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The effect of the method of combining running and plyometric exercises with suggested circuits to developing speed endurance, strength endurance, and achieving of 1500 m under 20 years

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Abstract

The researcher's approach include including running and plyometric exercises into advised training cycles. With the support of this strategy, the central nervous system will be able to activate fast fibers in very acidic conditions, enhancing speed and strength endurance and ultimately performance. The study's objective was to examine the effects of combining running and plyometric exercises with suggested circuits on the development of speed endurance, strength endurance, and the capacity to run the 1500 m in less than 20 years. The experimental design of the research involved two equal groups (the control and experimental groups), a pre-test, and a post-test. For the 1500 m race, 16 runners under the age of 20 from the governorates of the Middle Euphrates (Karbala, Babil, Najaf, and Diwaniyah) and the capital, Baghdad, made up the research population. For his study, the researcher selected a sample of 10. The runners were chosen at random. Accordingly, 62.5% of the research population was represented by the sample. The sample was similarly split into two groups, control and experimental, with five runners in each group.

The researcher reached the following important conclusion: The exercises he designed and executed using a combination of running and plyometric exercises helped develop the central nervous system's effectiveness in mobilizing the greatest number of fast-twitch fibers under highly acidic conditions, which significantly aided in the development of speed endurance, strength endurance, and achievement among participants in the experimental research sample. The expert advised taking into account studies and research that demonstrate the strong relationship between the central nervous system and endurance.

Keywords: Combining running, plyometric exercises, speed endurance, strength endurance

1. Introduction

The 1500-meter run is one sporting event where there is tension, excitement, and competitiveness among runners. In particular, the central nervous system, which is codependently dependent on the physical capacities of special endurance (speed, strength, and performance endurance), as well as on energy production using the mixed system (the lactic anaerobic system and the aerobic system), is heavily burdened by the specificity of this event due to the increased accumulation of lactate during competition. Performance is affected by a variety of physiological processes that are linked to the nervous system's ability to coordinate and control the functioning of the body's systems and organs.

The main factor in improving the nervous system's ability to mobilize fast-twitch muscle fibers during high lactate accumulation in the muscles, as well as the ability of these fibers to produce the energy they require by removing lactate and breaking it down during intense training and competition, is thought to be the development of the athlete's capacity to accept and deal with lactate accumulation. This is a strong sign of how well the body's systems and organs work.

The goal of the method of combining running and plyometric exercises with suggested circuits is to develop the ability of the central nervous system to mobilize fast fibers under strong acidic conditions, which contributes to developing speed endurance and strength endurance, which in turn is reflected in improved performance.

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Hence the importance of research into preparing exercises that include running on hills and on flat ground in addition to jumping exercises, and performing them interchangeably to develop speed endurance and strength endurance and achieving 1500 meters under 20 years of age, as the researcher believes that these exercises have a major role in developing these variables and thus improving achievement.

1.1 Research Problem

During his follow-up and fieldwork, the researcher-who for many years served as a trainer in this area-found a discernible reduction in performance. Because this exercise intensively uses the lactic acid system, he blames the lack of training on the nervous system's inability to operate under situations of lactate buildup. The researcher arrived at this conclusion after conducting several in-depth interviews with the coaches and maintaining continual communication with numerous runners that specialize in this field. The researcher decided to prepare exercises and implement them in a new and innovative way after observing that many of the coaches of this event place a lot of emphasis on exercises that target the circulatory and respiratory systems and use training methods that are directed to a specific physical characteristic or ability without taking into account the combination of exercises that are specifically designed to develop the effectiveness of the nervous system under challenging circumstances.

1.2 Research objective

1. Preparing exercises in the style of combining running and plyometric exercises with suggested circuits to develop speed endurance and strength endurance and achieving the 1500 m under 20 years.
2. Identifying the effect of the method of combining running and plyometric exercises with suggested circuits in developing speed endurance and strength endurance and achieving the 1500 m under 20 years.
3. Identify the differences between the two groups in developing the research variables under study.

1.3 Research hypotheses

1. The method of combining running and plyometric exercises with suggested circuits has a positive effect in developing speed endurance and strength endurance and achieving the 1500 m under 20 years.
2. The advantage of the experimental group over the control group in developing the research variables studied.

1.4 Research fields

1.4.1 Human field: Middle-distance runners (1500 meters) under 20 years old in the clubs of the Middle Euphrates and the capital, Baghdad.

1.4.2 Time field: From 1/1/2023 to 20/5/2023.

1.4.3 Spatial field: Kerbala Olympic Stadium, Al-Hashimiya District Stadium, Najaf Stadium, Ministry of Youth Stadium, Baghdad, Al-Jabal area in Babil Governorate.

2. Research methodology and field procedures

2.1 Research methodology

The researcher used an experimental design with two equal groups, control and experimental, and a pre- and post-test.

2.2 The research community and its sample

For the 1500 m race, the study community included 16 under-20-year-old runners from the Middle Euphrates governorates of Karbala, Babil, Najaf, and Diwaniyah as well as Baghdad. Accordingly, the sample made up 62.5 percent of the research population. The researcher randomly selected a sample of 10 runners for his study. The sample was similarly split into two groups, control and experimental, with five runners in each group.

The researcher used the variables of height, mass, and training age to homogenize the research sample's participants. then statistically analyzed the data using the skewness coefficient and the coefficient of variation by extracting the arithmetic means, standard deviations, and medians for the aforementioned variables, as shown in table (1).

Table 1: Shows the homogeneity of the individuals in the research sample:

Variables	Measruing unit	Mean	Std. Deviation	Median	Skew ness	Coefficient Variation
Length	Cm	175.600	4.222	176.000	-0.284	2.404
Mass	Kg	61.600	5.103	60.000	0.941	8.284
Age	Year	87.600	11.207	84.500	0.830	12.800

It is clear from Table (1) that all values of the skewness coefficient were less than (+ 1) and the coefficient of variation was less than (30), which indicates the homogeneity of the sample.

2.3 Methods, devices and tools used in the research

- Note
- personal interview
- Questionnaire
- Testing and measurement
- Chinese medical scale
- SONY camera, Japanese type
- Electronic calculator (ACER) (1)
- strength measurement platform
- A leather tape measuring length of 2 m.
- A metal distance measuring tape, 50 meters long.
- Stopwatch (4), Chinese type.
- Cones, 30 cm high, number (7).

2.4 Field research procedures

2.4.1 Determine the candidate tests for the variables

2.4.1.1 Determine the test for measuring speed endurance

One of the Kosmin tests was specified to measure speed endurance, which is a 1 minute x 4 test (rest 3, 2, 1), and the distance traveled is calculated for every 1 minute.

2.4.1.2 Determine the test for measuring strength endurance

After reviewing scientific sources, theses, and dissertations, the 60-second bosco test was chosen to measure strength endurance.

2.4.2 Test description

2.4.2.1 First: Kosmin test

2.4.2.2 The purpose of the test: To measure speed endurance.

2.4.2.3 Test requirements: Playground - Stopwatch - Whistle - Metal distance measuring tape 50m long - Cones - Registration form - Recorder - Timer - Absolute.

2.4.2.4 Description of the performance test: Tempo 1 minute When the trigger signal is received, the test starts from the high starting point, and the two runners begin running for a complete minute. The two runners halt and are granted a 3-minute break when the timer whistle is blown. When the assistant work team blows the whistle, a mark is simultaneously put at the end of each runner, and the distance he has traveled is calculated. Following the conclusion of the rest period, each runner is scored. The runners then set off when the shooter signals them to do so. The markings are raised when the runners have completed a full minute of running from the same starting point. The timer blasts a whistle when the minute is up. The runners halt and are given a two-minute break. The spot where each runner finishes at the sound of the whistle is also marked. Calculated and noted is the distance traveled. The two runners begin running the third (minute) repetition from the same starting line when the rest period is through, and the markings are raised. The timer blasts a whistle at the conclusion of the allotted one minute. When the whistle is blown, the two runners halt, and a mark is put at the end of each runner. Following a one-minute break, the distance is determined. Following the recording of each runner's performance, the two athletes begin the fourth and final repeat. Additionally, when the whistle is blown, the two runners halt, a mark is put at their finish line, and the distance is measured and recorded.

2.4.2.5 Registration: Every distance covered by the runner in each repetition is recorded on a special form prepared by the researcher.

2.4.2.6 Second: Bosco test, time 60 seconds

2.4.2.7 The purpose of the test: To measure strength endurance.

2.4.2.8 Test requirements: strength measuring platform - computer - whistle - stopwatch.

2.4.2.9 Description of the test: Test consists of jumping on the strength measurement platform for 60 seconds. After completing the warm-up requirements well, the test begins where the tester stands on the strength measurement platform and places his hands on the waist (waist position). When he is ready for the test, the timer sounds a whistle to begin the test. The tester jumps up from the half-squat position and continues jumping until the 60 seconds are completed, after which the timer blows the stop whistle, and in the same way all members of the research sample complete it, clarifying the nature of the test performance.

2.4.2.10 Registration: Data is recorded using a computer, and the data is taken and processed using the Excel program.

2.4.3 Pre-tests

Before starting to implement the exercises prepared by the researcher, he conducted pre-tests for the research sample members over the course of two days, with an interval of one day between one test and another. These are tests of speed endurance, strength endurance, and a 1500 m running test. All tests were conducted at the olympic Stadium in Kerbala, with the exception of the endurance test. Strength was conducted at the University of Babylon/College of Physical Education and Sports Sciences on the strength platform. The researcher worked to establish all the conditions related to the tests, such as the place, the method of implementing the tests, as well as the assistant work team, in order to work on unifying the same conditions when conducting the post-test, and the distribution of the tests was on the first day: Sunday 15/1/2023 AM)) Test strength endurance, PM, speed endurance test, and on the second day, Tuesday: AM, 17/1/2023, a 1500m running test.

2.4.4 Equivalence procedures

The researcher conducted the process of equivalence between the two groups with the research variables analyzed, between the control and experimental groups, using the parametric statistical law (t test) for two independent samples of equal size with the results of the measurements and pre-tests, as shown in table (2).

Table 2: Shows the equality of the control and experimental groups with regard to the variables studied:

Variables	Measurement units	Control group		Experimental group		t value calculated	sig level	sig type
		Mean	Std. Deviation	Mean	Std. Deviation			
speed endurance	M	1575.000	18.371	1588.000	11.511	-1.341	0.217	Non sig
strength endurance	Newton	2129.800	24.407	2177.400	85.894	-1.192	0.267	Non sig
achieving of 1500 m	second	245.400	2.881	243.200	2.588	1.270	0.240	Non sig

The tabular value is at 0.05 level of significance and 8 degrees of freedom, or 2.306, of freedom.

Table (2) makes it evident that all estimated t values are lower than the tabulated values at the significance level (0.05), proving that there are no significant differences in the variables (under study) between the control and experimental groups, proving their equality.

2.4.5 The main experiment

The researcher prepared the exercises using a method that combines running and plyometric exercises, to develop the research variables studied. The exercises were distinguished by the following:

- On Sunday, January 22, 2023, members of the experimental group began implementing the exercises included in their training program. The implementation

of the exercises lasted for a total of (12) weeks, with two units per week.

- As for the training methods, the researcher used the continuous training method to implement the style exercises combining running and plyometric exercises within the circuit, and the interval training method between the circuits.
- The exercises were designed in a combined manner with three different circuits. The first circuit included hill training exercises with plyometric exercises. The training location was on a hill in Babil Governorate. The first circuit was applied at the end of the basic period and the first week of the special preparation period. As for the second hill training circuit, it was applied from The beginning of the second week until the end of the experiment.

- The third circuit included exercises on the playing field, in the same way as the first circuit was designed, as the circuit consisted of running and plyometric exercises. This circuit was applied from the beginning of the experiment and continued until its end.
- On Sunday, April 23, 2023, the execution of the training program's exercises came to a conclusion.

2.4.6 Post-tests

The researcher committed to providing the same conditions and requirements for the post-tests on the research sample for the control and experimental groups after completing the application of the exercises to the experimental group for the days (Tuesday, Thursday) corresponding to (25-27/4/2023). In terms of the pre-testing's schedule, setting, and tools

Table 3: Shows the arithmetic mean, standard deviation, mean of the differences, standard deviation of the differences, calculated T value, and statistical significance for the experimental group's pre- and post-tests on the variables of speed endurance, strength endurance, and achievement.

Variables	Control group		Experimental group		Mean Differences	Std. Deviation Differences	t value calculated	Sig level	Sig type
	Mean	Std. Deviation	Mean	Std. Deviation					
speed endurance	1588.000	11.511	1626.000	23.022	-38.000	7.000	-5.429	0.006	Sig
strength endurance	2177.400	85.894	2334.800	50.919	-157.400	21.533	-7.310	0.002	Sig
achieving of 1500 m	243.200	2.588	237.000	2.915	6.200	0.735	8.437	0.001	Sig

A degree of freedom of (4) equals (2.776) and a significance level of (0.05) are used for the tabular value.

Table (3) displays the statistical results for the pre- and post-tests for the achievement variables—speed endurance and strength endurance—that the participants in the experimental group undertook. The significance levels were calculated using the statistical rule (T) for correlated samples. The levels of significance suggested this if the findings revealed that the arithmetic mean values were higher in the post-test and

Table 4: Shows the Presentation and analysis of the results of the pre- and post-tests for the variables (speed endurance, strength endurance, and achievement) for the control group:

Variables	Control group		Experimental group		Mean Differences	Std. Deviation Differences	t value calculated	Sig level	Sig type
	Mean	Std. Deviation	Mean	Std. Deviation					
speed endurance	1575.000	18.372	1588.000	10.368	-13.000	3.742	-3.474	0.025	Sig
strength endurance	2129.800	24.407	2228.400	28.711	-98.600	14.834	-6.647	0.003	Sig
achieving of 1500 m	245.400	2.881	242.400	2.408	3.000	0.316	9.487	0.001	Sig

The tabular value is at a significance level of (0.05) and a degree of freedom (4) = (2.776)

The statistical findings for the pre- and post-tests for the variables of speed endurance, strength endurance, and accomplishment that the participants in the control group underwent are shown in Table (4). The statistical law (T) for correlated samples was used to determine the levels of significance. If the results showed that the arithmetic mean values were higher in the post-test and in accordance with the measurement levels of the aforementioned variables, this is what the levels of significance indicated. All of these variables were less than the level of significance (0.05), which indicates the presence of significant differences between the two tests and in favor of the post-tests.

3.1.3 Discussing the results of the pre- and post-tests for the variables of speed endurance, strength endurance, and achievement for the experimental and control groups:-

From Tables 3 and 4, it is evident that there are substantial changes between the pre- and post-tests for the two groups (experimental and control) and in favor of the post-test for the variables of speed endurance, strength endurance, and

2.5 Statistical methods

- Mean.
- Std. Deviation.
- Skew ness.
- Median.
- Coefficient of Variation.
- T. Test for independent and symmetrical samples.

3. Presentation, analysis and discussion of the results:-

3.1 Presenting and analyzing the results of the pre- and post-tests for the variables of speed endurance, strength endurance, and achievement for the experimental and control groups and discussing them:-

3.1.1 Presentation and analysis of the results of the pre- and post-tests for the variables (speed endurance, strength endurance, and achievement) for the experimental group:-

consistent with the measurement levels of the aforementioned variables. The threshold of significance (0.05) for all of these variables was lower, indicating that there were significant differences between the two tests and in favor of the post-tests.

3.1.2 Presentation and analysis of the results of the pre- and post-tests for the variables (speed endurance, strength endurance, and achievement) for the control group:

accomplishment. According to (Ahmed Youssef), the researcher credits the major differences between the two groups to the efficiency of the training curriculum that members of the two groups created and implemented as well as to sound planning: "Planning is regarded as one of the predictive techniques that relies on several studies of reality, taking into account experiences, the available capacities and talents, and what may be accomplished to reach a particular objective. It is training athletes to realize their best potential, and this is in agreement with (Gamal Sabry): "Correct training planning is to enable the athlete to achieve the highest level of physical, motor, skill, and psychological readiness to use during competition and to maintain this level for the longest period through training," according to the American College of Sports Medicine. They underwent a variety of exercises designed to improve their speed endurance and strength endurance as well as other physical qualities and abilities relevant to the event, which in turn was reflected in the development of achievement, according to the organizer, the researcher's field observations of the control sample members during the experiment period, and ongoing communication with their trainers. The workouts had a significant effect on

developing these characteristics since they were also defined by the proper scientific standards in terms of intensity, comfort, and volume. Muhammad Mahmoud states that "codified and organized training programs that are based on scientific principles help to improve the players' physical and skill level".

As for the experimental group, the researcher, in agreement with the trainers, was keen to ensure that the other training days had uniform objectives for all members of the sample and to take into account the principle of fluctuation, especially after performing the experimental exercises, due to the difficulty of implementing these exercises and the degree of fatigue occurring after completing the exercises. The researcher's exercises were characterized by With the diversity between training periods, as well as the change in intensity, volume, and rest between one circuit and another, as (Majed Ali) stressed, "In order to achieve the duties of the training program or training circuit in a way that is consistent with the goals of training at each of its stages, the relationship between the degree of load and the rest period must be taken into account when forming or Sequence of training load amounts in training units and weekly circuits, up to monthly and then yearly. As the adaptation process requires training with high degrees of load, it is not possible to continue using the same high load every day because that leads to a drop in the level and the appearance of symptoms of overload ", The

exercises also included hill exercises, which were highly effective for development, as These exercises have a specificity and have been given in a manner directed towards many goals, including speed endurance and strength endurance. This is what Hussein Ali and Amer Fakher pointed out, saying: "Running on hills is one of the important methods for medium and long distance runners, as it depends on changing speeds due to the nature of the ground." The speed decreases and the effort increases when climbing to the top of the hill, as the muscles work against gravity, the speed increases and the effort decreases, as the muscles work with gravity.

Sports training is an organized and ongoing process that aims to improve athletes' levels and help them reach the highest levels, as confirmed by (Edington and Edgerton), and the researcher claims that the improvement in the post-tests for both groups can be attributed to this. Organized training improves a person's performance capacity by imprinting the body's systems to operate well for certain tasks throughout the course of doing physical exercises for many days, weeks, or months.

3.2 Presentation and analysis of the results of the post-tests for the variables of speed endurance, strength endurance, and achievement for the experimental and control groups and their discussion:

Table 5: Shows the values of the arithmetic means, deviations, and the calculated (T) value and their statistical significance for the post-tests of the research variables under study for the control and experimental groups.

Variables	Control group		Experimental group		t value calculated	Sig level	Sig type
	Mean	Std. Deviation	Mean	Std. Deviation			
speed endurance	1588.000	10.368	1626.000	23.022	-3.365	0.010	Sig
strength endurance	2228.400	28.711	2334.800	50.919	-4.070	0.004	Sig
achieving of 1500 m	242.400	2.408	237.000	2.915	3.193	0.013	Sig

The tabular value is at a significance level of (0.05) and a degree of freedom of $8 = 2.306$

The achievement of the participants in the control and experimental groups is shown in Table (5) along with statistical indications of the outcomes of the post-tests for the speed endurance and strength endurance variables. The speed endurance variable deals with the unit of distance, thus the larger the distance, the better the level, if the findings revealed that the arithmetic mean values for the speed endurance and strength endurance variables were greater for the experimental group than the control group. Regarding strength endurance, newtons are the unit of measurement. The level improves with increasing value. The findings also revealed that the achievement variable's arithmetic mean value was lower for the experimental group than for the control group. This is because the achievement variable has an inverse value, meaning that the lower the arithmetic mean, the higher the level because it measures the time factor. As all variables were less than (0.05), which shows the presence of significant differences between the two groups and favors the experiment, the significance levels using the statistical law (T) for independent samples revealed this.

4. Discussing

It is evident from the researcher's presentation and analysis of the results that the experimental group performed significantly better on the post-tests than the control group did for the variables achievement, strength endurance, and speed endurance. The high level of speed endurance and strength endurance are related, as are the muscles' capacity to accept

lactate and tolerate fatigue and the effectiveness of the central nervous system's work, the latter of which is responsible for the majority of performance regulation and fatigue resistance during training and competition, as stated by (Saleh Shafi): "Only when the central nervous system and the cardiovascular system have reached peak efficiency is special endurance (endurance of speed and endurance of strength) complete". The ability of the runner to cover a race distance quickly despite the buildup of lactate in his muscles and blood, which helps to develop time, emphasizes the significance of these two abilities. Speed endurance expresses the reciprocal relationship between the characteristics of speed and endurance, while strength endurance expresses the relationship between endurance and strength. Success, and Renato Canova noted this: "Every event is a speed event since the victor is always the athlete who is the fastest at the finish line. However, the majority of training is strength-endurance training, in which endurance training focuses on maintaining the same pace over the entirety of a competition's distance and strength training measures the speed that each athlete can sustain for around 3/4 of the distance. For 1500m runners, both speed endurance and strength endurance are crucial. As Essam El-Din Abdel Khaleq stated, "These two talents are the most crucial conditions for obtaining middle-distance running since they define the degree of athletic performance.

The exercises prepared by the researcher had the greatest role in developing the speed endurance and strength endurance variables, which in turn was reflected in the development of achievement and the emergence of significant differences for these variables in favor of the experimental group. The

exercises included some hill running exercises, as we mentioned previously, and as is known, hill training is a special form. It is a form of muscle strength training and has many benefits for endurance runners, as it helps develop local muscle endurance and accepts lactate within the muscle fibers and thus helps develop the athlete's ability to withstand the accumulation of lactate. In addition to improving running technique, these things helped develop speed endurance and strength endurance, and this is what Tulloh pointed out: (Hill training has multiple benefits, including: developing lactate endurance, improving strength endurance, developing stride length and frequency, as well as developing compatibility and encouraging use. The correct movement of the arm and foot during the driving phase as well as the pivoting phase. Hill training also helps to develop neuromuscular coordination, running economy, resistance to fatigue, muscular endurance, and anaerobic capacity, and running down hills helps to delay the onset of muscle pain, and this is confirmed by (Jamal Sabry) that hill training (is a very special type From muscle strength training, by increasing muscle strength we can develop the economy of running, and this reduces the energy cost by running at a speed less than the maximum, which leads to developments in the lactic threshold speed and increases the resistance to fatigue in the muscles. Also, running down hills includes eccentric load, especially on the quadriceps muscle, which contracts to prevent the knees from twisting when leaning backwards. Excitations by bending the knees and extending the quads cause microscopic injury to the muscle fibers, and this injury can lead to an unlimited delay in the onset of muscle pain (DOMS).

The combination of running and plyometric exercises in the circuits prepared by the researcher also contained some running technique exercises or what are called (rhythmic plyometric exercises), as these exercises contribute to improving the movements of the arms and legs because they are similar to the running movement, such as raising the knees and striking the hip with the heels. With the heels, in addition to the fact that these exercises are performed under conditions of fatigue, which helped improve neuromuscular coordination, which in turn was reflected in the development of speed endurance and strength endurance, and thus achievement, and this is what was confirmed by Arthur Lydiard) "The running technique is very important, as the position of the body and the work of the arms and legs are important". Once the basics of the correct technique are achieved in proportion to the nature of the event, we can develop endurance and strength to obtain the best results from the athlete. The modified training circuits also included rapid and explosive plyometric exercises, as these exercises helped improve the efficiency of the central nervous system by increasing the mobilization of the working motor units. And improving the efficiency of fast muscle fibers for anaerobic work, as well as controlling the rate of strength production, and this is what Gamal Sabry pointed out. Plyometric exercises work; by increasing the number of working motor units, increasing the efficiency of fast twitch fibers, thus improving anoxic work and working to improve the efficiency of the rate of strength production.

Through what was mentioned, it became clear the importance of combining running and plyometric exercises from which the proposed circuits were composed, and the role of each of them in developing the research variables studied. The main and important axis in the emergence of significant differences in favor of the members of the experimental group remains the method in which the exercises were implemented. The

proposed method is considered It is a modern training method, and unique in that it has never been used before in the field of athletics at the country level, which helped to develop the athletic level of the experimental group members, as modern and new methods help to develop the level of achievement to a great extent, and this is what (Raysan Khuraibet) pointed out: "The group of exercises or directed physical efforts leads to adaptation or functional change in the organs." The internal body, which helps to achieve a high level of athletic achievement, the main goal in this type of training methods, as we mentioned previously, is to develop the ability of the central nervous system to mobilize the largest possible number of muscle fibers, when lactate levels in the muscles increase and the state of fatigue increases after performing running exercises except on the hill circuit or the stadium circuit., so that the runner can use his strength and speed in the most difficult and harsh conditions, this was confirmed by Renato Canova (both running and strength exercises must be performed with high intensity, in order to quickly reach a high level of lactate, and our goal is to use the remaining strength in the worst conditions, as can happen during the last part of the race, and through this type of training we want to build the ability of the nervous system to mobilize a large number of fibers when the level of saturation of the muscles with lactate is very high, and from our experience, this training is one of the most important special exercises for improving the final sprint. In racing), therefore, the method of combining running and plyometric exercises specifically targeted the nervous system. The more the nervous system has a high ability to work under extreme fatigue, the greater its ability to resist fatigue. Which in turn affects the development of strength endurance and speed endurance because these two abilities are directly linked to the nervous system and thus improve achievement, as (Abu Al-Ala and Ahmed Nasr El-Din) confirmed that strength endurance "is the ability of the nervous system to overcome a certain resistance for the longest possible period in the face of fatigue." As for speed endurance, Gamal Sabry points out that speed endurance "is the ability to maintain speed in the presence of fatigue without decreasing that speed. As is known, what is responsible for speed is the central nervous system". From this standpoint, a fact becomes clear that cannot be ignored, which is the major role that the nervous system plays in developing endurance activities, including middle-distance running. This is what Philip Maffetone confirmed that endurance means (the ability of the nervous system to perform work and maintain it over time, cardiovascular capacity is merely a means by which we enhance this ability to maintain work. There are many studies and research that indicate the control of the central nervous system over endurance activities. Researchers from Finland have verified that they confirmed in their research the following conclusion: (Long-term training duration in endurance competitions will cause effects in the central nervous system to program muscle alignment according to the demands of that sport, and the researcher confirms that the exercises that he prepared and were implemented using the combined method had a significant impact on developing the efficiency of the nervous system, which in turn was reflected in the development of all the studied research variables due to the connection of these variables with the nervous system, as indicated by the sources and scientific studies that we mentioned previously, and this is what distinguished them. The experimental group differed from the control group, as the control group did not use these exercises, and if they used

some of them, the manner in which the experimental group implemented the exercises still had a significant impact on developing the research variables.

5. Conclusions and recommendations

5.1 Conclusions

1. The exercises prepared by the researcher and implemented using a method of combining running and plyometric exercises helped develop the efficiency of the central nervous system in mobilizing the largest possible number of fast-twitch fibers in strong acidic conditions, which was reflected in the development of speed endurance and strength endurance, which in turn was reflected in improving performance. Among the members of the experimental research sample.
2. The training method was new to the members of the research sample, which contributed positively to the development of the research variables.

5.2 Recommendations

1. The researcher recommends paying attention to aspects of training by applying modern methods, and diversifying exercises and training locations, to break the monotony that affects the extent of athletes' response to training.
2. Taking into account research and studies that confirm the strong relationship between the central nervous system and endurance.

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Appendix

Shows examples of exercises prepared using the modified circular method in different training units

Training unit number: (1) Day and date: Tuesday 24/1/2023

Total time: 78 minutes. Warm-up: 35 minutes. Main: 33 minutes. Cool-down: 10 minutes

N	Exercises	Intensity	Exercise time second	Circle time (minute)	Circles Number	Rest between circles
1	Run 300m uphill	85	61	7	3	6
2	10 forward jumps and half squats	85	20			
3	Run 60m fast climb	100	10			
4	Skip with short steps for 20 metres	90	30			
5	Run 300m downhill	105	50			
6	Hit the hip with the heels for a distance of 30 metres	90	35			
7	Run 200m uphill	90	39			
8	20 repetitions of right/left lunges	85	30			
9	Run 200m uphill	90	39			
10	30 hopscotch right/left	90	30			
11	Run 500m downhill	115	76			

Training unit number: (4) Day and date: Thursday 2/2/2023
Total time: 70 minutes. Warm-up: 35 minutes. Main: 25

minutes. Cool-down: 10 minutes

N	Exercises	Intensity	Exercise time second	Circle time (minute)	Circles Number	Rest between circles
1	Ran 200m	100	35	5	3	5
2	Bounding run, 50 meters	80	15			
3	Ran 200m	100	35			
4	10 forward jumps and half squats	90	10			
5	Ran 200m	100	35			
6	Skipping for a distance of 50 metres	85	20			
7	Ran 200m	100	35			
8	Hit heels with your hips for a distance of 50 metres	85	25			
9	Ran 200m	100	35			
10	Lunge 20 repetitions right/left	80	25			
11	Ran 200m	115	30			

Training unit number: (17) Day and date: Saturday 25/3/2023 minutes. Cool-down: 10 minutes
 Total time: 103 minutes. Warm-up: 35 minutes. Main: 58

N	Exercises	Intensity	Exercise time second	Circle time (minute)	Circles Number	Rest between circles
1	Run 300m uphill	90	58	6	5	7
2	Bounding, 80m running, 40m ascent, 40m descent	90	25			
3	Run 200m fast climb	95	36			
4	Skipping with long strides for a distance of 100 metres	80	50			
5	Run 100m fast climb	105	16			
6	10 jumps from a half squat position	85	16			
7	Run 200m downhill	105	33			
8	Skipping 80m, 40m climb, 40m descent	85	40			
9	Run 100m fast climb	105	16			
10	Bounding, running, 80m, 40m ascent, 40m descent, fast	90	25			
11	Run 300m downhill	115	45			