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Article

The Impact of Utilizing an Auxiliary Device During Muscle Stretching Exercises on the Performance of Para Powerlifting, Positive Mechanical Work, and Torso Flexibility

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Abstract: This study is to identify the impact of utilizing an auxiliary device during muscle stretching exercises on the performance of Para powerlifting, positive mechanical work, and torso flexibility. The experimental method in a one-group manner with a pre- and post-test has been used. The research community is the weightlifting team athletes in the Iraqi National Paralympic Committee. They are (8) athletes, from various weight categories, and aged (20-35) years. The average calculation of their weight and deviations was (68.92 ± 16.12), and the average calculation of their length and deviations was (71.22 ± 9.47). As for field research procedures, muscle stretching exercises have been conducted with an auxiliary device. The device will help by giving high flexibility to the torso, which in turn enables the athlete to increase the height of the chest while performing the lift. The training took place over a (6) week period, with (4) training units per week. The most important conclusions reached by the Researcher are: muscle stretching exercises are done using an auxiliary device have improved performance by reducing the lifting distance as a result of increasing torso flexibility and reducing positive mechanical work.

Keywords: Muscle Stretching, Auxiliary Device, Torso Flexibility, Positive Mechanical Work and Para powerlifting

1. Introduction

Para powerlifting is an individual sport that concerns athletes with mobility disabilities and is characterized by muscular strength and will by lifting high weights. It is one of the events that has had great development in the field of the Paralympic Games due to the records it has achieved in global and continental competitions. Which has increased the interest of developed countries in exerting their utmost efforts to care for disabled athletes, train them, employ them, and participate in cultural, recreational, and sporting activities in many bodies, ministries, and institutions. As one argues, "Disabled sports are the ideal means for disabled athletes to return to their communities and succeed as productive members of society" (9:22). The matter goes beyond that and becomes the sport of weightlifting, not only as an integration with society or for entertainment purposes, but rather as a competitive sport looking for achievements and breaking records. This does not come out of nowhere, but rather as a result of studies and research in all fields, whether physical, physiological, psychological, or mechanical, whose goal is to bring athletes to the highest level in performing this lift. Here, there must be a focus on building training

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(https://creativecommons.org/lice nses/by/4.0/) curricula and introducing devices and means that help athletes secure achievements. Para powerlifting is one of the sports that has a large share in the prosperity of Paralympic sports as a result of strong competitions and lifting high weights. Adam Z. Arthur G et al. point out that "however, it is one of the individual sports that highlights the strength of the athlete, is practiced by both sexes, and can be practiced in a sound and safe way for those who meet all the necessary standards in accordance with the rules of the International Paralympic Committee for weightlifting. Qualified athletes compete, but in different weight categories. There are 10 different categories according to the athlete's mass, and athletes participate in them according to the type of disability. These include weakness in muscle lengthening, such as muscle atrophy in the lower extremities, movement problems, disability of the lower extremities, difference in leg length, dwarfism, muscle tension, ataxia, and stiffness" (8:12). Through the experience of one of the Researcher, who is a certified trainer in the Central Federation of Olympic Weightlifting in Iraq, he found that the research problem lies in reducing the level of the height of the weight during lifting after fixing it on the chest, and this reduction of the height reduces the mechanical work done and thus is economical in the effort expended, which gives us good results. For this reason, the Researcher decided to use an aid that helps the athlete arch the back well, which increases the height of the chest and reduces the height of the weight. These very small steps are important in developing lifts as well as breaking records. Therefore, the Researcher decided to delve into this study by developing muscle stretching exercises are done using an auxiliary device to improve torso flexibility as well as positive mechanical work in order to develop performance in Para powerlifting. The primary goal is to identify the impact of utilizing an auxiliary device during muscle stretching exercises on the performance of Para powerlifting, positive mechanical work, and torso flexibility. While the research hypothesis is that muscle stretching exercises are done using an auxiliary device have a significant effect on torso flexibility, positive mechanical work, and the performance of Para powerlifting.

2. Materials and Methods

The experimental method in a one-group manner has been used to meet the given problem. The research community is the weightlifting team athletes in the Iraqi National Paralympic Committee. They are (8) athletes, from various weight categories, and aged (20-35) years. The average calculation of their weight and deviations was (68.92 ± 16.12), and the average calculation of their length and deviations was (71.22 ± 9.47). Relative achievement(•) is used as a variable to separate the effect of body mass from the experimental variable, and the research sample followed muscle stretching exercises while using the assistance method developed by the Researcher.

Independent variable:

The muscle stretching exercises are done using an auxiliary device: After reviewing sports training and weightlifting sources and books for the disabled, in addition to the personal experience of one of the Researcher, special exercises for muscle stretching are done using an auxiliary device are prepared. Taking into account the scientific components of the training load, grading the exercises from easy to difficult, and increasing the height of the chest level through the means. The training continued for (8) weeks at a rate of (4) units per week, bringing the total number of training units to (32) for the period from 6/3/2023 until 7/27/2023.

The auxiliary device: it consists of two pieces of strong plastic, the first of which is a base and graduated to three steps according to height, and the second one is placed above the base and fixed in designated places on one side, and the other side is controlled by the trainer on which step it is placed as shown in figure (1).







Figure (1). shows the auxiliary device

Dependent variables:

a. Test name: Prone position, extending the torso backwards **The objective of the test**: is to measure the flexibility of the spine.

Testing tools: tape measure divided into centimeters.

Test specifications: from the prone position, fully extending the legs while holding them and fixing the seat with the help of a colleague; extending the torso as far back as possible; measuring the distance from ground level and below the chin, calculated in centimeters to indicate flexibility.

Evaluation: Distance Flexibility Index (6: 178)

b. Positive Mechanical Work:

It is the vertical distance raised from the moment of fixation on the chest to the highest rise and fixation in the bench-press competition. Then it is extracted by photographing the athlete and then analyzing the image using the motion analysis program (Kinovea) to extract the distance. As for force, it is extracted through Newton's second law (acceleration), which is that "force = mass x acceleration" (1:98), and the mass represents the mass of the lifted weight and the ground acceleration (9.8 m/s). After that, the law of work is applied, which is "work = force x distance" (4: 115). Therefore, the law is as follows: work = mass x acceleration x distance.





Figure (2). shows kinetic analysis method

c. Para powerlifting:

The achievement test is conducted for the Para powerlifting national team players in the training hall of the Weightlifting Federation in the capital, Baghdad. Each athlete is given three attempts as per international law, and the highest weight raised is recorded for the successful attempt.

Main experience:

The pre-test for the variables of torso flexibility and positive work, as well as the para weightlifting achievement, was conducted on Wednesday, May 31, 2023, at four o'clock in the afternoon, at the Ealan Abdul Hussein Hall in the city of Diwaniyah, on the research sample. Then, muscle stretching exercises were given using an auxiliary device for (32) training units over a period of two months and at a rate of (4) training units per week to the research sample to determine the extent of the effect of the exercises given by the researcher on the lifters. After completing the training, a post-test was conducted on the variables of torso flexibility and positive work, as well as the Para powerlifting achievement, on Sunday, 7/30/2023, at four o'clock in the afternoon, at the Ealan Abdul Hussein Hall in the city of Diwaniyah, on the research sample.

3. Results

Displaying the statistical description of the sample data in the study variables:

Variables	measuring unit	arithmetic mean	standard deviation	Median	highest value	Lowest value	Skewness
Flexibility	cm	37.00	2.27	36.50	40.00	35.00	0.39
Work	joule	68140.63	10511.32	67375.00	86240.00	53900.00	0.42
Achievement	kg	134.38	21.45	137.50	160.00	100.00	0.39
	relative	1.65	0.10	1.66	1.77	1.50	0.39

Table (1) Shows the statistical description of the sample data in the study variables forthe research sample

Displaying the results of the research sample level in the pre-test:

Table (2). Shows the level of the research sample in the pre-test

Variables	measuring unit	arithmetic mean	standard deviation	Statistical Hypothesis	Percentage	
Flexibility	Cm	37.00	2.27	39.27	25%	
Work	Joule	68140.63	10511.32	78651.95	12.5%	
Achievement	Kg	134.38	21.45	155.83	12.5%	
	Relative	1.65	0.10	1.75	25%	

Presenting the results of the differences in testing the variables of torso flexibility, positive work, and achievement in the pre- and post-tests of the research sample:

Table (3). Shows the differences in the study variables in the pre- and post-tests of the research sample

					1		
Variables		Pretest		Posttest			
	measuring unit	mean	deviation	mean	deviation	Calculated T value	Sig
Flexibility	cm	37.00	2.27	55.13	4.70	12.77	0.00
Work	joule	68140.63	10511.32	59535.00	4559.14	3.35	0,01
Achievement	kg	134.38	21.45	151.88	11.63	3.78	0.01
	relative	1.65	0.10	1.90	0.29	2.98	0,02

Variables	measuring unit	arithmetic mean	standard deviation	Statistical Hypothesis	Percentage
Flexibility	Cm	55.13	4.70	59.83	37.5%
Work	Joule	59535.00	4559.14	64094.14	37.5%
Achievement	Kg	151.88	11.63	163.51	37.5%
	Relative	1.90	0.29	2.19	12.5%

Displaying the results of the research sample level in the post-test: Table (4). It shows the level of the research sample in the post-test

4. Discussion

Table (1) shows the statistical description of the research sample in terms of the arithmetic mean, standard deviation, median, highest value, and lowest value. As well as the skewness coefficient, which shows that the sample is normally distributed, where the value of the skewness coefficient is limited to (± 1) . Tables (2, 4) represent determining the level of the research sample members in the pre- and post-tests using (the hypothetical mean), which is the sum of the arithmetic mean with the standard deviation for each variable. The raw values whose value is higher than the hypothetical mean have a more advanced level. The percentage was used to determine the percentage of the most developed individuals using (the percentage rule: part/whole x 100). This showed a significant development in the studied variables (flexibility, work, and achievement). A noticeable development through the extracted percentages, except for relative achievement. This indicates the significant impact of stretching exercises using the auxiliary device. Table (3) shows that the significant differences in the variables (torso flexibility, mechanical work, and performance). The relative achievement test was conducted to eliminate the effect of body mass, and thus gives an accurate reading of the extent of development in Para powerlifting performance. The Researcher attribute this to the muscle stretching exercises using the auxiliary device used during the training sessions for the lifters, and the improvement these exercises contained in the flexibility of the torso as a result of the use of the auxiliary device, as it gives great flexibility to the back muscles, which helped the lifters increase the height of the chest level above the surface of the bench and thus reduced the distance raised. For weight, as increasing the flexibility of the torso is an urgent necessity in increasing the physical ability of the lifter. This is because "Coordination within and between muscles helps increase the speed of movement, as when coordinated muscles work, they make their efforts to overcome external resistance more quickly" (2:526). Therefore, the Researcher took care that their training was consistent with the nature of the technical performance of the lift, and this is consistent with "Using specialized training according to the practiced activity (specificity of training), which results in improving the aspects of the skill" (3:178).

As for the positive mechanical work variable, as it seen in the post-test decreased proportionately with the increase in the weight lifted, which is a positive condition for the lifter because it reduced the effort expended while performing the lift (economical work). This is because "Work is defined as a force that works against a resistance multiplied by the displacement of the resistance in the direction of the force. Work = force Includes supporting muscle action" (5: 82).

The significant improvement in the weightlifting achievement variable was a direct effect of the exercises using the auxiliary devices, which benefited the development of technical performance. As well as developing the muscles that oppose the chest muscles while performing weightlifting due to increased muscle lengthening, which gave high flexibility to the back, as well as economy of effort as a result of reducing the distance raised, which reduced the mechanical work on the lifter. This had an effective and fundamental role in developing the achievement variable and increasing the weights lifted. That is, "Those working in the field of sports training agree that the physical and physiological adaptations that are achieved are the result of the individual athlete undergoing organized and codified exercises that are built in an accurate scientific manner that can raise the level of the training status of the individual athlete and help him reach good achievements" (7: 48).

5. Conclusion

Based on the research conducted, it can be concluded that the use of assistive devices during muscle stretching exercises has a significant positive impact on torso flexibility, reduction of positive mechanical work, and increased performance in weight lifting for para-athletes. These aids allow for increased flexibility of the back muscles which in turn increases the height of the chest when performing the lift, reduces the distance of the lift, and reduces the mechanical work required. These results indicate that muscle stretching exercises using assistive devices can increase the performance efficiency of powerlifting athletes, which is reflected in an increase in the amount of weight lifted and improvements in overall technical performance.

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