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Static stretching exercises with resistance for the lower limb in some physical abilities and achievement of the long jump for youth

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Abstract

The purpose of this paper is to prepare exercises for stretching with Static contraction resisting the lower limb for long jumpers, and identify the effect of training in developing some physical abilities and achievement. The researcher used the experimental method: The research sample was chosen intentionally from all young long jump players (aged 16-17 years) in Wasit Governorate, and their number was (12) players. Two players were excluded for use in the exploratory experiment, and they represent 83.33% of the original research community. The researcher divided the sample randomly into two groups, one of which was a control group and the other an experimental group. The number of individuals in each group was (5) players. The researcher took some anthropometric measurements, as shown in Table (3) in the appendices. One of the most important results reached by the researcher is that: The method followed has clearly developed the capabilities and achievement to compensate for the deficiency in the ranges of motion of the lower limb, the new thing is the players' remarkable interest in stretching exercises with static resistive contraction due to the players' feeling of rapid developments. One of the most important recommendations recommended by the researchers is that: Using resistance exercises with eccentric contraction and stretching of the lower limbs on players of other jumping events and for different categories.

Keywords: Identify, stretching, lower, players

Introduction

Athletics events are events that differ from one another in terms of characteristics and components. They include running, jumping, and throwing. Jumping events include many types; including what are called horizontal jumps (such as the long and triple jump) and what are called vertical jumps (high and pole).

Using new types and modern training methods to improve achievement in general and long jumpers in particular is one of the most important requirements that must be paid attention to in order to improve the levels of physical abilities and what affects the development of the functional abilities of these players to reach the highest levels.

Therefore, the researcher was interested in using one of these methods in this study, which is the method of training muscle strength with static contraction and elongation (eccentric contraction) through the use of different resistances. It is a method that depends on the use of resistances and the muscle with its maximum elongation to influence and with eccentric muscle contraction for a varying period for the purpose of developing the special strength, which may lead to developing speed, explosive strength and relative strength in long jump players, in addition to its effect on developing the muscular-neurological response, muscle work and some kinetic abilities accompanying the development of physical abilities, in addition to the effect that may occur in the special and basic mechanical conditions of the long jump, which may ultimately contribute to developing the digital achievement. Most training curricula did not give central importance to studying the effects of this type of training on physical and kinetic abilities, or even such training was not used, to the best of the researcher's knowledge, as a means of developing strength. Rather, stretching exercises were used as exercises to increase the range of motion of the working muscles and joints only during physical preparation periods (warm-up), as this method is based on a scientific theory that says that muscles can perform a wide range of motion when stimulated and when they are subjected to a certain resistance and at their maximum ranges, which subsequently affects the result of their muscular work,

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as this training contributes to the positive development of the strength and flexibility of the working muscles and joints of the ligaments. Therefore, the importance of the research lies in trying to identify the extent of the impact of using this new training method by adopting static muscle contraction training and muscle stretching in developing physical and kinetic abilities, as well as knowing its impact on developing achievement through field applications that may have a positive impact on obtaining the most appropriate kinetic paths, improving sports technique, and raising the level of achievement.

Research problem

The discovery and use of new training methods is one of the important factors that help achieve progress in the training process, and those working in training must succeed in inventing new methods to help their athletes improve their technical and numerical levels by relying on various sports sciences and the extent of their overlap in order to develop these achievements. Therefore, the researcher focused on using a training method that is new in training athletics, especially long jump players in the Kurdistan Region, which is strength training with static muscle contraction and muscle elongation, as this method can give a high result of muscle work, which is one of the types of work associated with exerting force in the muscle and the distance achieved by the action of this force when elongating it. Since the muscle in the human body has an elastic feature, muscle elongation means that the distance in which the muscle works is greater than it is in a relaxed state. Therefore, the elastic feature gives the result of muscle work by using muscle force in the maximum range of motion, which inevitably increases the result of this work, whether when using explosive force or characterized by speed or Relative or absolute strength, and the problem of the research is that this training method of stretching did not get its share on Wasit youth players in athletics, especially long jumpers, so the researcher decided to address this topic scientifically to enhance the importance of this method in the applied aspect.

Research objective

- Prepare exercises for stretching with static contraction resisting the lower limb for long jumpers.
- Identify the effect of training in developing some physical abilities and achievement.

Research hypotheses

- The existence of statistically significant differences between the pre- and post-tests of the control and experimental groups in some physical abilities and achievement.
- The existence of statistically significant differences between the post-tests of the control and experimental groups in some physical abilities and achievement.

Research fields

- Human field: Al-Kut Club player
- Time field: (25/8/2024) to (18/10/2024)
- Spatial field: Al-Kut Olympic Stadium

Definition of Terms

Resistance training with muscle stretching and eccentric static contraction (Rolf Wir Hed. 1984)

It is an exercise with a special technique that leads to accelerating the neuromuscular response and developing muscle work, so the trend is to develop the maximum strength of the muscle while it is within the limits of its maximum stretching, because we cannot stretch the muscle to 120% of its original length according to the physiological rule that says that at this rate the actin and myosin filaments are at their highest effectiveness in producing force, and if it exceeds this percentage, the effectiveness of these filaments is very poor in producing that force. In addition to strength training with muscle and joint stretching on the response and adaptation that occurs to the muscle when working in this way and developing the neuromuscular response.

Research methodology and field procedures

Research Methodology

The researcher used the experimental method as it is considered "an attempt to control the situation to be studied." (Muhammad Hassan Alawi, and Osama Kamel Rateb. 1999).

Community and sample research

The research sample was chosen intentionally from all young long jump players (aged 16-17 years) in Wasit Governorate, and their number was (12) players. Two players were excluded for use in the exploratory experiment, and they represent 83.33% of the original research community. The researcher divided the sample randomly into two groups, one of which was a control group and the other an experimental group. The number of individuals in each group was (5) players. The researcher took some anthropometric measurements, as shown in Table (3) in the appendices. The researcher found the homogeneity of the sample individuals before dividing them, and found equivalence between the two groups after the division. Note Tables (1) and (2).

Information collection methods, tools and devices

Information collection methods

- Arab and foreign sources and references
- Technical and experimental observation
- Personal interview
- Tests and measurements

Tools and devices

To achieve the research objectives and reach its results, the following tools and devices were used:

- Casio electronic stopwatches, number (3)
- Measuring tape
- Sensitive scale to measure body mass to the nearest (50) grams
- Video camera, number (3) with a frequency of 25 s/s
- Whistle, number (1)
- Drawing scale with a length of (1) meter
- Signs, indicators and barriers of different heights and shapes

Table 1: Shows the homogeneity of the research sample in Length, Mass and the variables under study

| Variables | Measuring unit | Mean | Median | Std. Deviations | Skewness |
|---------------------------------------|----------------|---------|--------|-----------------|----------|
| Length | cm | 170.200 | 169.00 | 7.005 | 0.944 |
| Mass | kg | 60.600 | 60.00 | 3.893 | -0.060 |
| Achievement | m | 5.208 | 5.300 | 0.357 | -0.865 |
| distinctive strength of speed (right) | W/kg | 28.759 | 28.610 | 2.885 | -0.129 |

| | | | | | |
|--------------------------------------|----------|---------|---------|---------|--------|
| distinctive strength of speed (left) | W/kg | 26.436 | 27.285 | 3.088 | -0.689 |
| Explosive ability | kg.m/min | 736.204 | 748.830 | 171.908 | 0.259 |

* The tabular t value is (2.306) at a significance level of (0.05) and a degree of freedom of (5+5-2=8). 3 - 4 Research Tests

Therefore, the following tests were selected

1. **Explosive ability test** (Sareeh Abdul Karim Al-Fadhli. 2007)

Test name: Long jump from standing with both legs

Test objective: Measure the explosive ability of the legs from standing

2. **Three-hop test for each leg to measure the distinctive strength of speed** (Sareeh Abdul Karim Al-Fadhli. 2007)

Test objective: Measure the ability characterized by speed for the legs

Exploratory experiment

In order to determine the accuracy of the research work and avoid the obstacles and difficulties encountered during the field research procedures, the researcher must conduct the exploratory experiment to avoid shortcomings while specifying the location, time and duration of the experiment (Wajih Mahjoub. 1988) [5]. On this basis, the researcher conducted the exploratory experiment on (28/8/2024) on two jumpers who were excluded during the implementation of the main experiment with the aim of identifying several pieces of information, including determining the locations of the cameras and the clarity of the image, as well as the nature of the physical tests and the time taken to do so, as well as to familiarize the assistant work team with the nature of the experiment and the exercises used and the obstacles and difficulties that You may encounter the work team in the main experiment as well as the adequacy of the work team in terms of implementing the various tests and the method of recording the results, the extent of the suitability and appropriateness of the arrangement of performing the tests concerned with the research, the extent of the testers' understanding of the tests used and the time they take and the tests specific to the research as well as identifying the extent of the validity of the test tools.

Pre-tests

The researcher conducted the pre-test on (Sunday) dated (1/9/2024) at the Al-Kut Sports Club stadium in the presence of the members of the assistant work team after installing three video cameras next to the long jump approach run field and from three sides on a tripod for accuracy of photography. The first camera was vertically in the middle of the take-off board at a distance of (11.25 m) and its lens height from the ground was (1.13 m) so that this camera recorded the last part of the approach run (the last three steps) until the first third of the flight path. The researcher used a drawing scale with a length of (1) m and photographed it at the location of the player's movement to be analyzed, in order to convert the measurements in the tape to nature.

Table 3: Shows the difference in the arithmetic means, its standard deviation, the calculated (t) value, and the significance of the differences between the results of the pre- and post-tests in the achievement variable for the control and experimental research groups.

| Variables | groups | Unit of measure | Arithmetic mean | | arithmetic mean of difference | standard deviation of differences | T value calculated | type Sig |
|-------------|--------------|-----------------|-----------------|-------|-------------------------------|-----------------------------------|--------------------|----------|
| | | | pre | post | | | | |
| achievement | control | meter | 5.240 | 5.436 | 0.196 | 0.161 | 2.727 | non sig |
| | Experimental | meter | 5.176 | 5.796 | 0.620 | 0.340 | 4.076 | Sig |

The development of the level of achievement of the experimental group members was linked to the training paragraphs prepared by the researcher according to scientific

Field Procedures Steps

Resistance exercises were applied with eccentric contraction and muscle stretching (experimental training method) after relying on scientific sources and references in the field of sports training. This method includes the following:

- Emphasis on the method of muscle contraction and the muscle with its maximum stretch and in various positions with the highest eccentric muscle tension and in various positions and for the working muscles only.
- This method is applied in the first or second part of the main section and according to the goal of the daily training unit, as the application may be after completing the warm-up or after completing the first part of the main section and at a rate of three times a week. Work on these exercises continues for a period of time from (60-82 minutes) in one training unit and for a period of no less than (10) weeks and at a rate of (3) times a week.

So the total performance is $3 \times (60-82) = (180-246)$ minutes per week

Number of units = 30 training units
 $30 \times (180-246 \text{ minutes}) = 5400 - 7380$ minutes

The researcher used the load gradation system each week separately.

The researcher determined the training intensity according to the following:

- Measuring the maximum muscle strength by stretching using a dynamometer 100%.
- The training intensity was determined in light of this achievement measured by the dynamometer.
- The contraction time was determined (7) seconds - (12) seconds or more, depending on the progress of the training.
- The repetitions were determined (1 - 4) times or more.
- The rest time was relative to the work time.

Post-tests

The post-tests and post-imaging were conducted on (Monday) (14/10/2024) in the same manner and style, taking into account the conditions in which the pre-tests were carried out, on the same field and the same hole, with the assistance of all members of the work team.

Statistical methods: The search data was processed through the Statistical Package for the Social Sciences (SPSS).

Results and Discussion

Results

Presenting, analyzing and discussing the achievement results

foundations, as these trainings focused on developing all variables related to achievement (such as force push, angles of approach, push and kinetic transfer) by focusing on the

maximum achievement of the working muscles and exploiting the elastic feature of these muscles to produce the greatest mechanical work in them during the preparation situation and according to the training vocabulary, which made the differences in the values of these variables tend towards the results of the post-tests and this was reflected in the development of achievement, and this was evident through the digital level achieved by the experimental group members in the post-test compared to the values achieved for the achievement of the control group, and the researcher attributes the reason for this to the strength exercises for stretching that the researcher focused on and the resulting positive and effective role in focusing on the muscle groups specific to the long jump and their correct path in a way that ensures the economy of effort and guarantees the kinetic flow according to the skill performance, "since skill is a characteristic indicative of the effectiveness of performance, and the development of the learner's kinetic responses means

organizing and arranging the work of the muscle groups in the direction of movement." (Qasim Hassan Hussein. 1990) The effect of training in improving the flexibility and strength of the working muscles in the legs, which in turn leads to improving the speed rate, as a number of researchers indicated that "muscle flexibility can be increased by lengthening them with special training methods, and this increase means that the muscle can produce greater force that suits its length, and this will lead to improving the running speed", and thus affects the achievement, (Muhammad Fawzi Abdul-Shakoor - Muhammad Sayyid Muhammad Hilmi. 2003) "Practice and repetition of skill performance leads to a cumulative change in behavior as a result of the gradual growth in the strength of the kinetic program for the skill" (Muhammad Fawzi Abdul-Shakoor - Muhammad Sayyid Muhammad Hilmi. 2003) [7], and "the more the contradiction increases, it means loss of energy and an increase in the time to rise, which is not good for achievement, and vice versa" (I.A.A.F. 1997).

Table 4: Shows the arithmetic means in the pre- and post-tests, the difference between the means, and the percentage of development in the achievement variable for the control and experimental research groups

| Variables | Groups | Unit of measure | Arithmetic mean | | arithmetic mean of difference | Evolution rate % |
|-------------|--------------|-----------------|-----------------|-------|-------------------------------|------------------|
| | | | Pre | Post | | |
| achievement | Control | meter | 5.240 | 5.436 | 0.196 | 3.741 |
| | Experimental | meter | 5.176 | 5.796 | 0.620 | 11.978 |

From the above, the researcher believes that the facts that determine the horizontal distance in the long jump undoubtedly contribute to achieving the final result, in addition to its connection to the form of technical performance specific to this competition, as there are internal forces and external forces that have a reciprocal effect when the muscles and joints of the body work and according to the nature of the technical stage, in addition to the effect of that on controlling the kinetic performance and according to the rules of the competition.

The use of strength exercises specific to stretching had an effective and positive effect on developing the mechanical conditions related to the performance, and this development contributed to acquiring the kinetic skill and the resulting development of control over this performance according to its technical stages and achieving its mechanical goal, which is achieving the appropriate horizontal distance. This is the result that the long jumper hopes for.

"The elongation that occurs in the working muscles due to the tensile force to which these muscles are exposed has a relationship between the tensile force and the amount of elongation, which is called elastic limit" (Qasim Al-Mandlawi and et al. 1990) [9]. This force is the force required to affect a body in order for the tension to occur in order for a correct mechanical action to occur, "because every movement is a result of the work of the working muscles and the joints specific to this movement, as there is a rhythmic harmony, individual and collective, that merges with a kind of simplicity, clarity and harmony. The only coordinator of these movements is the central nervous system, whose work can be developed through the use of exercises that depend on creating harmony between the working muscle groups and the nerve signals." (Sareeh Abdul Karim Al-Fadhli. 2003) [7].

Presentation and discussion of the results of the physical variables

Table 5: Shows the difference in the arithmetic means and its standard deviation and the calculated (t) value and the significance of the differences between the results of the two pre-tests

| Variables | Groups | Arithmetic mean | | standard deviation of differences | arithmetic mean of difference | T value calculated | Type sig |
|---------------------------------------|--------------|-----------------|----------|-----------------------------------|-------------------------------|--------------------|----------|
| | | Pre | Post | | | | |
| Explosive ability | Control | 732.674 | 881.310 | 148.636 | 72.426 | 4.589 | sig |
| | Experimental | 739.734 | 1276.702 | 536.968 | 122.39 | 9.810 | sig |
| distinctive strength of speed (right) | Control | 27.966 | 28.498 | 0.532 | 0.334 | 3.557 | sig |
| | Experimental | 29.552 | 33.700 | 4.148 | 1.017 | 9.117 | sig |
| distinctive strength of speed (left) | Control | 26.814 | 28.094 | 1.280 | 0.418 | 6.847 | sig |
| | Experimental | 26.058 | 30.854 | 4.796 | 1.216 | 8.823 | sig |

The explosive strength test represented by the long jump from a standstill and using biomechanical indicators ($Q = K S / N$) which was used in the field experiment of the research has a high correlation with muscle capacity through the muscle work resulting from the muscle stretching distance in the preparatory position as well as the development of the muscle strength of this muscle with eccentric contraction exercises which were focused on during the training program used by the researcher on the members of the experimental group in

particular, and the development achieved in the results of this test indicated the effect of these exercises in the development of the muscle groups working in the extension and flexion movements on the joints related to these movements, so that this can affect the time of muscle contraction and relaxation as little as possible, which ensures a decrease in the time of the push at the moment of the jump which expresses the individual's ability to exert the highest rates of explosive strength to obtain the highest possible horizontal distance that

reflects the player's achievement represented by a decrease in the time of this push and covering this distance (the test distance), as most specialized studies indicated that the increase in strength is inversely proportional to time and directly proportional to mass and speed, which means covering a distance in the least possible time, with relative stability of mass and according to the law The following:

Since force = mass × velocity / time (Samir Muslat Al-Hashemi. 1999)

Since distance = velocity × time

Then force = mass × 9.8 × distance if this force is to be measured in Newton units in terms of the distance traveled by the jump.

The training carried out on the experimental group members led to an increase in explosive muscle strength and rapid response to produce the highest muscle capacity according to the type of resistance used and gradually upgrading it, which means increasing its kinetic energy represented by increasing the speed of muscle frequency (contraction and expansion) which was reflected in increasing the jump distance, as some researchers believe that "muscle fibers have the ability to produce great force according to the type of resistance that those fibers face, and thus the number of working kinetic units will increase and their ability to produce kinetic energy will increase accordingly." (Sareeh Abdul Karim Al-Fadhli. 2003) As for the results of the control group in the same variable, the researcher attributes the development in this ability to the fact that the long jump movements and their

repetition during the daily training of this group provide a benefit to developing this ability for the muscle groups, and therefore the differences also appeared significant, but with a lesser effect than that shown for the experimental group. This is what we notice through the development rates for these two groups that are presented in Table (5).

As for the variable of the speed-characterized strength of the leg muscles (right and left), it appears that the training had a clear effect on the speed-characterized strength of the members of the experimental group, as the training that the researcher used in these trainings included various strength exercises by stretching with eccentric contraction and specific to developing the muscles working in running and jumping. These trainings achieved development in the efficiency of the muscles and improved the level of achievement of this group in the speed-characterized strength test for both legs. This means that the members of this group will be better when applying the performance of the long jump in a way that serves the performance and technique, "since most of the stages of performance in the long jump depend entirely on the development of the characteristic of speed-characterized strength, speed and neuromuscular coordination, which means development in the ability of the working muscles to perform such movements" (Talha Hussam al-Din and et al. 1997). This is what appeared clearly in the results of this experimental group. From the researcher's point of view, the training that was used as strength exercises may have been directed towards developing the speed-characterized strength and explosiveness, and this is what these differences results proved.

Table 6: Shows the arithmetic means in the pre- and post-tests, the difference between the means, and the percentage of development in the physical variables for the control and experimental research groups.

| Variables | Groups | Unit of measure | Arithmetic mean | | arithmetic mean of difference | Evolution rate % |
|---------------------------------------|--------------|-----------------|-----------------|----------|-------------------------------|------------------|
| | | | Pre | Post | | |
| Explosive ability | Control | kg.m/min | 732.674 | 881.310 | 148.636 | 20.287 |
| | Experimental | kg.m/min | 739.734 | 1276.702 | 536.968 | 72.589 |
| distinctive strength of speed (right) | Control | Watt/kg | 27.966 | 28.498 | 0.532 | 1.902 |
| | Experimental | Watt/kg | 29.552 | 33.700 | 4.148 | 14.036 |
| distinctive strength of speed (left) | Control | Watt/kg | 26.814 | 28.094 | 1.280 | 4.774 |
| | Experimental | Watt/kg | 26.058 | 30.854 | 4.796 | 18.405 |

The differences between the means and the rate of development, which is an acceptable rate given the length of the training period in which the program was applied, indicated the development of the results of this test in the post-test, "and that all the leg push movements, which are the decisive factor for achieving the jump distance, depend mainly on the amount of rapid force exerted in a relatively short time by the leg muscles, especially during the performance of these movements, which indicate the continuation of the production of force speed represented by the ability to perform movements against a certain resistance at a level less than the maximum and at a high degree." (Samir Muslat Al-Hashemi. 1999)

This indicates the development of the performance level of this group, which was reflected in the performance of the maximum possible degree of force and for the shortest possible period of time. This is a result of the effect of the strength training that the researcher used in its training methods, which had a highly effective impact on the level of explosive strength of the research sample members, which expressed a high rate of energy produced by the muscles during the exertion of effort relative to the performance time,

as the more efficient the muscles performing the effort, the less time possible, which means an increase in the capacity of these muscles (as indicated by the results of the jump distance for this test). The difference between the two arithmetic means was large and the rate of development was good. These results indicate the effectiveness of these exercises in developing the strength of the flexion and extension muscles of the thigh, knee and ankle joints for the experimental group and at a greater rate than the control group. The jumper can perform these exercises for a specific period in order to improve the ability to work for the thigh muscles during running and jumping, as is the case with male and female long jumpers, as the range of motion of the thigh during the approach run leads the player to perform more swinging movements of the leg, as the amount of displacement of the angle cut by the thigh during running movements is estimated at approximately 210 (New studies Athletes the L.A.A.F). Therefore, with the change in the amount of resistance, the number of repetitions and the speed of movement, the problem of developing the required strength can be solved. Developing this strength depends on the homogeneous compatibility of the muscle contraction of the muscle groups

that the different parts of the body perform to perform the movement. The applied example of this homogeneous work of the muscles is performing flexion and extension movements in the leg joints during running, as the swinging movement in one leg depends on a pushing movement with the other leg and then the appropriate connection of the last steps in the approach with the rise. Effective, and that strength training with stretching focused on strengthening the connection with force between the leg muscles during running and climbing, and this is what the researcher confirmed when applying his training method using special strength training and technical movements similar to the technical movements of the basic activity.

Conclusions and Recommendations

Conclusions

- The method followed has clearly developed the capabilities and achievement to compensate for the deficiency in the ranges of motion of the lower limb.
- The new thing is the players' remarkable interest in stretching exercises with static resistive contraction due to the players' feeling of rapid developments.

Recommendations

- Using resistance exercises with eccentric contraction and stretching of the lower limbs on players of other jumping events and for different categories.
- Conducting similar research on the rest of the other sports events.
- The necessity of using tests to measure explosive and rapid muscle ability according to mechanical variables.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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