



The effect of rebound strength training on the values of some biomechanical variables of the skill of backward crushing volleyball for youth

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ABSTRACT

The skill of hitting the back crush is one of the offensive skills that have an effective and clear role in resolving the points of play, so workers in this field resort to raising the level of efficiency of the players in their performance and thus raising the level of technical performance of the team through the diversity of offensive skill performance by overwhelming beating from different playing areas, which facilitates the process of deceiving the opposing team's defenses from the field, and thus points can be obtained easily, and in order to achieve the above, it is necessary to use exercises commensurate with the development of Different weaknesses of the players, so the researcher resorted to the use of rebound strength exercises on some parts of the body.

The researcher noted that the rebound strength training did not take the required applied space within the coaches' curricula for the skill of beating the back crush and there is a lack of clarity in the possibility of achieving and developing physical capabilities associated with all mechanical conditions, as the study aimed to identify the impact of rebound force training in developing the values of some biomechanical variables of the skill of beating the back crushing volleyball for the research group.

The researcher assumes in this research that there are statistically significant differences between the pre- and post-measurements in the values of some biomechanical variables of the skill of beating the back crush volleyball for the research sample.

As for the research methodology, the researcher used the experimental approach with one experimental group to suit the nature of the research, either the research sample was chosen by the researcher in the deliberate method, as it consisted of (10) players from Al-Shatra Volleyball Club, the youth category, either the most important conclusions were that all the exercises that were used to develop muscular strength and biomechanical and anatomical foundations, whether for the muscles of the legs, trunk or arms, increased the efficiency of internal strength, and thus reflected positively on the biomechanical variables of the skill of beating the back crush. The researcher recommended emphasizing the conduct of rebound strength exercises in the manner of interval training and the use of various auxiliary devices and tools, especially for the muscles working in the lower limbs, the muscles of the center and arms, for their importance in achieving integration between the physical and biomechanical side of the skill of beating the back crushing volleyball.

Keywords:

sports training,
rebound force,
sports biomechanics,
volleyball

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1- Definition of the research:

1-1 Introduction to the research and its importance:

Researchers and coaches in volleyball have been interested in training methods and methods aimed at developing the motor performance of motor skills and their main sections that have an impact on the player's skill by relying on sports training that is based on theoretical and applied sciences, which in turn contributed to improving the effectiveness and efficiency of the sports training process, which led to raising the level of technical performance and achieving the best results.

The skill of back-kicking is one of the offensive skills that have an effective and clear role in resolving the points of play, so workers in this field resort to raising the level of efficiency of the players in their performance and thus raising the level of technical performance of the team through the diversity of offensive skill performance by crushing from different playing areas, which facilitates the process of deceiving the opposing team's defenses represented by the back-crushing hit. Thus, points can be obtained easily, and in order to achieve the above, it is necessary to use exercises commensurate with the development of the various weaknesses of the players, so the researcher resorted to the use of rebound strength exercises on some parts of the body, and from here the importance of rebound force is evident after the important and necessary physical capabilities of the player repelling as it maintains the maintenance of a positive motor momentum between the moments of support and payment by switching the rapid muscular work from eccentric muscle contraction to eccentric contraction and thus obtaining An ideal working capacity as a result of the development of instantaneous forces, whether of the muscles of the legs, trunk or arms, increased the efficiency of the internal force represented by the force of muscle contraction, and the strength of the ligaments in producing the force of torque.

Therefore, rebound strength training is one of the multiple methods of plyometric training affecting the development of the elements of strength and speed through the mechanism of action that occurs in the muscles working in the performance of lengthening and shortening, which occurs in short moments of time The muscle lies from the output of maximum force in the least time.

Therefore, the importance of this research came through the development of rebound force using a variety of trainings, especially for these forces, to improve the stage of the last jump and propulsion, which is related to the amounts of the force at the moment of payment and the compatibility of exerting these forces with the position that is supposed to be taken by the feet of the repelling player and

harnessing the acquired linear momentum and transferring it to the arms to ensure the best performance of a crushing hit from the back area. The researcher hopes to add new information in the applied field of sports training science and sports biomechanics and keep pace with the great progress made in the results of volleyball in general and the skill of backstroke in particular for the youth category.

1.2 Research problem:

The efforts made in sports training have achieved a great development in the game of volleyball, and despite that, there are still existing problems associated with the training process that requires scientific solutions that fall on the shoulders of coaches and specialists as well as require the search for modern scientific means and methods that help raise the level of physical performance and skill of players at all levels. The researcher has noted that the rebound strength training did not take the required applied space within the coaches' curricula for the skill of beating the back crush and there is a lack of clarity in the possibility of achieving and developing physical capabilities associated with all mechanical conditions, and the success of the player in the performance of this skill does not depend on the development of physical abilities and skill only, but goes beyond that to take into account the distinctive mechanical aspects of performance and the specifications of the player himself, which allows him to exploit the force according to the mechanical conditions that ensure him not to lose speed and momentum gained until the payment mode and maintain it as much as possible at the moment of launch. It means the performance of movement without delay or the presence of instantaneous deceleration between parts and stages of performance, which leads to the performance of the skill quickly through the integration or transmission of movement between the joints of the body.

The researcher hopes to study this problem to help coaches to identify the shortcomings and weaknesses of the players when performing the skill of beating the back crush volleyball and find ways to develop the physical, mechanical and skill side through the results that the researcher will reach in solving the problem of modest technical performance of the skill of beating the back crush of this skill and provide some scientific solutions.

1.3 Research Objectives:

- 1- Preparing and designing rebound strength training to develop some biomechanical variables of the skill of backward crushing volleyball for the research sample.

2- Identify the effect of rebound strength training in developing the values of some biomechanical variables of the skill of backward crushing volleyball for the research group.

1-4 Research hypotheses:

1- There is a positive effect of rebound strength training to develop the values of some biomechanical variables of the skill of backward crushing volleyball for the research sample.

2- There are statistically significant differences between the pre- and post-measurements in the values of some biomechanical variables for the skill of beating the back crushing volleyball for the research sample.

1.5 Research Areas:

1- Human field: Young players, Shatra Volleyball Club.

2- Time Range: Time period from 3/ 7 /2024 to 5 / 9 /2024.

3- Spatial field: Indoor sports hall in the Specialized Volleyball Center in Dhi Qar Governorate – Shatrah.

2- Research Methodology and Field Procedures:

2.1 Research Methodology:

The researcher used the experimental method, designing one experimental group.

2.2 Research sample:

(10) of the young players of Al-Shatra Sports Club were selected in volleyball deliberately in order to implement the study and achieve its objectives, and Table (1) shows the characteristics of the research sample.

Table 1

Shows the homogeneity of the sample in the variables of height, age, training age, apparent weight and achievement

Coefficient of variation	Standard deviation	Arithmetic mean	characteristics	t
6.214	0.11	1.77	Length (cm)	1
4.484	0.91	20.29	lifetime	2
4.126	0.43	10.42	Training Age (Year)	3
0.917	0.79	86.15	Bulk weight	4

2-3 Devices and tools used:

The researcher used the following devices, tools and means of collecting information:

- Arab and foreign sources.
- Observation and experimentation.
- Tests and measurement.
- International Information Network.
- Strength measuring platform.
- 1 Japanese-made Casio camera.
- Sony Japanese-made camera number (2).
- Kinetic analysis program Kinova.
- and Lockerpro kinetic analysis software.
- Different measurement methods for measuring (distances, weights, lengths).

2.4 Field research procedures

2.4.1 Tests under consideration

2.4.1.1 Rear Crusher Strike Test

Test name: Rear Overwhelming Multiplication Test from Center (1) ⁽¹⁾:

Test purpose : Measurement of the accuracy of the rear overwhelming multiplication of the center (1)

Tools:

- Volleyball court.
- 3 volleyballs.
- Adhesive tape to determine the accuracy areas in the test with dimensions (1.5 x 1.5).
- Tape measure .

Conditions:

- The player performs the skill of crushing the back from the position (1) legally.
- The player performs (5) attempts.

Sign up:

- If the ball falls in square (A) 5 degrees
 - If the ball falls in square (B) 3 degrees
 - If the ball falls inside the shaded area 2 degrees
 - If the ball falls outside the specified area (zero) degree
- Maximum score of testing (25) degrees

2.5 Exploratory experiments:

2.5.1 First exploratory experiment:

The researcher conducted the first exploratory experiment on 3-4 /7/2024, on a sample other than the original research sample, and it was on a sample other than the research sample, namely the young volleyball players, numbering (5) players from clubs north of Dhi Qar Governorate, and the goal of the exploratory experiment was as follows:

- Height of cameras.
- Identify the difficulties and obstacles that will appear during the implementation and conduct of the tests.
- Know when to take the tests and how long this procedure takes.
- The possibility of imaging and analyzing the results of mechanical variables.
- The ability of the sample members to carry out the tests and the extent and suitability for them.
- Identify the devices and tools necessary to carry out the experiment and perform the test.
- The possibility of measuring the power of the device used.
- The total time required by the experiment and introducing the work team to the nature of the experiment and its requirements.
- Identify all the difficulties that the researcher may face during his main experience.

2.5.2 Second exploratory experiment:

The researcher repeated the experiment on the same sample in the first exploratory experiment after a week on 10-11 /7/2024, and the researcher took into account when re-testing the same conditions available in the first experiment in terms of the assistant staff as well as the time of performing the tests for the purpose of finding the stability of the tests as shown in Table (3).

2.5.3 Scientific foundations of tests:

First: Authenticity of the test:

The researcher found the truthfulness of the content after the tests were presented to a group of experienced and specialists, where they confirmed that these tests are honest in their content and the goal for which they were developed.

Second: Stability of the test:

It means "an evaluative criterion for knowledge that is characterized by certainty as well as based on evidence that others can verify" (**Ali Salloum, 2006, p. 28**), when conducting the second test (second attempt) conducted on the research sample for the purpose of extracting the stability of the test. Where the value of the simple correlation coefficient (Pearson) was extracted to indicate the objectivity of this test, as objectivity means the agreement of the opinions of the arbitrators and the results came with indicators indicating that all tests are highly objective.

Third: Objectivity:

The test must have a high degree of objectivity, which is intended to give the test the same results, regardless of the differences of the correctors, assuming that the arbitrators conducting the test are equally competent and qualified" (**Zoukan Obeidat, Abdul Rahman Adas and Kayed Abdul Hafiq, 1992, 158**), and the test is objective "being constant" as Raysan Khreibit (1989) states that "the higher the coefficient of stability" leads to a rise in the coefficient of objectivity and vice versa" (**Raysan Khreibit, 1989, p. 22**).

Table (3)

Coefficient of honesty, consistency and objectivity of the tests

Objectivity	constancy	Honesty	auditions	t
0.96	0.92	0.95	Accuracy test for the skill of backward crushing volleyball	1

2.6 Pre-testing and measurement:

The researcher conducted the pre-tests of the research group on 15/2/2023 on the indoor sports hall at the Specialized Volleyball Center in Dhi Qar Governorate - Shatrah. All 10 players attended the research sample and the following tests were performed:

Table (4)

Tests used in research

Unit of measurement	audition	t
degree	Accuracy test for the skill of backward crushing volleyball	1

The researcher proved all other conditions of the test in terms of place, time, method and climate so that the same or similar conditions could be created when conducting post-tests.

2-7 Rebound strength training applied by the research group:

The researcher prepared the proposed training program according to the scientific foundations by reviewing some specialized scientific references and previous studies, and the exercises were carried out according to the following:

Table 5
Planning and implementation of functional strength training

8 weeks	Number of training weeks
Rebound Force – Plyometric Training	Objective of the period
35 – 45 minutes	Unit time
Medium load – high load – maximum load	Number of units per week
90:85 %	Training loads
High intensity	Training method
(6-8)	Number of groups

Here are some observations about the training curriculum:

1. Respondents trained three times a week on Saturdays, Mondays, and Wednesdays.

2. The researcher relied on the principle of increasing the load, which aims to "displace the level of capacity limits of the individual and in an orderly manner without entering training in the phenomenon of overload (**Essam Abdel Khaleq, 1994, p. 79**).
3. The researcher used the principle of ripple training load (dynamic) in the small and medium courses for rebound strength training plyometric (3-1) as Abu Ela 1997 mentions "The use of the principle of ripple leads to better results and ripple means the exchange of rise and fall by carrying training and not walking at one pace or one level (**Abu Ela Abdel Fattah, 1997, p. 17**).
4. The researcher used the high-intensity fungal method.
5. The researcher relied on determining the rest periods between exercises to be sufficient to restore the normal functional state of the player (**Raysan Khreibit Majeed, 1995, p. 565**).

If the researcher is keen when applying rebound strength training, the focus is on strengthening and stability of the center muscles as well as the muscles of the lower extremities of the body, as well as training the center muscles and the muscles of the arms to reach the high training state before conducting the post-tests, taking into account the selection of exercises based on motor performance time and maximum repetition, to develop rapid strength, as it is a new training trend because it focuses on the development of mobile muscle contraction that combines central and eccentric contractions, which contributes to increasing strength values Muscular and thus maintaining the maintenance of muscular and motor momentum continues until the last minute before breaking the full contact with the ground and with the highest possible efficiency according to the limits of the permissible muscular moments, and the duration of the exercises within the period of preparation for 8 weeks, and by three training units per week The time of one training unit is (35-45 minutes).

2-8 Testing and telemetry:

The researcher conducted the post-tests for his research sample on 15/9/2024 and followed the same method that he followed in the pre-tests, after completing the prescribed period of the experiment, which lasted 8 weeks, and the researcher was keen to find all the conditions for the pre-test and their requirements when conducting the post-test in terms of time, place and test means.

2.9 Statistical means:

The researcher used the statistical program (SPSS) to process the results.

4- Presentation, discussion and analysis of results:

4-1 Presentation and discussion of the results of the differences in the pre- and post-test of the research group:

Table (6)

Shows the values of the differences arithmetic means, standard deviations, calculated (t) value for the vertical distance, biomechanical variables, and the accuracy of the skill of backward overwhelming multiplication of the pre- and post-tests of the research group

Total	Significance level 0.05	t-value	Post-Test		Pre-test		Unit of measurement	Processors Variables	t
			±	Going to	±	Going to			
Moral	0.000	10.668	0.0858	3.659	0.5511	1.8483	m/s	Last step speed	1
Moral	0.000	5.988	0.090	3.48	0.4779	2.57	m/s	Cruising speed	2
Moral	0.000	16.547	1.840	145.5	2.160	127	D	The angle of the knee joint at the moment of absorption	3
Moral	0.000	28.570	1.771	18.291	2.880	53.179	kg.m/s	Momentum changed between credit and payment modes	4

Moral	0.000	10.614	0.0113	1.532	0.0471	1.376	meter	Maximum height of the center of mass of the body	5
Moral	0.000	5.936	99.314	2165.611	172.91	1744.6	Hey you	Maximum force at the moment of final thrust	6
Moral	0.000	3.822	0.0048	0.147	0.0204	0.172	second	Maximum power time	7
Moral	0.003	3.60	1.40	18.62	3.02	14.37	degree	Accuracy of the rear crushing hit skill	8

***At \leq significance level 0.05**

The researcher attributes the reason for this development to the nature of the exercises applied by the research sample according to the muscle groups for performance in the same general direction to perform the skill of beating the back crush, especially the moment of jumping, as rebound strength training was used as a training method for plyometric exercises according to the principle of gradient load and the effect of training load on the muscle groups to be developed, so that it represents a certain system and method in training as the researcher relied on the use of exercises applied by the research sample on the rules and laws derived from the study And the analysis of the training load used, as well as the adaptation processes related to it, where this knowledge is used to focus on raising the training status and modifying the mechanism of motor performance of the skill of back-crushing volleyball in a way that helps players achieve the best accuracy of the back-end crushing volleyball.

As the significant differences that appeared in the variable distance of the last step attributed by the researcher to the nature of rebound strength training, as it worked to increase the efficiency of the working muscle moments and their ability to produce a high level of momentary power during the stages of performance, especially the stage of support and payment and the least contact of the feet with the ground according to the performance of the skill for its effective contribution to making these stages of support and payment linked and smoothly the moment of preparation and ascent to repel the ball in a sound mechanical manner led to reduce the amount of time taken During the fulcrum and rotation stages around the longitudinal axis to achieve the best speed during the last step, it helps the player to exploit the achieved horizontal force vehicle into a large vertical force vehicle that expresses the change in the final speed that the player reaches at the moment of pushing, and the higher the speed of the last step, the faster the starting speed, and this prompted the players to increase the angle of the knee in order to increase the concentration of the force as well as convert it from horizontal direction to vertical direction without stopping or wasting effort The effort of the player and the increase in the acceleration distance, which helped the players to perform the skill smoothly without delay in jumping to face the striking player from the opposing team, as the players, thanks to the rebound strength training, had a high degree of synchronization and appropriate timing with the jump of the attacking player affected the movement of the arms and raised them early to monitor the launch and direction of the ball, as the increase in the angle of the knee joint caused a rise in the center of mass of the body, and the researcher also indicates that the small distance between the point of support and the line The imaginary descending from the center of mass of the body by post-tests and their improvement has allowed the research group to retain the speed gained from approaching, and this was evident through the small change in the amount of momentum between the moments of **support and thrust**, and this means "good performance at the moment of pushing, with great strength and good motor momentum" (Sareeh Abdul Karim, 2007, p. 165), and this is mainly due to the physical strength gained by the players as a result of the application of rebound strength training in the high-intensity interval method, And the development in the explosive power of the muscles of the legs and arms, and this indicates a positive relationship between the level of skill of the rear crusher and the element of special physical fitness and the mechanism of technical performance of the skill of beating the back crusher and the most important in the game of volleyball, and this is confirmed by (Kamal Darwish et al. 1998) quoting (Krestovikov) as he says "The various motor skills of the player are reflected in the

growth of physical qualities, and therefore it becomes easy to master the new motor skills, that is, there is a link between the stock of skills and physical qualities" (**Kamal Darwish, 1998, p. 19**), where "Frank Abdel Karim" asserts that effective force propulsion provides a large vertical height and thus creates the appropriate conditions for the performance of some skills such as... Rear crushing hit" (**Sareeh Abdel Karim, 2007, 45**), this was evident through the development in the values of the maximum force of the final thrust as a result of increasing the efficiency of the internal force represented by the force of muscle contraction, and the strength of the ligaments in producing the force of torque, while the achieved time indicates the extent of the impact of the exercises on the development of force moments and increase them during the preparatory stage of jumping and the player's rush towards the ball, time is one of the mechanical variables that play a major role in the variables of force and speed, and it must focus To achieve its requirements according to the optimal technical performance performance.

4 - Conclusions and recommendations:

4.1 Conclusions:

1. The emergence of a clear development in the level of technical performance of the skill of back-crushing volleyball as a result of the development of rebound force.
2. All the exercises used to develop muscular strength and the biomechanical and anatomical foundations of the muscles of the legs, trunk or arms, increased the efficiency of internal strength, and thus reflected positively on the biomechanical variables of the skill of backward crushing volleyball.
3. Rebound force training developed biomechanical variables (last step speed, starting speed, angle of the knee joint at the moment of absorption, change of momentum between support and push positions, maximum height of the center of mass of the body, maximum force of the moment of final thrust, time to reach maximum force) as a result of the development of force moments of the muscles holding according to some relative angles of performance, especially at the moments of support and thrust).
4. A continuation of the speed between the pivot and the thrust without any hindering forces forcing the player to delay or slow down can occur as the forces of the moment of gravity, weight or friction if the transition from the rear pivot and then full support and then rotation on the front pivot.
5. Retrograde exercises made the research sample members achieve a high level of strength and a very short time in the post-test.

6. Rebound strength training on the research sample achieved a positive effect on the accuracy of the skill of backward crushing volleyball.

4.2 Recommendations:

- 1- Emphasis on conducting rebound strength exercises in the manner of interval training and the use of various devices or auxiliary tools, especially for the muscles working in the lower limbs, center muscles and arms, for their importance in achieving integration between the biomechanical physical aspect of the skill of backward crushing volleyball.
- 2- Emphasis on the application of rebound strength training according to the sections of the back-crushing skill to emphasize the technical aspect and the mechanism of motor performance of the back-end crushing volleyball skill.
- 3- Using other training methods to develop physical abilities, biomechanical indicators and accuracy of the skill of back-end crushing volleyball according to the anatomical axes of movement.
- 4- Conducting complementary studies aimed at studying other biomechanical variables (such as angular kinetic energy, angular power, etc.) and others).
- 5- Conducting similar studies Conducting similar studies on the use of auxiliary tools to enhance the teaching of absolute angles of body parts contribute to the achievement of the main section of performance and by using rebound strength training with these tools to develop the physical and skill side.
- 6- Conducting similar research and studies on different age groups.

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