



Resistance Training Using TRX Bands and Its Effect on Some Biomechanical Variables And The Accuracy of The Offensive Blocking Skill of Youth Volleyball Players

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Abstract

Research Abstract: Blocking is a fundamental skill in volleyball, comparable to the effectiveness of the spike, which has offensive advantages at the net. Furthermore, it has a psychological impact on the attacker, as the attacker's awareness of opposing players restricts their freedom to act decisively when serving. The ball is moved to the appropriate location and distracts him. The importance of this research lies in subjecting the sample to resistance training using TRX bands to verify their suitability and ability to enhance the skills of young players, thus benefiting them and strengthening national teams. The national research problem arose from the researchers' observations of some teams' training sessions. They noted that some coaches' failure to utilize such modern and advanced training methods could negatively impact biomechanical variables, as well as the adjustment of approach steps and proper utilization. The distance between the net and the player is crucial for achieving optimal skill performance. Therefore, the researchers decided to study this problem by developing resistance exercises using TRX bands, which could develop the strength needed by the player to achieve the correct movement path for performing the blocking skill. The offensive, but the research objectives are to prepare resistance exercises using TRX bands for some biomechanical variables and the accuracy of the offensive blocking skill, and to identify the effect of resistance exercises using TRX bands on some biomechanical variables between the pre-test and post-test. To determine the effect of resistance training using TRX bands on the accuracy of the offensive blocking skill between the pre-test and post-test, the researchers used an experimental method with a single group pre-test and post-test. The research population consisted of volleyball players from the specialized center. The study involved (16) players aged 16-18



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years, from whom (8) players were selected to represent the research sample. These 8 players were chosen purposively and represent (50%) of the population. The most important conclusion is that resistance training using TRX bands had a significant impact on developing biomechanical variables among the players. The research sample is based on the fact that these exercises work to develop the ability.

Keywords: Resistance exercises, use of TRX bands, biomechanical variables, accuracy of offensive blocking skill.

1- Introduction to the Research

1-1 Research Introduction and its Importance:

The scientific progress the world is currently witnessing is one of the main reasons for the advancement and improvement of human life through programmed and well-thought-out scientific planning that contributes to achieving human goals. This progress has encompassed all areas of life, including the field of sports, and has... Practical studies and research related to the training process have helped the coach develop his knowledge of the variables that can affect the success of the training process, thus achieving the best athletic results in games that involve skills requiring the participation of a large number of groups. Muscular and require a high degree of strength.

Resistance training is any exercise that causes muscles to contract against external resistance with the expectation of increased strength, tone, mass, and/or endurance. External resistance can be... Resistance bands, your own body weight, sand, water bottles, or any other object can cause muscles to contract.

Resistance training is an important fitness exercise that causes muscles to contract against external resistance, increasing strength, mass, and endurance. While resistance training is generally a safe form of exercise to use during pregnancy, it is recommended to avoid lifting weights overhead or using heavy weights that strain the lower back. Resistance training can provide a way to modify the routine for women's strength training during pregnancy.

The blocking skill is one of the fundamental skills that rivals the most important volleyball skills, such as the effectiveness of the spike, which has offensive advantages at the net, in addition to its psychological impact on the attacker, as the attacker's feeling that a player from the opposing team is involved reduces his freedom of action. In sending the ball to the right place and distracting his attention



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Thus, the importance of the research lies in subjecting the sample to resistance exercises using TRX bands in order to verify their suitability and ability to provide young players with skills and raise their level of skill, which benefits them and supports the national teams.

1-2 Research Problem:

Developing biomechanical variables is the cornerstone in developing the skill ability of volleyball players and one of its main requirements that helps the player and enables him to control the course of the game, especially since its skills depend on strength and speed in hitting the ball and jumping upwards in several directions. Through observing the training of some teams, the researchers noted that the failure of some coaches to utilize such modern and advanced training methods may negatively affect biomechanical variables, as well as the control of approach steps and the correct utilization of the distance between the net. The player needs to achieve optimal skill performance.

Therefore, the researchers decided to study this problem by developing resistance exercises using TRX bands, which could develop the strength the player needs to achieve the correct movement pattern for performing the offensive blocking skill.

1-3 Research Objectives:

- 1- To develop resistance training exercises using TRX bands to assess certain biomechanical variables and the accuracy of the offensive blocking skill.
- 2- To identify the effect of resistance training using TRX bands on certain biomechanical variables between the pre-test and post-test.
- 3- Identifying the effect of resistance training using TRX bands on the accuracy of the offensive blocking skill between the pre-test and post-test.

1-4 Research Hypotheses:

- 1- There are statistically significant differences in some biomechanical variables between the pre-test and post-test, favoring the post-test.
- 2- There are statistically significant differences in the accuracy of the offensive blocking skill between the pre-test and post-test, favoring the post-test.

1-5 Research Areas:



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1-5-1 Human Scope: Players of the Youth Volleyball Specialization Center, aged 16-18 years.

1-5-2 Time Scope: November 1, 2025 – March 15, 2026.

1-5-3 Spatial Scope: The hall of the Youth Volleyball Specialization Center in Dhi Qar, Al-Shatra District.

3- Research Methodology and Field Procedures:

3-1 Research Methodology:

The researchers used the experimental method with a single group approach, including pre-test and post-test, to suit the nature of the problem and to obtain accurate information and results. The experimental method is considered one of the most efficient means of reaching reliable knowledge.

3-2 Research Community and Sample:

The research community included the players of the specialized volleyball center aged 16-18 years, and their number was (16) players. (8) players were selected to represent the research sample, and they were selected purposively and they represent (50%) of the community.

3-3 Sample Homogeneity:

To verify sample homogeneity, the researchers implemented several procedures to control variables, even though the selected sample was from a similar age group. Therefore, statistical methods were used, specifically the arithmetic mean and standard deviation. The coefficient of variation for morphological measurements is used to determine whether or not there is a difference, as illustrated in Table (1).

It was established that the value of the coefficient of variation is less than 30%. Sources indicate that the lower the coefficient of variation, the more homogeneous the sample.



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Table (1)

The homogeneity of the research sample in terms of age, height, and weight is demonstrated using the coefficient of variation, which shows values less than 30%.

on	Morphological Measurements	Unit of Measurement	x	sd	Coefficient of Variation
1	Chronological Age	Month	193	5.69	%2.94
2	Mass	kg	64	6.34	%9.90
3	Height	cm	177	8.25	%4.66

3-4 Methods and Tools Used:

□ Information Gathering Methods:

□ Arabic and foreign sources. □ Observation and analysis. □ Experimentation. □ Testing and measurement.

□ Tools and Equipment Used:

Measuring tape. 8 TRX strips. Medical scale. Whistle. Manual stopwatch. Dell Ci7 laptop (Irish made). Regulation volleyball court. 8 regulation volleyballs.

3-5 Variables and tests used in the research:

First: Biomechanical Variables

Approach Velocity: This is the approach distance covered per unit time, and its unit of measurement is (m/s). It is the ratio of the approach distance, represented by the initial foot movement from the ground to the time it takes to leave the ground (measured after converting the approach distance, which is the distance shown in the The figure below shows the distance between the starting point of the movement and the end of the approach to its natural equivalent (as measured by scale).



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2- The angle of takeoff: This is the angle between the horizontal plane and the line connecting the point of contact of the takeoff foot with the ground to the point of contact of the player's hip joint in the last image before the foot leaves the ground.

3- Maximum height of the object's approximate center of mass: This is the vertical distance between the object's center of mass at the moment of impact and the Earth's surface.

4- Flight speed: This is measured by dividing the distance traveled at the moment of launch by (5) frames per second, and its unit of measurement is (m/s).

5- Total performance speed: This is calculated by dividing the total performance distance by the total performance time (Ahmed Abdul Amir Shabar, 2008).

Second: Testing the Accuracy of the Blocking Skill (Qasim Hassan Hussein et al.; 1990).

- Objective of the test: To measure the accuracy of the blocking skill in volleyball.
- Equipment used: A regulation volleyball court, (5) regulation volleyballs, colored tape to divide the court.

Performance specifications: The test player stands in position (3) in front of the net and at a distance of (50 cm) from the net and in a position ready for the blocking process. The teacher performs the smashing skill from the opposite court and the test player performs the blocking wall skill according to the method agreed upon beforehand.

Performance Requirements:

- Each player has (5) consecutive attempts.
- The smash must be well-executed in each attempt.
- Scoring is based on the ball's landing position as follows:
 - * Center (2) 2 points.
 - * Center (3) 3 points.
 - * Center (4) 2 points.



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* Outside these areas (0) points.

Recording: The player will receive the scores obtained in the five attempts, noting that the maximum score for the test is (15) points.

3-6 Pilot Test

To ensure the accuracy and validity of the research work and to address any obstacles that may arise during the field experiment procedures, the researchers conducted a pilot test on Sunday. On 7/12/2025 at 10:00 AM, a pilot test was conducted on players (outside the sample). The purpose of the pilot test was to identify shortcomings, specifying the location, time, and duration of the test (7:239). The objective of the pilot test was:

1. Preparing and guiding the support team according to the research objectives.
2. Preparing the necessary equipment and tools.
3. Determining the time required for the test.

3-7 Scientific Foundations of the Test:

1. Test Validity:

The researchers presented the test to experts and specialists in the field of training through personal interviews, and they agreed on the validity of the tests, as shown in Table (2).

Table (2) shows the percentage of validity of the research test.

No	Test Name	Number of Experts	Number of Agreed Opinions	Percentage
1	Offensive Wall Block Test	7	7	%100

1- Test Reliability:



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The researchers used the test-retest method to calculate the reliability coefficient, with a time interval of (7) days between the first and second tests. The test-retest method is one of the simplest methods and is characterized by its ability to determine the interval for consistency, since the error associated with the measurement is, fortunately, always greater. This is evident when there is a period of one day or more between the two tests (Ibrahim Ahmed Salama: 1980). The researchers extracted the reliability coefficient using Pearson's correlation coefficient between the results of the first test and the results of the second test, and determined the significance of the correlation. The researcher concluded The tests are highly significant because the (sig) value is $> (0.05)$.

3- Objectivity:

The researchers determined the objectivity coefficient for the offensive block test by calculating the simple correlation coefficient (Pearson correlation coefficient) between the results of the two referees in the first application. The test conducted during the pilot study showed high correlation coefficients, indicating the objectivity of the research test, as shown in Table (3).

Table (3) shows the reliability coefficients of the research tests.

C	Test	Reliability Coefficient	Sig	Objectivity Coefficient	Sig
1	Offensive Wall Block Test	0.93	0.000	0.98	0.000

The correlation coefficient is significant at a significance level $> (0.05)$.

3-8 Field Research Procedures:

3-8-1 Pre-tests of the Research Sample:

The researchers conducted the pre-test and measurement before starting the proposed exercises on Sunday, December 14, 2025, at 10:00 AM. All (6) players in the research sample were present, and their measurements (height, mass, and age)



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were recorded. Then the researchers... The support team conducted an offensive blocking skill test and analyzed the results.

3-8-2 Resistance Exercises Using TRX Bands

To obtain effective exercises, it was necessary to consult modern sources and references in sports training science that would enrich the researchers' understanding. With information to help him design resistance exercises using TRX bands, the researchers prepared the exercises for the research sample, drawing on scientific training principles, scientific sources and references, as well as the opinions of some specialists in the field of training science. The athlete and the game of volleyball.

The training program began on Wednesday, November 24, 2025, and continued until Wednesday, February 18, 2026, for a period of eight weeks, with three training sessions per week (Saturday, Monday, and Wednesday). The program focused on developing and improving lower limb abilities. The research sample was conducted under the supervision of the researchers, the supervisor, and the supporting team.

The following are some clarifications regarding the methodology:

- The training period is two months.
- The training phase that aligns with the methodology is the preparatory phase.
- The number of training units per week is three.
- Total number of training units: 24.
- Training days: Saturday, Monday, Wednesday.
- Submaximal and moderate intensity levels were used.
- The average intensity for the experimental group was calculated to standardize intensity and start with a single starting point.

3-8-3 Post-tests of the research sample:



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The post-test was conducted on the research sample on Saturday, February 22, 2026, after the completion of the methodology application period, which lasted (8) weeks. The researchers ensured that the conditions and procedures followed for the pre-test were in place.

3-9 Statistical Methods:

The researchers used statistical methods that helped in processing the results and testing the research hypotheses through the use of the statistical package (IBM SPSS Statistics 24), which are:

- Arithmetic mean.
- Standard deviation.
- Coefficient of variation.
- Pearson correlation coefficient.
- T-test for paired samples.
- Percentage.

4- Presentation, analysis, and discussion of results:

4-1 Presentation and analysis of pre- and post-test results for the sample

Table (4)

Shows the values of the arithmetic means, standard deviations, and calculated t-value for the pre- and post-tests of the sample.

Physical Abilities	Unit of Measurement	Pre-test		Post-test		t-value	Sig	Result
		x	sd	x	Sd			
Approach Speed	m/s	3.27	0.071	3.98	0.12	5.16	0.000	Significant
Take-off Angle	min	67.12	1.80	71.37	2.32	4.8	0.001	Significant



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Maximum Center of Mass Height	m	1.36	0.042	1.58	0.022	13.10	0.000	Significant
Flight Speed	m/s	2.35	0.12	3.04	0.09	21.03	0.000	Significant
Overall Performance Speed	m/s	2.45	0.072	2.65	0.047	7.40	0.000	Significant
Accuracy of Offensive Wall Block Skill	Degree	8.61	4.46	12.85	6.89	10.25	0.000	Significant

*Significant at a significance level of (0.05)

Table (4) shows the arithmetic means, standard deviations, and calculated t-value between the pre-test and post-test results. The results presented in the table show that the significance level for all values ranged from (0.001) to (0.000). This is less than the significance level of (0.05), indicating the presence of differences. There is a statistically significant difference between the pre-test and post-test for the sample.

4-2 Discussion of Results:

Strength indicators play a fundamental role in achieving offensive blocking skills. The results of these tests showed clear improvement compared to the post-test results of the experimental group, indicating that resistance training using TRX bands, which they used, was beneficial. The researchers found that the training methodology used to develop the biomechanical variables of this group was effective in improving the accuracy of their offensive blocking skills.

The researchers attribute this improvement to the varied resistance exercises using resistance bands. TRX exercises focused on developing arm and leg strength. The goal of the movement task is to produce a rapid torso and then arm motion, allowing the skill to be performed with maximum range and angular speed. This provides the necessary speed at the moment of blocking the ball. Emphasis was placed on performing the exercises correctly. Precise and in accordance with its specific kinetic paths of the body's center of gravity, these exercises were consistent in their form, structure, fluidity, and degree of compatibility with the form and kinetic structure of the blocking skill, thus serving its primary objective. This gave the research sample suitable heights to achieve the highest jump



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distance. Extending the arm when applying the skill for a very short time, and TRX exercises that develop and simulate the skill performance of the blocking wall, where the continuation of applying these exercises was reflected positively on the biomechanical variables in a good and appropriate manner during performance as a natural result of action and reaction between The body's muscles contract eccentrically (as an action) and concentrically (as a reaction), strongly demonstrating the application of Newton's Third Law.

The researchers emphasized the importance of frequencies in the joints and muscles of the legs during exercise. Rhythmic exercises, on the one hand, and on the other hand, the emphasis on increasing the range of motion in these joints during jumping, which means increasing resistance for the legs by increasing their extension (2) when performing resistance exercises using TRX bands. The other principle that was emphasized is the increase in mass The body is subjected to the use of weights, which places a burden on the athlete during strength training.

Resistance exercises using TRX bands, as demonstrated in the research methodology, confirmed that the use of various pulling and pushing exercises affects leg strength and speed during performance. This requires greater effort to move it, and this effort means an increase in the individual's ability to maintain speed as much as possible for outstanding performance, which requires the individual to exert more force to move the body during performance. This means increased force exertion to overcome this resistance, and this increase signifies strength development. The muscular and explosive nature of the jump, along with the positive results in all strength tests and the positive results in the accuracy of the blocking skill of the research sample, which were mentioned in previous sections, indicate that the results in this indicator (accuracy) test should be Statistically significant in favor of the post-test for the experimental group.

Some researchers indicate that the emphasis on strength development and the adoption of exercises related to the motor performance pathways of the blocking skill, which were included in the proposed training curriculum, Researchers have adopted TRX resistance bands for their exercises, which have facilitated the execution of balanced steps, pushing, and controlling body movements during each phase. This has helped coordinate movements according to the body's movement path at every moment of stabilization and pushing in each phase. This led to the development of the necessary propulsion for the working leg joints and



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the achievement of smooth and correct alternating movements for both the pushing and leading legs. This process helped generate an explosive propulsion movement for the legs during performance, thus developing all stages of the performance to achieve The vertical distance during the jump was improved compared to the pre-test.

The researchers believe that resistance training using TRX bands contributed to strengthening the working muscles by activating and mobilizing a greater number of fast-twitch muscle fibers. Improving the muscles that assist contraction and increasing the inhibition of antagonistic muscles (Dirix, A. (and others). 1988). This was confirmed by Qasim Hassan Hussein, who stated that one of the basic methods for developing speed-strength is through strength development. (Qasim Hassan Hussein, 1998) Through resistance training using various TRX bands, strength development occurred in the muscle groups involved in the work at higher intensity than the participants were accustomed to. This stimulated the working muscle groups and subsequently improved performance by increasing explosive power, speed-strength, and endurance. Strength, and this opinion agrees with what Qasim Hassan Hussein and Abdul Ali Nassif indicated, that "the development of speed-strength is achieved in two ways: firstly, by developing muscular strength, and secondly, by increasing muscle contractions" (Qasim Hassan Hussein and Abdul Ali Nassif, 1987), and that coordination within and between muscles helps to increase speed. Movement (Power): When muscles work in a coordinated manner, their efforts combine to overcome external resistance more quickly (Risan Khuraibat, 1997).

5- Conclusions and Recommendations

5-1 Conclusions:

- 1- Resistance training using TRX bands had a significant impact on developing biomechanical variables in the research sample, as these exercises contribute to power development.
- 2- Resistance training using TRX resistance bands with this load undulation resulted in this level of improvement in the accuracy of the offensive blocking skill.



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3- The improvement in the accuracy of the offensive blocking skill among the research participants was evident from the differences in the pre-test and post-test results, with the post-test showing higher accuracy.

4-2 Recommendations:

- 1- Use resistance training with TRX bands, which helps develop biomechanical variables in volleyball players.
- 2- Emphasize the use of resistance training with TRX bands, as they are suitable for these types of skills.
- 3- Using varying weights, intensity, and wave patterns in the load may lead to better results.
- 4- It is essential to use different TRX resistance bands for resistance training and not limit one method to a single technique.
- 5- TRX resistance bands are suitable for different levels of athletes.

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Appendix (1) shows some of the exercises used and explains how to perform them:

- 1- Standing Pull-ups
- 2- Lying Pull-ups
- 3- Single-Leg Lunge
- 4- TRX Push-Up: For chest and shoulder muscles.

5- TRX Row: For back muscles.

6- TRX Squat: For leg muscles.

7- TRX Crunch: For abdominal muscles.

Appendix (2) Example of training units used

Goal	Lower Body Strength Development			Week	First	
Main	Section Duration	24.25 minutes			Training Unit	First
Date	Tuesday, 19/3/2019			Intensity	%80	
No	Exercise Name	Volume		Rest Between	Rest Between Sets	Total Exercise Duration
		Repet ition	Sets			
1	Standing Arm Pull	3 × 6		s 25	s 90	s 485
2	Supine Arm Pull	3 × 6		s 25	s 90	s 485
3	Single-Leg Lunge	3 × 6		s 25	s 90	s 485