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## The effect of various resistance exercises on developing some physical and functional abilities of 100 m runners

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### Abstract

Resistance exercises are an effective tool in improving athletic performance by enhancing strength, speed, and endurance, which are crucial elements in the 100-meter race. The research problem focuses on the effectiveness of various resistance exercises in improving the physical and functional performance of 100-meter runners. The research aims to prepare exercises for various resistances with free weights to develop some physical and functional abilities. The researcher used the experimental method, designed the experimental group with two pre-, and post-tests in order to suit this design to the research procedures. The research sample consisted of (8) 100-meter track and field athletes from the junior category, aged (15) years. The researcher concluded that the free-weight exercises developed the explosive power, the strength characterized by speed, and the long and short anaerobic ability of the research sample. The development that occurred in the variables of the study came as a result of continuing the special exercises on a regular and regulated basis and the suitability of the exercises to the sample. The researcher recommended using free weight exercises in a scientific manner within the training programs for youth teams, specialized schools, national teams, and local club teams. The training programs for young people must include training and exercises with free weights and multi-purpose devices that will develop the physical, functional and skill capabilities of the players.

**Keywords:** Resistance exercises, athletic performance, 100-meter race

### Introduction

The various strength training programs, including training programs with various resistances (Free weights and various devices such as the multi-purpose machine), aim to develop different types of strength, as well as developing muscle structure, strengthening ligaments and joints, and giving the body healthy shape and beautiful coordination by increasing balanced muscle size and removing fat. The researcher believes that the connection of strength with various physical elements has given it great importance to coaches and researchers in various sports events and sports, each according to his specialty. For example, 100-meter athletics is one of the individual sports characterized by extreme speed, as it relies in its physical training on several forms of strength and speed, such as strength characterized by speed. And speed and explosive power, and strength and compound reaction speed. This diversity in functional physical training requirements necessitates coaches and those in charge of the game to find means, methods, and training that would raise the level of players with those abilities, while most individual games or events require players to train to develop specific types of strength. Depending on the type of game or event, and so on, there are activities that require training to develop another type of strength, which is maximum strength, such as weightlifting events. These different strength training exercises must be prepared within specialized scientific training programs that are codified to suit the type of event, game, or sporting activity practiced, as well as taking into account the age group of the players. In order for it to bear fruit in achieving positive development that serves improved achievement.

The effect of training with various resistances in increasing strength, muscular ability, body structure, and functional ability has sometimes gone beyond other things that may be negative, and this depends on the correctness, accuracy, and suitability of those exercises to the type of game or activity being practiced, the athlete's physical ability, and the age group

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to which he belongs.

The importance of the research lies in using exercises for various resistances that are more comprehensive, careful, and precise (Targeting specific muscles) for junior 100-meter athletes aged (15) years, one of which is training with free weights for the purpose of developing some physical and functional abilities.

**Research problem:** The researcher believes that the problem lies in the lack of interest in codifying muscular strength training and various resistance exercises to some extent and in their application by some track and field athletes for all ages in general and for the junior category in particular. Therefore, the researcher prepared a set of special exercises for strength with various resistances for junior 100-meter athletes of all ages. (15) years, applying them to specific muscles and studying their effect on some physical and functional abilities.

#### Research objectives

- Preparing exercises for various resistances with free weights to develop some physical and functional abilities.
- Identify the effect of exercises using free weights in developing some physical and functional abilities.

#### Research hypotheses

Exercises for various resistances lead to the development of

some physical and functional abilities.

### Research methodology and field procedures

#### Research Methodology

The researcher chose the experimental method and designed the experimental group with pre- and post-tests in order to suit this design for the research procedures, as the experimental method depends on introducing a deliberate variable that is controlled for the specific conditions of an accident and observing and interpreting the resulting changes in the accident itself (Wajih Mahjoub, 1993) <sup>[1]</sup>.

#### Community and sample research

The goal of selecting the research sample is to obtain accurate information about a society. As for the study population, it is the group through which the researcher wishes to generalize the results of his study (Khair Ahmed Al-Khatib, 2003) <sup>[2]</sup>, so the researcher deliberately selected a sample consisting of (8) track and field athletes for the 100-meter event from the junior category. At the age of (15) years, and in order to ensure the homogeneity of the research sample members, the researcher calculated the skewness coefficient in the variables of height and weight, and the values of the skewness coefficient were all ranged between (+1, -1). This means the homogeneity of the sample, and Table No. (1) shows this.

**Table 1:** Shows the homogeneity of the research sample in the variables of height, weight, and pulse

| Variables      | Measruing unit | Arithmetic mean | Mediator | Standard deviation | Skewness |
|----------------|----------------|-----------------|----------|--------------------|----------|
| Height         | Centimeter     | 165.333         | 166.500  | 4.119              | -0.688   |
| weight         | Kg             | 52.750          | 52.000   | 4.475              | 0.095    |
| Pulse (Rest)   | Blow/minute    | 71.167          | 70.000   | 5.078              | -0.077   |
| Pulse (Effort) | Blow/minute    | 183.833         | 182.000  | 17.087             | 0.333    |

#### Methods used in the research

##### Equipment and tools used

1. EMG Bluetooth device and its accessories.
2. A barbell and various weights.
3. Bars, weighted balls and straps.
4. Leather and metal measuring tapes.
5. German-made Sartorius medical scale.
6. Japanese-made Casio stopwatches (3).
7. Personal computer (HP).
8. Desktop computer (ART) type.
9. CDs and electronic storage devices (RAMS).
10. Digital camera type (Sony).

#### Tests and measurements used in research

##### Physical tests

**Stability broad jump test:** (Ali Salloum Jawad Al-Hakim, 2004) <sup>[3]</sup>.

**Objective of the test:** To measure the muscular ability of the legs to jump forward.

**The three-wheel test for the right leg and the left leg:** (Qasim Muhammad Hassan, 2001) <sup>[4]</sup>

**The aim of the test:** To measure the speed-related strength of the leg muscles.

**Functional tests:** Vertical jump test for (60) seconds to measure long-term anaerobic capacity (Abu Al-Ala Ahmed Abdel Fattah and Muhammad Subhi Hassanein, 1997) <sup>[5]</sup>:

Objective of the test: To measure prolonged anaerobic capacity by calculating mechanical power.

#### Calculation of mechanical power (watts/kg)

The mechanical power can be calculated for every 15 seconds using the following equation:

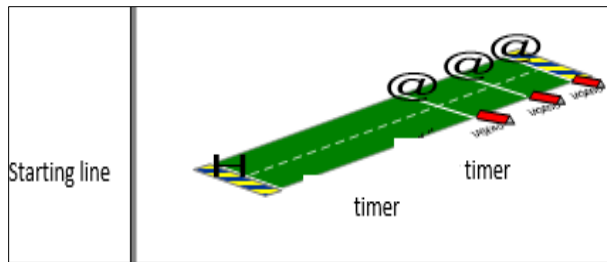
Mechanical power (watts/kg) =  $9.8 \times \text{total flight time during all jumps} \times 60 / 4 \times \text{number of jumps during 60 seconds}$  (60 - total flight time during all jumps).

However, if we want to calculate the mechanical power for a full period of (60) seconds, we do not divide by (4) in the equation, but we divide by (2) if we want a period of (30) seconds.

Scientific parameters of the test: The degree of reliability of this test reached (0.95).

**Jogging test (40, 50, 60) yards to measure short-term anaerobic capacity using distance** (Muhammad Nasr al-Din Radwan, 1998) <sup>[6]</sup>

**Purpose of the test:** To measure short-term anaerobic capacity using the horizontal distance traveled by the tester. The relative horizontal capacity can be estimated by dividing the tester's weight by the running time.



**Fig 1:** Shows the running test (40, 50, 60), yards

**Table 2:** Shows the percentile standards and performance levels of the 50-yard sprint test for boys and girls

| Classification category | Centennials | Time of 50 yards in seconds |          |
|-------------------------|-------------|-----------------------------|----------|
|                         |             | Boys                        | Girls    |
| Excellent               | 95          | 5.9- 6.1                    | 6.8- 7.7 |
| Good                    | 75          | 6.3- 6.4                    | 7.4- 7.5 |
| Middle                  | 50          | 6.6                         | 7.9      |
| Acceptable              | 25          | 7.0- 7.1                    | 8.3- 8.4 |
| Low                     | 5           | 7.5- 7.9                    | 8.9- 9.5 |

#### Age level and gender

- The 40-yard sprint test is suitable for boys and girls aged 9 years and above.
- The 50-yard sprint test is suitable for boys and girls aged 10 years and over.
- The 60-yard sprint test is suitable for boys of university age as well as for athletes.

The researcher chose the 50-yard sprint test due to its suitability for the category of juniors aged (15) years, in consultation with the supervisor and the specialized experts.

#### Exploratory experiment

Since the exploratory experiment means an initial experimental study conducted by the researcher on a small sample before embarking on his research with the aim of testing the research methods and tools according to the (Arabic Language Academy) (Arabic Language Academy, 1984), it was carried out with the help of God Almighty at exactly five-thirty in the afternoon on Monday, corresponding to (19/6 / 2023) At Al-Kut Club Stadium, the first exploratory experiment was conducted on five emerging players (from the community of origin), who were not participating in the sample. The exploratory experiment was aimed at physical and functional tests. The researcher benefited from that experience in identifying negatives in performance to address them, as well as calculating time. What is necessary for each test, the readiness and ability of the supporting staff, and the tools used in the experiment.

#### Pre-tests

At exactly five-thirty in the afternoon on Sunday, corresponding to June 25, 2023, at Al-Kut Sports Club, the emerging players participating in the research sample were gathered, they were identified, the tasks required of them were explained, and they were generally introduced to the research and its importance to them. After that, the tests that would be conducted were explained. It was conducted on them and how to implement it with the required accuracy. The researcher and the assistant team carried out the tests in front of the players in the correct way, and then the pre-tests for the research group began to be conducted, which

included the following: physical tests and functional tests.

#### Various resistance exercises under study (special exercises)

On Monday, corresponding to 3/7/2023, at exactly four-thirty in the afternoon, the exercises under discussion began. After the players gathered and their usual training unit began, a warm-up and stretching exercises were performed, and the training unit proceeded as planned by the relevant trainers until arriving at The end of the main section of the special physical preparation, where the players head to the sports hall to begin the exercises in question, where the group members train with free weight exercises. The exercises were explained and how to perform them in the correct and precise manner, and emphasis was placed on full adherence to the instructions and guidelines in terms of accurate calculation of repetitions and strict commitment to inter-rest. Between repetitions, as well as rest between exercises, the duration of performing the exercises was (25 - 30) minutes, after which the players joined their colleagues in completing their training unit in its final section with their coaches, and the total number of training units was (24) training units that extended from Monday, corresponding to (3 / 7 / 2023) until Wednesday, corresponding to (27/9/2023) at the rate of two training units per week, and the training intensity was progressive by adding weights once and reducing the time for performing repetitions again, starting from the third week, while the first and second weeks were for preparation and conditioning and at a rate of (30 35% successively of the maximum intensity of each exercise until the last week in which the intensity reached (75%) of the maximum intensity of each exercise.

#### The targeted muscles are

1. Quadriceps muscle.
2. Adductors longus, magnus, and brevis muscles.
3. Hamstring muscles.
4. Gluteals.
5. Hip flexors.
6. The sacrospinous muscles and all ligaments of the hip, knee and ankle.
7. The goal is to develop the strength and ability of those muscles and ligaments.

#### Post-tests

On Monday, October 2, 2023, at exactly three-thirty in the afternoon, the post-tests began, and the researcher took care that the conditions were as similar as possible to the conditions of the pre-tests in terms of the timing and place in which the tests were conducted, the tools used. etc., It began by conducting physical tests, then functional tests, and the tests ended at exactly five-thirty in the evening on Saturday. The results were recorded and transcribed into forms for each test, and they were compared to the results of the pre-tests after conducting the appropriate statistical treatments and extracting the final results.

**Statistical methods:** The statistical package (SPSS) was used, which allowed the researcher to access the results.

#### Presentation, analysis and discussion of results

Presenting, analyzing and discussing the results of pre-tests in physical and functional tests.

**Table 3:** Shows the arithmetic means for the two experimental groups (Multi-gms and weights) in the pre- and post-physical, functional and skill tests

| Tests   | Measruing unit | Mean pre-tests | Standard deviation | Mean post-tests | Standard deviation |
|---|----------------|----------------|--------------------|-----------------|--------------------|
| Broad jump from standstill                      | Centimeter     | 160.500        | 22.30              | 208.333         | 18.10              |
| Bounding (Right)                                | Centimeter     | 523.000        | 44.90              | 579.000         | 39.89              |
| Bounding (Left)                                 | Centimeter     | 520.333        | 46.20              | 551.667         | 43.40              |
| Vertical jump (60) seconds (Anaerobic capacity) | Watts/kg       | 2.809          | 0.911              | 2.300           | 0.592              |
| Run (50) yards (Horizontal capacity)            | kg/s           | 7.196          | 2.302              | 7.485           | 1.203              |

**Table 4:** Shows the difference of the arithmetic means, their standard deviations, the value of (t), and the significance of the differences between the results of the pre- and post-tests for the (Weights) group in the physical and functional tests

| Tests   | Measruing unit | Arithmetic mean of difference | Standard deviation of differences | Value(t) Calculated | Error level | Meaning of differences |
|---|----------------|-------------------------------|-----------------------------------|---------------------|-------------|------------------------|
| Broad jump from standstill                      | Centimeter     | 47.833                        | 80.611                            | 3.453               | 0.016       | Sig                    |
| Bounding (Right)                                | Centimeter     | 56.000                        | 42.445                            | 3.232               | 0.023       | Sig                    |
| Bounding (Left)                                 | Centimeter     | 31.333                        | 29.337                            | 2.616               | 0.047       | Sig                    |
| Vertical jump (60) seconds (Anaerobic capacity) | Watts/kg       | 0.509                         | 0.171                             | 7.298               | 0.001       | Sig                    |
| Run (50) yards (Horizontal capacity)            | Kg/s           | 0.289                         | 0.265                             | 2.669               | 0.044       | Sig                    |

\* Significant at the significance level (0.05) if the error level is smaller than (0.05).

The researcher attributes this increase in the arithmetic mean between the pre- and post-tests in the static broad jump test for the (Weights) group, which represents the development of explosive power and maximum strength of the muscles under study to the gradual increase in the intensity of the training load, once by increasing the weights and at other times by increasing the speed of performing the exercises, which in turn led to increasing muscular strength, and this is what (Talha Hossam El-Din and others) argued that muscular strength can be increased by (increasing the size of the load, which is represented by the number of repetitions, increasing the intensity of the load used by increasing the weights and barbells, and increasing the speed of performing the exercise) (Talha Hossam El-Din and others, 1997) <sup>[8]</sup> as The difference in training intensities and volumes, in turn, led to an increase in muscle capacity in general and an increase in the strength and ability of the targeted muscles in particular, as weight exercises work to increase muscle capacity through exercises of different intensities and volumes, and this method is considered one of the ideal methods for improving muscle strength at different levels. Depending on the goal of this improvement (Ahmed Mahmoud Khadem, 1999) <sup>[9]</sup>.

The researcher attributes this increase in the arithmetic mean between the pre- and post-tests in the three-leg test for the right leg for the (Weights) group, which represents the development of the strength characterized by speed of the muscles under study, to the researcher's use of exercises directed to increase the strength characterized by speed and the power of jumping or vaulting. The exercises are (Al-Dabni, medium hole, Half dip with jumping, double standing golf), and this was confirmed by (Becker 1996) <sup>[14]</sup> citing (Angus 1994) <sup>[10]</sup> that to develop jumping ability, multiple methods are relied upon, such as general strength exercises that include different dip exercises, as well as special strength exercises, which are exercises that attempt to transfer force. General to the specific strength of jumping represented by the vertical jump, in addition to developing the speed of strength (Power) such as the directional jumping exercises with one leg or with two legs on jumping boxes. (Angus Burnett, 1994) <sup>[10]</sup>.

From Table (3) in the bounding test for the left leg for the (weights) group, we notice that there are differences in the arithmetic means between the pre- and post-tests in favor of

the post-test, as the arithmetic mean in the pre-test was (520,333 cm), while the arithmetic mean was (520,333 cm). In the post-test (551,667 cm), and from Table (4) we notice that the difference in the arithmetic means between the pre- and post-tests for the (Weights) group amounted to (31,333 cm), with a standard deviation of the differences of (29,337 cm), and the calculated (t) value was (2,616) at the level The significance is (0.05) and the degree of freedom is (5) with a development rate of (6.0217%). The error level was (0.047), which is smaller than the significance level (0.05), which indicates that there are significant differences between the results of the pre- and post-tests in favor of the post-test.

The researcher attributes this increase in the arithmetic mean between the pre- and post-tests and the percentage of development in the three-hop test for the left leg for the (Weights) group, which represents the development of the strength characterized by speed for the muscles under study, to the same reasons that were mentioned in the discussion of the results of the (three-hop for the right leg) test for the same group.

The researcher attributes this development, which came in the form of a clear increase in the economy of exerting effort or expending energy (i.e. increasing mechanical ability) between the pre- and post-tests in the 60-second vertical jump test for the (Weights) group, as increasing mechanical ability comes with a reduction in performance time, and this What was expressed by the differences between the arithmetic circles in the pre- and post-tests, this development, in the researcher's opinion, was achieved as a result of the precise implementation of the exercises under study by the experimental group and adherence to the intensity, volumes and rest periods precisely, which led to an increase in the ability of the targeted muscles, especially the strength characterized by speed, as performance At an intensity (60 - 80%) of the maximum intensity, this is one of the characteristics of methods for developing strength characterized by speed, and the precise use of grading the appropriate weights has a prominent impact on the development of the characteristic of speed strength. (Bou Al-Ala Ahmed Abdel Fattah, 2000) <sup>[11]</sup>

The researcher attributes this development, which came in the form of a clear increase in the arithmetic mean between the pre- and post-tests, to the special exercises prepared by the researcher for the (Weights) group, which led to growth

and a noticeable increase in the size of the muscles of the legs and the rest of the targeted muscles, which in turn led to an increase in the strength and ability of these muscles. Weight training has an effective effect in growing muscle strength on the one hand, and increasing muscle size on the other hand.

The researcher attributes this development (Even if it was simple) in the differences between the arithmetic means of the pre- and post-tests and the percentage of development to the use of exercises and weight training that aimed to develop the strength and ability of the inner, outer, front and back thigh muscles, in addition to the muscles of the leg, abdomen, back and ligaments of the hip, knee and ankle joints, which led to In turn, it increases the strength and stability of those joints and the muscles working on them, and then increases better control and control of the angles of those joints, as the nature of special training is necessary for the adaptation process to occur to the activity practiced, which leads to the development of the level and the possibility of raising the load and the level of achievement. (Amr Allah Ahmed Al-Basati).

The researcher attributes this clear development in the differences in the arithmetic settings between the pre- and post-tests and the rate of development to the development of strength and ability (Power characterized by speed) of the targeted muscles under study, as well as the development of the strength of the ligaments and joints on which those muscles work and the improvement of neuromuscular work (Neuromuscular compatibility), which led to To increase control and control in kicking and handling the ball, as believes that some development of the strength characterized by speed among young people will help develop quick motor skills against resistance by improving the work of the nerves and muscles. (Banwan Hasan, B., & Awed, R., 2024) <sup>[13]</sup>.

### Conclusion

Through presenting, analyzing and discussing the results, the researcher reached a set of conclusions, the most important of which are the following:

1. The free-weight exercises prepared by the researcher developed explosive strength, speed-specific strength, and long and short anaerobic ability among members of this group.
2. The development achieved in the variables of the study came as a result of continuing the special exercises on a regular and standardized basis and making the exercises appropriate to the sample.

### Recommendations

Based on the findings, the researcher recommends the following:

- Using free weight exercises scientifically prepared by the researcher within the training programs for junior teams in specialized schools, national teams, and local club teams.
- The training programs for juniors must include training and exercises with free weights and multi-purpose devices that will develop the physical, functional and skill capabilities of the players.
- Conduct similar research for youth teams of different ages and for various games and events due to the lack of research and training programs for youth in this direction.

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