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DEVELOPMENT OF EXPLOSIVE POWER USING WEIGHTS IN A HIERARCHICAL MANNER AND ITS EFFECT ON IMPROVING THE VALUES OF SOME BIOKINEMATIC VARIABLES AND THE TECHNICAL PERFORMANCE OF THE LONG JUMP

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Abstract
The aim was to identify the effect of using weight training in the up-and-down method on the development of explosive power in the student. Identifying the effect of explosive power development using weight training in the up-and-down method in improving some biokinematic variables of the long jump for students for the research sample, as for the hypothesis of the study, the researcher imposed the use of weight training in the up-and-down method that positively affects the development of explosive power in the student., The research population was identified with the students of the first stage of Division (1) of the Faculty of Physical Education and Sport Sciences, Maysan University for the season 2025, which are (15) students. As for the recommendations that the researcher came out with, the need to conduct similar studies and researches on other jumping events, using different training methods or using devices such as the strength platform for both genders, if the researcher concludes that weight training in a hierarchical way leads to the development of explosive power, the development of explosive power leads to the improvement of some biokinematic variables of the effectiveness, the development of explosive power through weight training in a hierarchical way leads to the improvement of the technical performance of the event.
Keywords: Explosive power, Pyramid exercises, Long jump.

Introduction

The development in all sports, including athletics, is the result of continuous studies and research, which reflects positively on the results of teams and players, and this is what we have observed in the recent global, continental and Olympic championships, and that most of the studies and researches have recently focused on the development of muscular strength because of its fundamental and effective role in the development of sports achievement (Thompson et al., 2022). The use of weights is one of the methods that leads to the development of muscular strength, and weight training used to develop muscular strength may lead to the development of explosive power if used in the appropriate amounts in terms of intensity and size (Suchomel et al., 2018). Explosive power is one of the physical attributes that mainly affect the success of events, especially the long jump. Most of the figures achieved are the result of explosive power (Mola & Adane, 2020), which is the ability to detonate the maximum force in the shortest possible time for a single kinetic performance, i.e., the maximum instantaneous power of performance (Cronin & Sleivert, 2005). It requires the player to have some physical qualities such as speed and strength of all kinds, and learning the technical stages (Kudryavtsev et al., 2024), which are the basis for mastering the stages, especially the last stage in this event, is related to the reaction in the muscles through the strength produced by the muscle (Bompa & Buzzichelli, 2021). Hence the importance of researching the use of weight training in the up-and-down method

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and identifying its effect on improving some biokinematic variables and technical performance in the effectiveness of the long jump.

Research Problem.

The development of explosive power is a crucial factor in improving the achievement of the long jump, as it is directly related to approach speed, climb force, and tee angle, which are biokinematic variables that determine the quality of technical performance and distance traveled. Although the use of various training resistors is common in the development of this physical attribute, its use in the ascent and descent method within the training module has not been scientifically decided in terms of its exact effect on the biokinematic values associated with the technical performance of the long jump. Therefore, the researcher resorted to preparing a training curriculum that includes the use of weight training in the method of ascent and descent to develop explosive power to identify its effect on improving some biokinetic variables and the technical performance of the long jump.

Research Objectives.

1. Identify the effect of using weight training in the up-and-down method on the development of the student's explosive power.
2. Identifying the Effect of Explosive Power Development Using Weight Training in the Method of Climbing and Landing in Improving Some Biokinematic Variables of the Long Jump

Research hypotheses.

1. The use of weight training in the method of up-and-down has a positive effect on the development of the student's explosive power.
2. There are statistically significant differences for some biokinetic variables between the results of the pre- and post-tests as a result of the development of explosive power using weight training in the method of up-and-down and in favor of the post-test.

Research Areas.

Human Area: Students of the Faculty of Physical Education and Sport Sciences, Maysan University
Spatial Area: College Weight Hall and Outdoor Playground
Time Area: 26/1/2025 to 26/3//2025

Methodology

The researcher used the experimental method with one experimental group with two pre- and post-tests to suit the nature of the research.

Research Sample.

The research sample was selected by the deliberate method, which included (27) students of the Faculty of Physical Education and Sport Sciences – Missan University for the (first) stage, where (5) students were excluded for non-compliance and (7) from the request as a survey sample, as the number of the sample that was applied by the researcher reached (15) students, i.e. (68%).

Methods of Data Collection, Equipment, and Tools Used

Methods of Data Collection:

- Arabic and foreign sources and references.
- Personal interviews with professors specialized in Athletics.
- The global information network (Internet).

Equipment and Tools Used:

- Athletics field (track and field stadium).
- Stopwatch (Japanese-made).
- Measuring tape (50 m).

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- Data recording forms.

Steps of the field research procedures.

The steps of the field research procedures included the following:

Determine the physical abilities used in the research.

The researcher resorted to selecting some tests for the explosive powers of the legs and arms, which were approved after the interview with a group of experts and specialists, clarifying the physical character and the proposed tests, taking into account the clarity of their purpose and the extent of their suitability for the research sample. The following two tests were selected

est 1: Vertical Jump from Standing Position (Sargent Jump Test) (Al-Hakeem, 2004, p. 88) This test is used to measure the **explosive power of the legs**.

Test 2: Two-Handed Medicine Ball Throw Test (2 kg) (Radwan, 1994, p. 84) This test is used to measure the **explosive power of the arms**.

Biokinematic Variables:

Through video film analysis and computer-based processing, the results of the most important biokinematic variables under study were extracted. These variables were selected by the researcher according to their significance in terms of the influence of explosive power on them, as well as their importance as key variables in this event.

a. Trunk inclination angle during the approach.
b. Trunk inclination angle during take-off.
c. Hip height at the moment of take-off board contact.
d. Take-off board contact time.

Pilot Study:

The Pilot Study:

The researcher conducted the first pilot study, one of which was related to the physical tests of the research on the same experimental sample. It was carried out on **January 20, 2025**, corresponding to **Saturday**, and included tests of **explosive power** and **speed–strength of the legs**. The objectives of these tests were as follows:

- To determine the time required to administer the tests.
- To verify the suitability of the tools and equipment used in the research.
- To familiarize the assisting team with the procedures of measurement and recording results.
- To determine the extent to which the research sample accepts the proposed tests.
- To identify potential obstacles and difficulties that may arise during the main experiment.

Main experience:

The researcher conducted the tribal explosive force tests on the (15) students at ten o'clock in the morning on Monday, 20/1/2025 in the inner hall of the Faculty of Physical Education and Sport Sciences.

Tribal video photography.

The researcher conducted the video photography on Tuesday, 21/1/2026 at ten o'clock in the morning in the outdoor playground of the Faculty of Physical Education and Sport Sciences, and the researcher used (2) cameras in the experiment, and the cameras were placed on a tripod and fixed at a height of (1.30 cm) from the focus of the camera lens to the ground, where the first camera was at a distance of (6 m) from the elevation plate and the second at a distance of (10 m), and one of the cameras was filming in front and the second on the sides.

Pre-Tests:

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The researcher and the assistant team carried out the pre-tests on (22/1/2025) on Wednesday on the research sample before starting the implementation of the training curriculum, as the (explosive power of the feet and arms) was tested and the long jump was tested on Thursday, 23/1/2025.

Proposed Training Program for Developing Explosive Power

Since the research problem focuses on identifying the effect of **pyramid-style weight training** on the development of explosive power and the improvement of some biokinematic variables and performance, the researcher followed the following steps in designing the proposed training program:

- Determining the maximum strength of the leg and arm muscles by identifying the maximum weight that could be lifted once (one-repetition maximum – 1RM) prior to implementing the training program.
- Determining 40% of the one-repetition maximum (1RM) for both leg and arm muscles for each participant before starting the implementation of the training program.
- Determining the number of repetitions and sets according to the ascending and descending (pyramid) training method, in order to define the training loads in terms of repetitions and sets.
- The implementation of the proposed training program began on January 26, 2025, and continued until March 26, 2025.
- The application of the training program lasted 12 weeks, at a rate of three training sessions per week (Sunday, Tuesday, and Thursday), repeated with the same sets and repetitions until adaptation to the training load was achieved. The duration of each training session was 20 minutes, and the total number of training sessions reached 36 sessions, with a total training time of 720 minutes.

Dimensional explosive force tests.

The post-explosive strength tests of the research sample were conducted at ten o'clock in the morning on Thursday, 27/3/2025, and the researcher was keen to provide the same place and conditions with the use of the same devices, tools, sequence of tests, measures, and the work team used in the pre-physical tests.

Statistical Methods

The researcher used the following statistical methods (Al-Obaidi, 1996, pp. 101, 157, 310) to test the research hypotheses:

- Arithmetic Mean
- Standard Deviation
- Paired Samples t-test

Results

Presentation, Analysis, and Discussion of Results

Presentation, Analysis, and Discussion of Explosive Power Results

Table 1: Shows the arithmetic means, standard deviations, and calculated t-values for the explosive power tests of the legs and arms between the pre-test and post-test measurements.

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Variables	Unit	Pre-test		Post-test		Mean Differences	SD of Differences	Error of Differences	T	Sig
		M	SD	M	SD					
Vertical jump from standing (legs)	Cm	2.08	0.10	2.19	0.05	0.115	0.090	0.023	4.92	0.000
Two-hand medicine ball throw (2 kg) (arms)	M	4.58	0.46	4.99	0.40	0.413	0.134	0.034	11.91	0.000

(*) Significant at the level of (0.05) with a degree of freedom (n − 1 = 14).

By presenting the results of the explosive force in Table (1) above, it is clear that there are significant differences between the results of the pre- and post-tests and in favor of the post-test for both the muscles of the legs and arms. The researcher attributes the reason for this to the fact that the training curriculum that includes weight training in a pyramid method led to the development of explosive power, taking into account that it is not a condition for the development of explosive power that the weight lifting should be explosive, as "when lifting weight explosively, the load falls on the muscle during the first part of the movement and stops in the last part of it, and the need for muscle tension is actually reduced and the development of strength decreases because the increase in size and strength is related to the amount of tension generated by the muscle" (Alwan, 2007, Page 89), i.e., "the use of high movement speed when strength training does not develop strength more than slow training speed" (Alwan, 2007, p. 86), and the form of exercises used in the training curriculum using different resistances had a direct impact on the service of the working muscles, as "the process of overcoming a resistance by performing a certain technical movement and accomplishing it as quickly or as long as possible is achieved in the service of explosive force" (Sabri, 1980, p. 20). Thus, it can be said that weight training in the pyramid method contributed to the development of the explosive power of the muscles of the legs and arms, and thus the first hypothesis of the research was achieved.

Presentation, Analysis, and Discussion of Biokinematic Variables Results of the Long Jump for Pre- and Post-Tests

In order to identify the extent of development in some biokinematic variables during the technical performance phases after applying the proposed training program, the results of these variables for the pre- and post-tests were presented in Table (2), as follows.

Table 2: Shows the arithmetic means, standard deviations, and calculated t-values for the selected biokinematic variables of the research for the pre- and post-tests.

Variables	Unit	Pre-test		Post-test		Mean Differences	SD of Differences	Error of Differences	T	Sig
		M	SD	M	SD					
Trunk inclination angle during approach	Degree	16.33	14.60	1.23	0.985	1.73	1.27	0.330	5.24	0.000
Trunk inclinatio	Degree	25.66	1.98	24.00	1.36	1.66	0.975	0.251	6.61	0.000

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n angle during take-off										
Hip height	Cm	93.73	4.23	112.27	4.66	-18.53	6.37	1.64	11.25	0.000
Take-off time	Sec	17.80	0.941	16.80	0.676	1.00	1.00	0.258	3.87	0.002

(*) Significant at the level of (0.05) with degrees of freedom (n − 1 = 14).

From Table (2) we can see that all the bio kinematic variables of the long jump effectiveness were significant because the value of its significance level was less than the value shown in the table above, and we will explain the reasons for these differences in the discussions below:

A- **The angle of the inclination of the trunk during approaching.**

The reason for the significant difference in this variable is due to the development of the explosive power of the legs through weight training in a pyramid method, which led to an increase in the speed of moving the legs to the rise plate and thus affected the angle of the inclination of the torso during approaching, as it is necessary to "work on increasing the speed of moving the legs to the jumping board in order for the two legs to precede the center of gravity of the body at the moment of touching the legs" (Lazm, 1987, p. 70) and this is what happened in the post-test.

B- **The angle of the inclination of the trunk during getting up.**

The researcher attributes the significance of the differences here as a reaction to the improvement of the angle that he accepted, as well as the increase in the development of explosive power helped to improve the striking of the take-off plate, and this works to convert the horizontal speed gained from the approximate run into a vertical speed during the jumping process to achieve the first flight. It must also be "the position of the body while taking the final thrust on the tilt plate (10-15◦) (Saudi, 19888, p. 210).

C- **C. Hip elevation during the stroke of the rise plate.**

The apparent improvement in hip height during the rise plate is due to the improvement in the explosive muscle strength of the legs through weight training in a pyramidal manner, as "one of the requirements of jumping movements is that the muscles of the legs are strong, and that the athlete can perform jumps from the double rise after the approximate run" (Al-Deen, 1994, p. 326), and the reason is also due to the increase in the strength of the explosive arms muscles, which helped to move the center of gravity of the body to a higher level through "It is preferable to raise to the maximum possible height in the case of the arms being weighted forward high in the moment before launching, as the movements of the body parts lead to a change in the position of the body's center of gravity that is supposed to be at the level of the pelvis in the case of normal standing, so the upward movement of the arms leads to the shifting of the center of gravity of the body in their direction to a few centimeters, which eventually leads to its height before the start of the launch", and this is what happened. In the post-test.

D- **D. The time of striking the wake-up board.**

The researcher attributes the significant difference in this variable to the proposed training method to develop the explosive power of the muscles of the legs and arms, which made a difference in them, and then led to a reduction in the time taken to hit the rise plate through the speed of striking it and the speed in the swinging of the arms, which leads to a speed in leaving the rise plate and then reducing the time spent on hitting the rise plate.

Conclusions

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After processing the results using appropriate statistical methods, the researchers reached the following conclusions:

1. Weight training using the **pyramid method** leads to the development of **explosive power**.
2. The development of explosive power contributes to the improvement of some **biokinematic variables** of the event.
3. The development of explosive power through pyramid weight training resulted in an improvement in the **technical performance** of the event.

Recommendations

1. It is recommended to generalize the proposed training program, which includes pyramid weight training, for the development of explosive power in this event.
2. Coaches and specialists should be encouraged to use modern scientific methods and technologies for analyzing various sports events.
3. Conducting similar studies using different training methods and on different skills and sports events is recommended.

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