Arabic and foreign sources, the researcher selected the biomechanical variables and their tests, the fatigue index and its test, as well as the internationally recognized physical fitness test.

3-7-1 Transitional Speed Test for a Distance of 30 Meters²:

Test Name: 30-Meter Run

Purpose of the Test: To measure transitional speed.

Equipment: Stopwatch, whistle, two parallel lines marked thirty meters apart (with the first line as the start line and the second line as the finish line).

Performance Description:

The participant stands behind the starting line in a high start position. Upon hearing the whistle, the participant begins running at maximum speed until crossing the finish line.

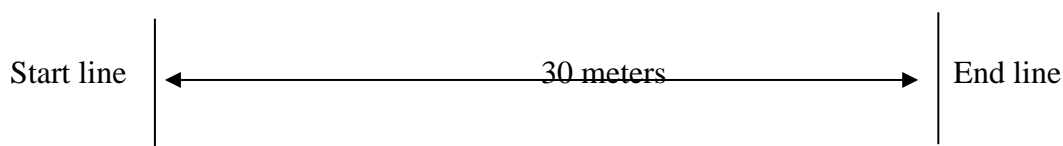
Recording Method:

The participant is allowed two attempts with adequate rest in between. The time taken to cover the distance from the start line to the finish line is recorded in seconds.

²- enstangsto, Magnimohr; **fitness in football** : (2014) p82.

Recording:

The best time achieved by the participant from the two attempts in covering the thirty meters is recorded. Figure (2) illustrates the test.

**3-7-2 Endurance (Mawtala):**

Objective of the Test: To measure general endurance³.

Equipment and Tools Used: Stopwatch, four markers shaped as squares with a side length of fifty meters.

Performance Description:

The participant takes a high start position behind the starting line. Upon receiving the start signal, the participant begins running around the square while ensuring not to touch or knock over the markers during the run.

Recording:

The time taken by the participant to complete five laps, equating to a total distance of 1000 meters, is recorded in minutes and seconds. Figure (3) illustrates the test.

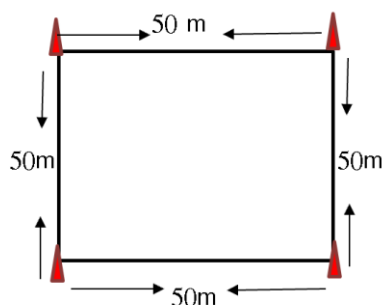


Figure (3): This illustrates the endurance test.

3-7-3 Speed Endurance⁴:

Objective of the Test: To measure speed endurance.

Equipment Used: Stopwatch, whistle, running track.

³ Maki Mahmoud Al-Rawi; **Some Physical Measurements and Their Relationship with Certain Elements of Physical Fitness Among Football Players:** (Unpublished Master's Thesis, College of Physical Education, University of Mosul, 1989) p. 48.

⁴ Mu'taz Younis Dhunun; **The Effect of Two Training Programs Using Compound Exercises and Play Exercises on Certain Physical and Skill Attributes in Football:** (Unpublished Doctoral Thesis, College of Physical Education, University of Mosul, 2001) p. 85.

Procedures:

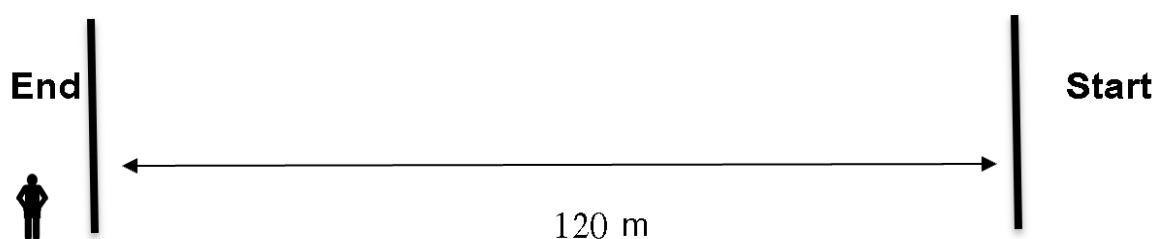
The participant assumes a high start position at the starting line.

Performance Method:

Upon receiving the start signal, the participant sprints at maximum speed over a distance of 120 meters.

Recording Method:

The time taken to complete the test is recorded to the nearest hundredth of a second. Figure (4) illustrates the test.

**3-7-4 Agility:**

Test Name: Shuttle Run (20 Meters)⁵.

Objective of the Test: To measure agility.

Equipment Used: Measuring tape, ten markers, stopwatch, whistle.

Performance Method:

The participant stands on the starting line, which is two meters away from the first marker. Upon hearing the whistle, the participant starts running, navigating through ten markers over twenty meters, with each marker spaced two meters apart. The importance of the markers lies in performing zigzag movements as the participant passes through them.

Recording Method:

The timer starts counting when the participant begins running and stops when the participant crosses the last marker. The time is rounded to the nearest tenth of a second, with one attempt allowed for each participant. Figure (5) illustrates the test.

⁵ **Risan Khreibat; Encyclopedia of Tests in Physical Education:** (Basra, College of Physical Education, 1999) p. 155.

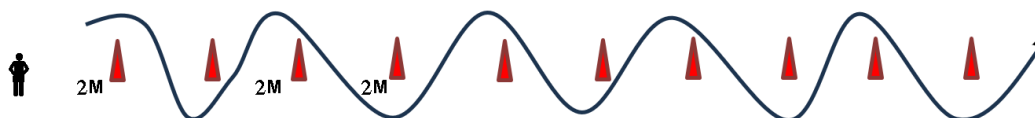


Figure (5): This illustrates the agility test (shuttle run between ten markers).

3-7-5 Fatigue Index Test (RAST):

Test Name: RAST Test.

Objective of the Test: To measure anaerobic capacity.

Equipment Used: Field, four stopwatches, electronic scale, two whistles for starting, pulse measurement device.

Performance Description:

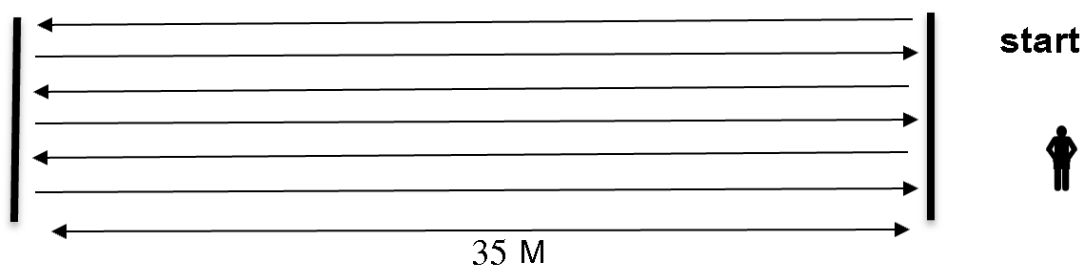
The participant performs six quick sprints over thirty-five meters, completing all sprints with a rest period of 10 seconds between each sprint. Figure (6) illustrates the test.

Recording Method:

The time taken to cover each 35-meter sprint is recorded in seconds and tenths of seconds. The anaerobic capacity for each repetition is calculated using the following formula:

Anaerobic Power Formula: Anaerobic Power (Watts) = (Weight × Distance²) / (Time³)

Average Anaerobic Power Formula: Average Anaerobic Power (Watts) = Sum of Values /



3-7-6 International Physical Fitness Tests for Field Referees⁶:

3-7-6-1 Speed Test: The test consists of running (40) meters, repeated (6) times for first-grade referees within a time of (6) seconds, with a rest period of (90) seconds between each repetition.

Test Objective: To measure speed.

⁶ International Physical Fitness Tests for Referees (International Rules for Referees).

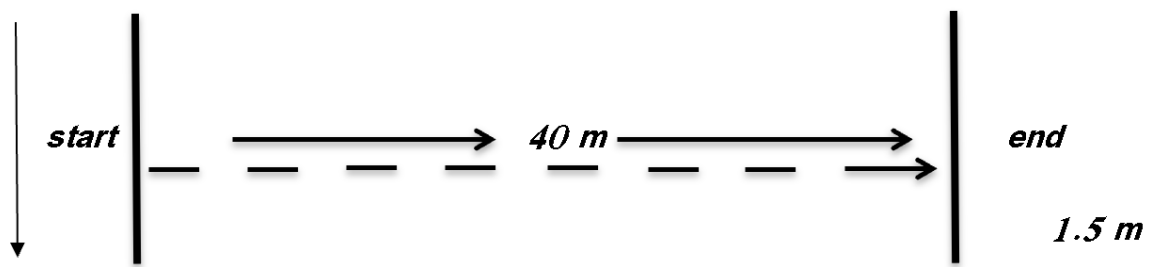


Figure (7) illustrates the 40-meter running test.

3-7-6-2 Speed Endurance Test (75 meters \times 40 repetitions):

The speed endurance test consists of running forty repetitions, equivalent to ten laps around the field, with the following timing:

- **First Division:** Run seventy-five meters in 15 seconds.
- **Rest:** 18 seconds between each repetition.

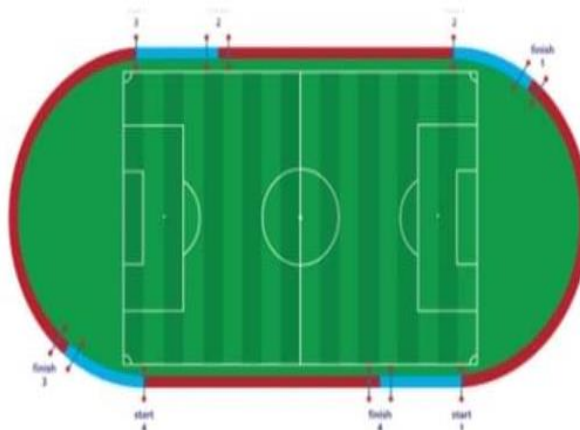


Figure (8) illustrates the speed endurance test (75 meters \times 40 repetitions) for first-division referees.

3-8 Exploratory Experiments:

For the researcher to achieve positive results by following the practical method of research procedures, it is essential to conduct the following exploratory experiments:

3-8-1 First Exploratory Experiment:

The researcher, in collaboration with the supporting team⁷, conducted the first exploratory experiment on Friday, 24/5/2024, at the Al-North Gas Sports Club fields at 5 PM, involving (4) second-division referees. The aim of this exploratory experiment was to:

- Identify difficulties that may occur in the prepared exercises.
- Assess the efficiency of the supporting team.

3-8-2 Second Exploratory Experiment:

The researcher, in collaboration with the supporting team, conducted the second exploratory experiment on Saturday, 25/5/2024, involving (4) second-division referees on the biomechanical tests and fatigue index. The aims of this experiment were to:

- Ensure the suitability of the tools and equipment used.
- Determine the time required for the tests.
- Assess the responsiveness of the subjects to the tests.

3-8-3 Third Exploratory Experiment:

The researcher, in collaboration with the supporting team, conducted the third exploratory experiment on (4) second-division referees on Sunday, 26/5/2024, at the Al-North Gas Club fields, focusing on the international physical fitness tests, specifically the 40-meter run (6 times) and the 75 meters × 40 repetitions speed endurance test. The aims of the tests were to:

- Determine the time taken for the tests.
- Assess the responsiveness of the subjects.
- Address any obstacles that arise during the tests.

3-9 Field Research Procedures:

3-9-1 Pre-Tests:

The researcher, with the assistance of the supporting team, conducted pre-tests on the research sample, which consisted of (8) first-division referees at the Al-North Gas Sports Club fields at 6 PM over the course of (3) days.

- **Tuesday, 28/5/2024**

⁷ **International Referee:** Amir Dawood Hassan

International Referee: Youssef Said

International Coach: Zahir Ali Murad (Track and Field)

International Coach: Ali Abdul Karim (Track and Field)

International Coach: Haitham Hafez (Track and Field)

- 1000m endurance test.
- Speed endurance test.
- Agility test (20 meters between ten markers).
- **Wednesday, 29/5/2024**
 - 30-meter run test.
 - Fatigue index test (RAST).
- **Thursday, 30/5/2024**
 - 40 meters × 6 repetitions run test.
 - 75 meters × 4 repetitions run test.

3-9-2 Main Experiment:

The sample of the research (8) first-division referees underwent the exercises prepared by the researcher to develop and enhance the biomechanical variables and fatigue index. The exercises were applied for a period of (6) weeks, totaling (36) training units for all days of the week except Friday. The training units began on Saturday, 1/6/2024, and ended on Thursday, 11/7/2024. The researcher supervised the exercises with the help of the supporting team. Below are some observations regarding the main experiment:

- The duration of the proposed exercises is (6) weeks.
- The number of weekly training units is (6) units, scheduled from Saturday to Thursday.
- The total number of training units is (36), see Appendix (1).
- Exercises were implemented during the specific preparation period.
- Low and high-intensity interval training methods and repetitive training methods were used.
- Rest intervals between repetitions and sets were considered.
- The intensity of exercises ranged from (65-75%) for low-intensity intervals, (80-90%) for high-intensity intervals, and (90-95%) for repetitive training methods.
- The weekly training load pattern was (1:3).
- Focus was placed on both aerobic and anaerobic systems in the exercises.
- The researcher provided physical exercises before starting the main experiment for a period of two weeks to prepare the subjects for the main experiment.

3-9-3 Post-Tests:

After completing the main experiment on 11/7/2024, the researcher, with the assistance of the supporting team, conducted post-tests at the Al-North Gas Sports Club at 6 PM over the course of (3) days.

- **Saturday, 13/7/2024**
 - 1000m endurance test.
 - Speed endurance test for a distance of 120m.
 - Agility test (20 meters between ten markers).
- **Sunday, 14/7/2024**
 - 30-meter run test.
 - Fatigue index test (RAST) 35m × 6 repetitions.
- **Monday, 15/7/2024**
 - 40 meters × 6 repetitions run test.
 - 75 meters × 4 repetitions run test with a rest of (25) meters.

3-10 Statistical Methods:

The results were obtained using the Statistical Package for Social Sciences (SPSS).

- Arithmetic mean.
- Standard deviation.
- Mode.
- Skewness coefficient.
- T-Test for related samples.

4- Presentation and Discussion of Results:**4-1 Presentation and Discussion of the Results of Pre-Test and Post-Test for the Biomechanical Variables of the Research Sample:**

Table (2) shows the means, standard deviations, t-values, and significance levels (sig) between the pre-test and post-test.

No	Unit	Pre-test	Post-test	T Value	Sig	Sig
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	Variab les		M	SD	M	SD			
1	Endura nce 1000 m	Mi n	4.288	.2840	3.791	.1580	6.729	.0000	Sig
2	speed enduran ce 120m	Se c	17.017	.3850	15.560	.3830	10.537	.0000	Sig
3	Speed 30m	Se c	4.282	.2470	3.825	.1330	6.689	.0000	Sig
4	Agility 20m markers 10m distance 2m	Se c	6.191	.2950	5.332	.2600	7.943	.0000	Sig

* Significant if the significance level (sig) > (0.05)

It is evident from Table (2) the results of the pre- and post-tests for the biomechanical variables (endurance, speed endurance, speed, agility), indicating significant differences between the pre-test and post-test results for the variable (endurance 1000m) in favor of the post-test. The researcher attributes the improvement in endurance to the exercises prepared by them, which enhanced the efficiency of the cardiovascular and respiratory systems, crucial for football referees. This allows referees to manage matches that can last up to (120) minutes when there are extra times to break the tie without a decline in their fitness level. Additionally, the researcher utilized low-intensity interval training methods, which are effective in improving endurance among referees, conducting endurance exercises twice a week, resulting in a positive impact on endurance. "Endurance requires a long time to develop, and it depends on the mastery of motor performance in a coordinated manner, and then the ability to conserve the effort needed for performance."⁸

It is evident from Table (2) that there are significant differences in the results of the pre-test and post-test for the variable (speed endurance 120m) in favor of the post-test. The researcher attributes the improvement in speed endurance to their use of varied exercises in the form of repetitions and sets, focusing on the rest intervals between repetitions and sets. This

⁸ Muatiz Younis Dhnoun, Rayan Abdul Razzaq; Fundamentals of Sports Training: (Mosul, Dar Ibn Al-Ather, 2013) p. 113.

helps the referee return the pulse to a nearly normal state quickly, especially since speed endurance exercises are performed at near-maximal intensities, requiring the referee to exert maximum speed to keep up with the movements of players and the ball in order to be in the best position to make accurate decisions. Furthermore, the researcher employed high-intensity interval training and repetitive training methods, which significantly contributed to increasing the load on referees. "The high-intensity interval training and repetitive training methods are considered the most suitable training approaches for developing speed endurance."⁹

Table (2) shows the results of the pre- and post-tests for the variable (30-meter speed), favoring the post-test. The researcher views speed as very important for referees to be able to keep up with the play, especially in matches where the teams' performance levels are close, leading to frequent attacks on the goals. This requires referees to utilize fast sprints over varying distances, sometimes ranging from 20 to 50 meters. The researcher attributes the improvement in the 30-meter speed variable to the referees' continuous training without interruption, as well as their application of principles of sports training science such as continuity, regularity, and progression. All these factors contributed to the enhancement of speed among referees.

The researcher also believes that the repetition training method played a significant role in the improvement observed in speed because this method has a high intensity that reaches 90-100%. Due to the high intensity of this method, complete rest is necessary to allow the body's various systems to recover and prepare for repeated exertion. "This method is considered one of the important approaches aimed at developing maximum strength, transitional speed, explosive strength, and speed-related strength within the anaerobic system."¹⁰

In addition, the researcher relied on scientific sources and principles of sports training in designing the training units and exercises used. The gradual increase in training loads through the exercises employed for adaptation among referees has a clear impact on speed development. The researcher also attributes the improvement in speed to the gradual increase in intensity during the training units. "Speed develops if appropriate and gradual intensity is used, in addition to using repetitions correctly and having suitable rest periods."¹¹

Table (2) shows the results of the pre- and post-tests for the agility variable (20 meters), favoring the post-test. The researcher believes that agility is very important for referees due to the frequent changes in direction during matches, whether for central referees or assistant referees. They need to change direction quickly to follow the movement of the ball and players to make correct decisions during the game. The researcher used varied exercises with different repetitions and sets, along with appropriate rests between the repetitions and sets. All these factors contributed to the development of agility in the research sample. Additionally, the use of targeted exercises and specialized methods during the special preparation period, which

⁹ Ali Bek et al.; *Athletic Rest*: (Alexandria, Dar Al-Maaref, 1994) p. 31.

¹⁰ Moez Younis Dhnoon, Rayan Abdul Razzaq; previously mentioned source, (2013) p. 113.

¹¹ Mohammed Tawfiq; *Handball – Learning – Training – Tactics*: (Kuwait, Dar Al-Salam Printing Press, 1994) p. 451.

align with the level of preparation for these physical variables, was essential. "In the special preparation phase, the focus is on developing specific muscle groups related to the abilities."¹²

4-2 Presentation of the Results of the Pre-Test and Post-Test and Discussion of the Fatigue Index for the Research Sample:

Table (3) shows the means, standard deviations, T-values, and significance levels (sig) between the pre-test and post-test.

No	Variables	Unit	Pre-test		Post-test		T Value	Sig	Sig
			M	SD	M	SD			
1	Fatigue index	Wa tt	52.568 0	26.59 0	515.12 5	12.26 4	6.897	.0000	Sig

It is evident from Table (3) that the results of the pre- and post-tests for the fatigue index favor the post-test. The researcher notes that in the game of football, the anaerobic system accounts for a higher percentage than the aerobic system, with the anaerobic system representing about 70% and the aerobic system about 30%. This is because football is a very fast-paced game. The researcher attributes the observed improvement to the application of training science principles in preparing exercises within the training units, particularly the principle of specificity—working according to the specific requirements of the game and focusing on energy production systems. Notably, anaerobic energy is fundamental in football, while the aerobic system is primarily relied upon to aid in recovery speed during matches when play intensity decreases, as well as between halves and after the game concludes.¹³

The use of high-intensity interval training and repetitive training methods played a significant role in improving the fatigue index among referees. These two methods are characterized by high intensity and appropriate rest periods, resulting in positive outcomes in the post-test for the fatigue index.

4-3 Presentation and Analysis of Pre-Test and Post-Test Results for Physical Fitness Tests:

Table (4) shows the means, standard deviations, t-values, and significance levels (sig) between the pre-test and post-test.

¹² Kazem Al-Rubaie, Muwafaq Al-Mawla; *Physical Preparation in Football* (Baghdad, House of Wisdom, 1988), p. 242.

¹³ Bahaa El-Din Ibrahim Salama; *Physiology of Sports and Physical Performance* (Cairo, Dar Al-Fikr Al-Arabi, 2000) p. 287.

No	Variables	Unit	Pre-test		Post-test		T Value	Sig	Sig
			M	SD	M	SD			
1	40 meters × 6 repetitions Speed endurance 75m	Sec	6.407	0.112	5.538	0.156	12.129	0.000	Sig
2	40 meters × 6 repetitions Speed endurance 75m	Rep	23.625	2.669	40,000	0,000	351.17	.0000	Sig

Table (4) shows the results of the pre and posttests for the 40-meter run (4 × 40 meters). The researcher attributes the observed improvement in speed to the use of various speed drills over different distances, starting from 30m, 35m, 45m, 50m, 55m, and 60m. This development is essential for referees to enhance their speed, allowing them to stay close to the ball and the play, thereby avoiding incorrect decisions due to being distant from the action.

International physical fitness tests require center referees to successfully complete the 40-meter run for six repetitions in a time not exceeding 6 seconds, with only a 90-second rest between repetitions.

Referees need an elevated level of speed, as mobility is considered one of the essential requirements for a referee when managing matches. During fast movements, referees may have to dodge players to reach the appropriate position for decision-making. Additionally, referees may need to initiate quick movements at the start of a match. The researcher believes that the exercises they designed emphasize speed and include various repetitions and sets with appropriate rest intervals, all contributing to the improvement of referees' transitional speed.

Furthermore, speed exercises are utilized at the beginning of the main section of the training unit. "It is preferable to start speed exercises immediately after warming up, especially in sessions aimed at developing more than one physical attribute."¹⁴

It is evident from Table (4) that there are significant differences between the pre-test and post-test results for speed endurance (75 meters) in favor of the post-test. The researcher attributes the development of speed endurance (75 meters) to the use of low and high-intensity interval training methods, where the running pace is constant. The variety of exercises used in the training units, along with varying distances and times, repetitions, and groups, as well as attention to rest intervals between repetitions and groups, all contributed to positive results in the post-test for judges covering a distance of (75) meters in (40) repetitions, totaling (4000) meters. The researcher also links the improvement in speed endurance to the progressive increase in intensity within the training units and running on the playing field. Speed endurance is a crucial variable for referees, especially since the International Federation relies on speed endurance tests (75 meters × 40 repetitions) as the minimum requirement for success in international tests for referees. This is based on running seventy-five meters in (15) seconds, with (18) seconds of rest for first-division referees and (20) seconds of rest for second- and third-division referees.

Furthermore, the proposed exercises developed by the researcher were structured around aerobic and anaerobic systems based on time, including repetitions and rest times, allowing referees to rebuild energy and eliminate waste. The high-intensity training method increases the referee's resistance to fatigue by utilizing energy sources during performance through the interplay between strength and relaxation, activity and recovery, and the storage and depletion of energy sources. These phenomena are the essence of interval training methods. "Reducing fatigue during training can lead to an increase in the training load (intensity, volume)."¹⁵

5- Conclusions and Recommendations:

5-1 Conclusions:

1. The proposed exercises based on both aerobic and anaerobic systems had a significant impact on the development of biomechanical variables (endurance, speed endurance, speed, and agility).
2. The proposed exercises based on both aerobic and anaerobic systems were effective for the fatigue index.

¹⁴ Mohammed Hassan Alawi; Sports Training: (Cairo, Dar Al-Fikr Al-Arabi, 1992) p. 159.

¹⁵ **Essam Abdelkhaleq; Sports Training – Theories and Applications, 1st Edition:** (Cairo, Dar Al-Fikr Al-Arabi, 1998) p. 222.

3. The training sessions prepared by the researcher positively impacted the middle referees in passing international physical fitness tests for speed ($6 \times 40\text{m}$) and speed endurance ($75\text{m} \times 40$ repetitions).
4. The training methods used by the researcher (low and high-intensity interval training and repetitive training) played a positive role in developing biomechanical capabilities, the fatigue index, and international physical fitness tests.
5. International physical fitness tests rely on both aerobic and anaerobic systems.

5-2 Recommendations:

- Exercises should be designed based on scientific principles and under the supervision of a specialist in physical fitness.
- There is a need to provide dedicated fields for referees.
- The exercises prepared by the researcher can benefit referees of other levels (international, second, and third).
- The exercises can also be utilized for female football referees across all levels (international, first, second, and third).

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Week One (First, Second, Third, Fourth, Fifth, and Sixth Training Units)

Day	Exercise and Duration	Repetition	Rest	Sets	Rest Between Sets	Total Exercise Time	Total rest Time	Total Exercise Time with rest	Intensity
Saturday	Run 12.30min	-	-	2		25min	5min	30min	65%
Sunday	Run 2min								
	Run 3min	-	-	1	2min	2min	4min		
	Run 4min	-	-	1	2min	3min	5min	30min	85%
	Run 5min	-	-	1	2min	4min	6min		
	Run 6min	-	-	1	2min	5min	7min		
Monday	Run 12 seconds	10	15s	2	5min	240s	9.30min	13.30min	85%
						4min			

Tuesday	run 25m in 4 seconds	4	1mi n	2	5min	32s	16min	16.32m in	85%
	run					402s		16.40m in	
	35m in 5 seconds					1.12mi n		32.12m in	
Wednesday	Run 13 min	-	-	2	5min	26min	5min	31min	85%
Thursday	Run 14 seconds	10	15s	2	5min	280s	9.30m in	14.10m in	85%
						4.40mi n			

Week Two (Training Units Seven, Eight, Nine, Ten, Eleven, and Twelve)

Day	Exercise and Duration	Repetition	Rest	Sets	Rest Between Sets	Total Exercise Time	Total rest Time	Total Exercise Time with rest	Intensity
Saturday	Run 15 minutes	-	-	2	5min	30min	5min	35min	70%
Sunday	Run 7min	-	-	1	3min	2min	25min	40min	90%
	Run 6min					3min			
	Run 5min					4min			
	Run 4min					5min			
	Run 3min					6min			

Monday	Run 16 seconds	10	15s	2	5min	320sec	9.30min	14.50min	90%
						5.20min			
Tuesday	Run 30m (5 seconds)	5	1min	2	5min	50s	18min	37.10min	90%
	Run 35m (6sec)	5	1min	2	5min	60s	18min		
Wednesday	Run 16 min	-	-	2	5min	32min	5min	37min	90%
Thursday	Run 18sec	10	15s	2	5min	360s	9.30min	15.30min	90%
						6min			

Week Three (Training Units Thirteen, Fourteen, Fifteen, Sixteen, Seventeen, and Eighteen)

Day	Exercise and Duration	Repetition	Rest	Sets	Rest Between Sets	Total Exercise Time	Total rest Time	Total Exercise Time with rest	Intensity
Saturday	Run 17 minutes	-	-	2	5min	34min	5min	39min	75%
Sunday	Run 3min	-	-	1	3min	25min	15min	40min	95%
	Run 4min	-	-	1	3min				
	Run 5min	-	-	1	3min				
	Run 5min	-	-	1	3min				

	Run 6min								
	Run 7min								
Monday	Run 20 seconds	12	15s	2	5min	480s 8min	15.30m in	23.30m in	90%
Tuesday	Run35 m (7s)	5	1mi n	2	5min	70s 1.10mi n	18min 18min	38.30m in	95%
	Run 60m (8s)	5	1mi n	2	5min	80s 1.20mi n	36min		
Wednesd ay	Run18 min	-	-	2	5min	36min	5min	41min	75%
Thursda y	Run22s ec	12	15s	2	5min	5.48mi n	15.30m in	21.18m in	95%

Week Four (Training Units Nineteen, Twenty, Twenty-One, Twenty-Two, Twenty-Three, and Twenty-Four)

Day	Exercise and Duration	Repetition	Rest	Sets	Rest Between Sets	Total Exercise Time	Total rest Time	Total Exercise Time with rest	Intensity
Saturday	Run 19min	-	-	2	6min	38min	6min	44min	70%
Sunday	Run 4min	-	-	1	3min	30min	15min	45min	90%
	Run	-	-	1	3min				
	Run 5min	-	-	1	3min				

	Run 6min Run 7min Run 8min	- -	- -	1 1	3min 3min				
Monday	Run 16 seconds	13	15s	2	5min	6.56min	16min	22.56min	90%
Tuesday	Run 45m (8 seconds) Running 55m (9s)	6 6	1min 1min	2 2	5min 5min	96s 1,36min 108s 1,48min 3,24min	15min 15min 30min	33.24min	90%
Wednesday	Run 20 minutes	-	-	2	6min	40min	6min	46min	70%
Thursday	Run 17s	13	15min	2	5min	7,22min	16min	23.22min	90%

Week Five (Training Units Twenty-Five, Twenty-Six, Twenty-Seven, Twenty-Eight, Twenty-Nine, and Thirty)

Day	Exercise and Duration	Repetition	Rest	Sets	Rest Between Sets	Total Exercise Time	Total rest Time	Total Exercise Time with rest	Intensity
Saturday	Run 21min	-	-	2	7min	42min	7	49min	75%

Sunday	Run 5min								
	Run 6min	-	-	1	3min				
	Run 7min	-	-	1	3min	35min	15min	50min	95%
	Run 8min	-	-	1	3min				
	Run 9min	-	-	1	3min				
Monday	Run 18 seconds	14	15s	2	5min	8.24min	16.30min	24.54min	95%
Tuesday	Run 50m (8 seconds)	5	1min	2	5min	80s	18min	38.50min	95%
						1.20min			
	Running 55m (9s)	5	1min	2	5min	90	36min		
						1.30min			
Wednesday	Run 10min	-	-	3	6min	30min	18min	48min	95%
Wednesday	Run 19s	14	15s	2	5min	8.52min	16.30min	25.32min	95%

Week Six (Training Units Thirty-One, Thirty-Two, Thirty-Three, Thirty-Four, Thirty-Five, and Thirty-Six)

Day	Exercise and Duration	Repetition	Rest	Sets	Rest Between Sets	Total Exercise Time	Total rest Time	Total Exercise Time with rest	Intensity
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Saturday	Run 11 minutes	-	-	3	7min	33min	18min	51min	75%
Sunday	Run 9min								
	Run 8min	-	-	1	3min				
	Run 7min	-	-	1	3min	35min	15min	50min	95%
	Run 6min	-	-	1	3min				
	Run 5min	-	-	1	3min				
Monday	Run 18 seconds	14	15s	2	5min	8.24min	16.30min	24.54min	95%
Tuesday	Run 60m (9s)	5	1min	2	5min	90s	18min	39.10min	95%
	Run 65m (10 seconds)	5	1min	2	5min	1.30min	18min		
						100s			
						1.40min	36min		
Wednesday	Run 12 min	-	-	3	6min	36min	18min	54min	75%
Thursday	Run 16s	15	15s	2	5min	8min	17min	25min	95%