

## **RESISTANCE TRAINING IN THE WEIGHT OF DIFFERENT BODY PARTS AND THEIR EFFECT ON SOME MECHANICAL BIO VARIABLES AND THE ACHIEVEMENT OF THE HIGH JUMP FOR YOUNG PEOPLE**

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### **Abstract**

The study aims to identify the effect of training with weight added to different parts of the body in improving the biomechanical variables of the last step and upgrading the high jump for young people, the research was applied to one of the elite high jumpers for young people, and video imaging and kinetic analysis were conducted to extract the variables under study, and then the jumper underwent For the proposed exercises by 3 training units per week for a period of (8) weeks, in which emphasis was placed on improving the rotational forces (moments) of these parts, and then the post-tests were conducted, and the researcher concluded that the exercises applied and the added weights for all parts of the body (leg, thigh, trunk, and arms) led to a significant improvement in the values of all variables arranged by the last step of approach and not Upgrading and flying and passing the crossbar and achievement of the research sample through the improvement of the absolute values of all these variables by post-test.

### **Introduction:**

Weight resistance exercises cause the muscles to contract and increase their mobilization against external resistance to increase the harmony between the weight used (as resistance) and the strength and capacity of the working muscles whose duty is to perform the angular movements of these parts and increase their ability to produce muscular moments, which are related to the stages of performance, especially the last step and the rise, there are types Various weights exercises can be performed by selecting (torso weights, thighs, legs, hand weights, and rubber bands).

The ability to jump vertically is considered one of the most important physical abilities to improve the height of the vertical (vertical) jump. Achievement in this jump is linked to the effective participation of angular work in the muscles contributing to the extension of all joints, especially the moment of ascent and push. Among the most important training methods that serve motor work according to the goal of performance are weight training added according to each part of the body, in addition to training rubber ropes during skill training, as these exercises

give a direct effect in improving angular muscle work without limits in movement, such as those shed when training Strength with weights (general weights), and the researcher believes that these exercises did not receive much attention, as the use of added weights in proportion to the weight of each part of the body, as an effective training method compared to daily training or plyometric exercises, did not constitute a large space in the high jumper exercises according to the illiteracy of the joints Work and the nature of the movement when rising that performs on more than three axes of rotation that one and each axis requires angular muscle work that integrates with the muscles of the angular work of the other axes mutually and continuously, the purpose of this study was to provide an overview of jump training with weights added to body parts and variables Associated potential benefits for enhancing biomechanical conditions and high jump achievement.

The results of some studies have indicated that “improving the ability to jump vertically is one of the most desirable goals for athletes, personal trainers, and strength and conditioning coaches” (Argus, Gill, Keogh, Blazevich, & Hopkins, 2011, p. 2221), as well as other studies indicated To "an innovative training concept that uses assistance through elastic ropes or absolute loading of body weight and achieving increased speed may constitute an additional training tool for athletes that can increase starting speed" (Bartolini, et al., 2011, p. 1265).

Another result of some studies that focused on weight training was that "the starting speed increased by up to 30%, with no statistically significant differences between 30% and 40% of the average body weight" (Bobbert, 1996, p. 1407). Another result of the studies is that "the relative reaction force of the man against the ground increases linearly with the increase in the relative strength of the man driving against the body" (HANSON, LEIGH, & MYNARK, 2007, p. 1013). Some studies reported that vertical height increased by more than 2.5 cm as a result of improved cruising speed and accordingly these studies suggested that the use of high-speed motions rather than near-maximal or near-maximal overloading may be more beneficial for improving high-speed performance. There were only two studies reported on the modulus of elasticity of the rubber ropes used. (Tran's study) reported "the modulus of elasticity of their wires to be 100.72 N/m<sup>2</sup> (calculated by dividing the delta force by the length during the rope stretch)" (Tran, et al., 2011, p. 3473). And the study (Markovic et al.) reported that “the modulus of elasticity of the ropes is 2.5 MPa, but they did not indicate the method of their calculation. Since many previous studies did not mention the modulus of elasticity of the ropes, it is difficult to compare the results of the jump measurements accordingly” (Markovic, 2021, p. 368). With the exception of the two studies of (Imachi et al) that used non-athletes, the bungee-assisted jumping method showed an increase in jump height and take-off speed. There was no decrease or no changes in peak power. These results show that different levels of assisted jumping will have effects. different jump parameters" (Imachi, 1997, p. 507). Overall, “if increasing vertical jump and speed are the desired goal, method-assisted jump training may be more effective than free jump training” (Alkazaly & Altay, 2023, p. 4). Therefore, this study came in order to solve the problem of developing different angular muscle strength during skillful performance by using added weights

for each part of the body according to its angular movement during the last step and ascent, as well as using auxiliary rubber bands when performing in order to improve some biomechanical changes for young high jumpers. This training problem explores to the best of the researcher's knowledge. Therefore, the research aimed to prepare exercises according to the skillful performance of the high jumper, "with weights added to each part of the body" (Shlash & Alfadly, 2023, p. 341), and on the other hand, exercises using rubber bands, with the aim of improving the biomechanical variables associated with the final step of approaching, Ascending, and achieving this effectiveness.

#### Procedures:

The researcher used the experimental approach by applying one experimental group, as it is the most appropriate approach to the nature of the current research, with the best youth jumper in the high jump in Iraq (2.02 m), at the age of 16 years, with a length of 1.96 m, and with a weight of 80 kg. With a training age of 7.5 years. The researcher used many means of collecting information, such as Arabic and foreign scientific sources, personal interviews, observation, technical analysis, and electronic information network. And I use

1. fast imaging cameras (Casio type, made in China) with a speed of (from 120 images / sec to 1000 images / sec) with a tripod number (2), various measuring tools and a computer (Surface Pro 4 Microsoft). ), for the purpose of kinetic analysis procedures in the "Kinovea" program, number (1).

The biomechanical variables were measured through the use of video imaging and kinetic analysis software. Weight resistance exercises cause the muscles to contract and increase their mobilization against external resistance to increase the harmony between the weight used (as resistance) and the strength and capacity of the working muscles whose duty is to perform the angular movements of these parts and increase their ability to produce muscular moments, which are related to the stages of performance, especially the last step and the rise, there are types. Various weights exercises can be performed by selecting (torso weights, thighs, legs, hand weights, and rubber bands).

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Therefore, this study came in order to solve the problem of developing different angular muscle strength during skillful performance by using added weights for each part of the body according to its angular movement during the last step and ascent, (Kzar & Kadhim, 2020) as well as using auxiliary rubber bands when performing in order to improve some biomechanical changes for young high jumpers. (Ahmed Amer Abdul Hussein, 2020) This training problem explores to the best of the researcher's knowledge. Therefore, the research aimed to prepare exercises according to the skillful performance of the high jumper, "with weights added to each part of the body"

(Shlash & Alfadly, 2023, p. 341), and on the other hand, exercises using rubber bands, with the aim of improving the biomechanical variables associated with the final step of approaching, ascending, and achieving This effectiveness.(jawad kadhim, M., & Mahmood, 2023) procedures: The researcher used the experimental approach by applying one experimental group, as it is the most appropriate approach to the nature of the current research, with the best youth jumper in the high jump in Iraq (2.02 m), at the age of 16 years, with a length of 1.96 m, and with a weight of 80 kg. With a training age of 7.5 years. The researcher used many means of collecting information, such as Arabic and foreign scientific sources, personal interviews, observation, technical analysis, and electronic information network. And I use

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Program, number (1).

The biomechanical variables were measured through the use of video imaging and kinetic analysis software.

## Results and discussion:

Table (1) shows the absolute values of the research sample, as follows:

**Table (1) the results of the biomechanical measurements of the pre and post-tests of the Research sample**

N.	variable	Tribal	Remote	Differences	Preference
1	thrust angle (degrees)	73.5	85.5	12	Post-test
2	Departure angle (degrees)	48	54.5	6.5	Post-test
3	approach angle (degrees)	64.5	77	12.5	Post-test
4	last step time (s)	0.285	0.262	-0.338	Post-test
5	Last step speed (m/s)	7.24	8.325	1.085	Post-test
6	Cruising speed	6.06	6.21	0.15	Post-test
7	Maximum height msg moment of thrust (m)	1.12	1.23	0.11	Post-test

8	Height msg above the crossbar at the moment of traversal (m)	0.025	0.045	0.02	Post-test
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The results of the post-measurements of the biomechanical variables of the research sample improved compared to the pre-measurement values, and this was the result of the main effects after the training of added weights and rubber bands, which took place for a period of 6 weeks.

The exercises had a clear effect on the ability to jump, the increase in muscular power and the torques of the muscles of the working body parts during the moment of ascent for the research sample, and recent studies confirmed that these exercises also had a "positive effect on modifying running performance and increasing the production of force during running" (Vuk, Goran, & Slobodan, 2012, p. 142), these results were consistent with strength training with added weights according to the skillful performance adopted by the researcher according to the principle of levers (power gain and speed gain) so he worked to increase muscle activation and mobilization by using added weights,(Hussein, yasir, & Abdulazeen, 2022) which positively affected the activity of the device Nervous and muscular,(Kadhim, 2012) and thus clearly influenced the development of angular strength of different parts of the body and extreme ability.(Sabbar et al., 2023) It has been suggested that "strength training using additive weights is associated with maximal force generation without muscle hypertrophy, attributable to neuroadaptation" (Ross, et al., 2009, p. 389). This is consistent with our results. Given that no changes were observed in body weight, fat-free mass, and BMI, we hypothesized that "the improvement in maximal strength is likely due to neural adaptations such as recruitment of motor units and an increase in momentary impulse" (Upton, 2011, p. .2649).(Jawad, M., & Jabbar Shinen, 2016)

As for the improvement of the rest of the biomechanical variables, the researcher explains it as follows:

The angles of approaching and pushing (getting up) have developed for the research sample, as the exercises have enabled the research sample to feel the need to correct these angles while anchoring and to enhance the sense of the path of the body's center of gravity in a way that secures a vertical launch as much as possible and helps the athlete focus on applying force at the moment of pushing, which resulted in an improvement These angles,(Ahmed Fadhil Farhan Mohammed Jawad Kadhim, 2016) as confirmed (Sheppard and others) that "the instantaneous launch velocity increases with the greater the force that can be obtained by taking the appropriate position for the push)" (Sheppard, et al., 2011).(Mohameed, L., & Mohameed, 2011)

The researcher believes that lengthening the field of propulsion in the vertical direction is an attempt to increase the trajectory of the body's center of gravity and increase the ability of the muscles to generate the appropriate speed, because the starting speed is linked to the rate of force exerted in the shortest time and passing from the center of the body's gravity. Where he indicates that “the hip is clearly prepared, especially in the last two steps of approaching speed” (PARADISIS & COOKE, 2006, p. 770), with what is consistent with achieving the goal in motor performance, (Easa et al., 2022) which is to achieve an effective, strong, rapid and appropriate extension that ensures the transfer of the center of gravity. The body is in accordance with the correct path for it to perform the movement of getting up and flying in the appropriate automatic manner to ensure the achievement of the achievement, (Mondher, H. A., & Khalaf, 2023) which is obtaining the highest possible vertical height, as the statistical results indicate an improvement in the speed of the last step (Raed, H., & Laith, 2022). As “the angles of approach and push have a direct relationship with the position that the body takes at the moment the foot touches the ground, and whenever the value of this angle is large, this indicates a decrease in the resistive torque of the center of gravity of the body, (Al-frejawi, A., & Adnan, 2023) and this in turn causes the lowest amount of decreasing body speed at the moment of getting up or the moment of pushing for effective rise.” and the highest starting speed” (Nuzzo, et al., 2010, p. 1272).

The upgrading and weighted stages require mastery of the technical performance for long periods in order for the complete interdependence of the jumping process to continue and the automatic control of the rest of the technical stages of jumping (Mohammed, D., & Jalal, 2020). Therefore, the auxiliary means that the researcher used on the research sample improved the value of the starting angle. Studies indicate that “they are jumping and jumping exercises performed in different forms and are accompanied by activities carried out by the muscles by eccentric and central contraction in order to develop muscle strength and the ability of the athlete’s reaction” (Ebben, Davies, & Clewien, 2008, p. 899). That the penultimate step has become one of the main reasons for improving the level of achievement by adjusting its own rhythm that prepares the jumper to make an effective rise and achieve a vertical path for the center of gravity and good for the moment of departure to pass the bar, and the proposed exercises helped to improve the performance of the last step and enhance the feeling and sense of the required strength. The final push must be commensurate with the rapid and instantaneous motor action at this stage (Mousa, A. M., & Kadhim, 2023). (Mahmood et al., 2023) The current study focused on the neuromuscular adaptation mechanisms resulting from sensorimotor training, weight training and plyometric training in developing the work of neuromotor cells, which are directly related to muscle fibers. In view of the direct dependence of the functional characteristics of the motor units on the firing feature of the working motor cells, (Fadel et al., 2021) (Yaseen & Alrawi, 2021) it was necessary to separate the different adaptive responses of the neuromuscular system to training according to the different training models, and this is indicated in some studies that “it must be emphasized that the length of the last step is appropriate. In order to ensure that its speed is not reduced, which must be commensurate with the angles of ascent and propulsion for the high jumper” (Cormie, CAULLEY, & BRIDE, 2007),

and in this regard, studies also indicate that “the wisdom of the length of the penultimate step is to prepare the center of gravity so that it is lower What can behave the upward undulating motion during the rise” (Ebben W. P., 2008, p. 90).(Mohameed, O., & Mohameed, 2017)

And the studies add that “the nervous-muscular system adapts to a specific performance time, and jumpers can change the advancement strategy in the future to depend more on speed, and that the physiological adaptation to speed in jumping takes place with exercises similar to motor performance” (Kawamori & Haff, 2004, p. 679).(Sami, F., & Mohameed, 2016). This means that the proposed exercises and the aids used by the researcher had a clear effect on a noticeable increase in the rate of speed when performing the last step, which led to improving the level of performance and achievement and developing them in the sample.

Studies indicate that there is a noticeable increase in the rate of this speed with the penultimate step, and it reached an average rate among the sample of his study.

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