# THE EFFECT OF CORRECTIVE EXERCISES ACCORDING TO SOME BIOMECHANICAL VARIABLES TO DEVELOP THE SKILL OF SPIKING IN VOLLEYBALL FOR FEMALE PLAYERS AL-AMANAH SPORTS CLUB

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## Abstract

The purpose of this paper is to preparing special kinetic corrective exercises according to the values of the biomechanical variables of facing (front) spiking in volleyball, and identifying the effect of special exercises in developing the values of biomechanical variables when performing of facing (front) spiking in volleyball. The researcher used the experimental method by designing (the two equal groups), which is consistent with the nature of the research problem, as experimentation is one of the most efficient means to reach reliable knowledge. The researcher identified the community, who are Al-Amanah Sports Club players, who number (20) players in the Premier League for the 2019 season. 16 players were selected, and the researcher divided the sample randomly into two groups, the first (A) experimenting with 8 players, and the second (B) controlling 8 players The experimental variable was introduced using special (mechanical) corrective exercises in the experimental group, and the control group was trained in the usual method followed by the trainer. Before starting to work with the special corrective exercises. One of the most important results reached by the researcher is that: It turns out that the preparatory stage represented by the approach stage directly affects the goal of the skill, as it determines from where and when the player begins to perform the next stage and that any influence in this stage and for any reason leads to a deficiency in the main stage, any biomechanical change at any stage clearly affects the subsequent stage due to the stability of performance determinants, whether it is related to the law of the game on the one hand or in terms of exploiting biomechanical laws on the other hand, and the results in the field of the kinetic analysis showed that the four stages when performing confrontational spiking are effectively affected by three basic variables involved in building the principles of movement in spiking, namely, approach speed, launch angle and peripheral speed of the striking arm through which we can obtain information that can contribute as much as Effective in studying performance details and setting standards that govern it. One of the most important recommendations recommended by the researchers is that: Paying attention to the variables of the stage of advancement by reducing the stopping time and increasing the speed in the final momentum of the movement in the approaching stage so that the maximum potential of the players available can be utilized in achieving the appropriate level according to their abilities, the necessity for those in charge of the training process to be familiar with the rules of kinetic analysis that depend on the basic principles of kinesiology, anatomy, biomechanics and other sciences related to movement and necessity of focusing on the biomechanical laws that basically control each of the four stages of performance through what these values have achieved in terms of moral differences that have effectively contributed to a higher level of performance with less effort.

**Keywords:** Special corrective exercises. Biomechanical variables. Volleyball

## Introduction

Scientific progress is one of the advantages of our present age, as it includes all aspects of life, including the mathematical aspect, which interacted with many natural and human sciences to prepare the player in comprehensive and balanced numbers in preparation for reaching the highest levels in the chosen sports game, and since the preparation of the player cannot be achieved without these sciences, It is necessary to develop modern methods and methods that contribute to the development of all sports, especially the game of volleyball, which requires high physical and skill preparation. Biomechanical analysis in volleyball is research on performance and seeks to study the movement's parts and components to reach their minutes in pursuit of better technical performance. Discover the minutes of errors and work after measuring them to correct them in light of the specific considerations of the performance specifications.

And the importance of using offensive skills in volleyball increases, as they are crucial in achieving points where performance is required to be governed by biomechanical characteristics that are the main determinant of the success of the skill. Spiking the ball through the speed of approaching and the agility of the jump, in addition to the accuracy of directing the ball to the opponent's court and implementing it well by saving effort and achieving the desired goal. The goal of the skill is to score a point or finish playing for the team after performing despite the presence of the opposing team's defensive formations.

Hence the importance of the research, as the researcher sought to study the most important biomechanical variables for the performance of the frontal spiking to reach the variables to achieve the ability to control and control muscular work, and this is done by studying the parts of the skill (approach - rise - spiking - landing) for confrontational hitting and methods to increase the effectiveness of performance in a biomechanical environment, as well as preparing special exercises for skill, as well as knowing the impact of special exercises on achieving ideal performance by exploiting biomechanical principles and laws and saving effort to reach the highest height to hit the ball from the highest point when performing spiking and trying to find solutions A rationale for faulty performance problems by means of special exercises with the aim of improving the technical performance of the athlete and bringing it to the highest level.

The research problem came because of the researcher's observation and follow-up of developments in this game, as well as being one of the players in volleyball. He noted that the rapid change in offensive skills, especially spiking, deserved comprehensive study, so the availability of biomechanical information must keep pace with recent developments as a result of the change in the type and speed of spiking. This speed in the ball comes through a relatively stable technical performance through which all mechanical principles are used that can serve the spiking movement and thus perform the required goal. In addition, most coaches do not focus during their training on the mechanical aspects of performing the skill, but rather their training focuses on the physical and skill aspects in a way superficial without taking into account the important mechanical details, especially if we know that the locomotor system in the human body is characterized by many mechanical properties. Spiking so that it reflects the appropriate use of mechanical bases in light of the Preparations and mechanical properties present in the work of the human locomotor system.

## Research Problem

The problem of the research comes from the weak technical performance of hitting the players and the decline in the level of performance, especially if we know that the players have appropriate physical qualities. If these qualities are exploited with the principles and mechanical laws that limit movement, the economic aspect will be available with effort and skill performance with high accuracy and the required form, so the researcher decided to identify the biomechanical variables affecting performance and working to develop them through the preparation of special (mechanical) kinetic exercises, thus approximating the performance of the skill of spiking with the ideal global performance, and then the contribution of these variables to achieving the economy with the mechanical burdens on the joints of the body related to the

mechanical movement of the required technical performance and reaching performance to the best level.

### Research objective

- Preparing special kinetic corrective exercises according to the values of the biomechanical variables of facing (front) spiking in volleyball.

- Identifying the effect of special exercises in developing the values of biomechanical variables when performing of facing (front) spiking in volleyball.

### Research hypotheses

- Special corrective exercises positively affect the development of the values of biomechanical variables for the skill of facing (front) spiking in volleyball.

### Research fields

- Human field: Al-Amanah Volleyball Club players for the 2019-2020 season

- Time field: (3/7/2019) to (5/9/2019)

- Spatial field: The interior hall of Al-Amanah Sports Club

### Research Methodology and Field Procedures

### Research methodology

The nature of the problem at hand is what determines the nature of the method used, so the researcher used the experimental method by designing (the two equal groups), which is consistent with the nature of the research problem, as experimentation is one of the most efficient means to reach reliable knowledge.

### Community and sample research

The researcher identified the community, who are Al-Amanah Sports Club players, who number (20) players in the Premier League for the 2019 season. 16 players were selected, and the researcher divided the sample randomly into two groups, the first (A) experimenting with 8 players, and the second (B) controlling 8 players,

The experimental variable was introduced using special (mechanical) corrective exercises in the experimental group, and the control group was trained in the usual method followed by the trainer. Before starting to work with the special corrective exercises, the parity between the two groups was calculated in the measurements and tests, as follows.

### Sample equivalence

For the purpose of knowing the reality of the measurements, tests and biomechanical variables under study for the experimental and control groups, the researcher measured these indicators in order to identify the significance of the differences in the mentioned variables and to ensure that the control and experimental groups were equal, the (t) test was used for independent samples between the two groups and as shown in the tables 1, 2 This is what qualifies the researcher to do his research and apply special corrective exercises (Table 1).

It is evident from Table 2 that all the calculated (t) values are less than the tabular value under the significance level (0.05) and the degree of freedom (14), and this case means that the arithmetic mean of the first group for each variable is close to the mean of the second group for the same variable and without any differences A function between them, which indicates the equivalence of the control and experimental groups in the indicators under study (Table 2).

**Table 1:** Shows the equivalence of the experimental and control groups in the measurements and tests using the (t) value.

| No. | Measurements and tests | Measuring unit | T value Calculated | T value Tabular (Mardan. 2006) | degree of freedom | level Sig | Type Sig |
|---|---|---|---|---|---|---|---|
| 1 | Training age | Year | 0.521 | 2.145 | 14 | 0.05 | Non sig |
| 2 | Weight | Kg | 0.696 | | | | Non sig |
| 3 | Total length | Cm | 0.409 | | | | Non sig |
| 4 | Accuracy spiking front-facer | Degree | 0.845 | | | | Non sig |

**Table 2:** Shows the values of the arithmetic means, standard deviations, and the calculated and tabulated (T) value of the values of the biomechanical variables for the pre-test for the control and experimental groups in front-facing spiking.

| | No. | Biomechanical variables | front spiking (pre-control) | | front spiking (pre-experimental) | | T value calculated | T value tabular | degree of freedom | level Sig | Type Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | standard deviation | Mean | standard deviation | | | | | |
| ((approach)) | 1 | Approach distance | 2.642 | 0.214 | 2.64 | 0.194 | 0.65 | 1.658 | 14 | 0.05 | Non sig |
| | 2 | Approach speed | 2.78 | 0.21 | 2.69 | 0.17 | 0.89 | | | | Non sig |
| | 3 | Last step time | 0.459 | 0.027 | 0.49 | 0.031 | 0.95 | | | | Non sig |
| | 4 | Horizontal distance of the last step | 0.727 | 0.129 | 0.81 | 0.24 | 1.54 | | | | Non sig |
| | 5 | Maximum flexion of the knee joint | 139.5 | 6.124 | 140.3 | 5.13 | 0.73 | | | | Non sig |
| ((rise)) | 6 | Starting angle | 75.85 | 6.01 | 79.33 | 9.34 | 1.09 | | | | Non sig |
| | 7 | Starting speed | 3.446 | 0.474 | 3.87 | 0.18 | 1.12 | | | | Non sig |
| | 8 | Distance between the elbow joint and the longitudinal axis | 0.249 | 0.019 | 0.271 | 0.055 | 1.28 | | | | Non sig |
| | 9 | Maximum torso arc angle | 158.1 | 4.91 | 161.6 | 8.53 | 1.43 | | | | Non sig |
| ((spiking)) | 10 | Wrist joint angle | 170.1 | 7.61 | 173.1 | 10.15 | 1.17 | | | | Non sig |
| | 11 | Elbow joint angle | 165.5 | 4.41 | 169.5 | 7.46 | 1.56 | | | | Non sig |
| | 12 | Shoulder joint angle | 162.6 | 5.11 | 169.6 | 6.21 | 1.33 | | | | Non sig |
| | 13 | Circumferential speed | 6.63 | 1.66 | 7.17 | 1.32 | 1.47 | | | | Non sig |
| | 14 | High hip point to spiking the ball | 1.51 | 0.042 | 1.59 | 0.08 | 0.67 | | | | Non sig |
| ((landing)) | 15 | Distance between leaving the earth and returning to it | 0.79 | 0.092 | 0.90 | 0.087 | 1.57 | | | | Non sig |

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**Tools, means and devices used in the research:**

The research tools are "the means by which the researcher can collect data and solve his problem to achieve the objectives of the research, whatever the tools are with data, samples and equipment" (Mahjoub. 1988).

**Scientific research tools:**

- Arab and foreign sources and references.

- Accuracy registration form for spiking skill (frontal) in volleyball.

- Tests and measurements used in research

**Means and devices used in the research:**

- A Japanese-made Sony video camera with a frequency of 25 images/sec. (2).

- Korean-made SKC video films.

- Japanese-made CASIO hand-held calculator.

- Japanese-made SHARP TV set.

- A laptop computer (Inspiron. 1520) of the type (DELL)

- Korean-made SKC CDs.

- Software and applications used in the computer for kinetic analysis.

- The scale of the drawing (1 m length) to find out the real value that appears in the film. Its length is actually one meter and it is equal to (1.53 cm) in the picture.

- Metal tape measure.

- Adhesive tape with a width of (5) cm and stationery.

- A device for measuring height and weight.

- Legal volleyball court, and legal volleyballs (3).

- Volleyball net with a height of (2.24 m).

- Casio electronic stopwatch.

- Medicinal balls (10)

- Boxes of different heights number 9.

- Gymnastics rugs number 4.

- 3 rubber ropes with a length of (12) meters.

### Tests Used in Research

**Accuracy spiking front-facer test ( Hassanein and Moneim. 1997).**

The skill performance test for the accuracy of spiking in volleyball is represented by the performance of the skill, according to the legal conditions of the game, and the sample members perform the skill with three attempts according to the apparent construction of the skill in its four stages. (Approaching, rising, spiking, landing).

- Purpose of the test: Accuracy of spiking in straight directions

- Tools: A legal volleyball court, legal volleyballs, a coach and a mattress are placed in the back area in Center No. (1), 5 cm away from the side line and the end, and Japanese-made Sony video cameras with a speed of 25 (photos / sec) number (2) Big whistle scale drawing.

- Performance Specifications: The tested player performs the skill of facing spiking from centers (4), (5) by preparing (by the coach) from center (3) and the tester must perform the skill to the opposite court and on the rank in the center (1) to cross the ball quickly Appropriate two attempts to drop it in the rank in the center (1) for each laboratory three attempts from the frontal area as shown in (Figure 1).

- **Registration method:**

(4) Points for each correct smash in which the ball falls on the rank.

(3) Points for each correct smash in which the ball falls into the planned area.

Two points for each correct aces in which the ball falls in areas (a) and (b).

Zero for each failed smash.

**Technical performance test (technical) for the skill of spiking facing (front) in volleyball:**

The technical (technical) performance test of the skill of spiking facing volleyball is represented by the performance of the skill, according to the legal conditions of the game, and the sample members perform the skill according to the apparent construction of the skill in its four stages (approach, rise, spiking, landing) with five attempts in the front.

- Purpose of the test: Extracting biomechanical variables by depicting five attempts to perform the spiking skill in volleyball for each player in its four stages (approaching, ascending, spiking, landing) and kinematically analyzing them.

- Tools: Legal volleyball court, legal volleyballs, Japanese-made Sony video cameras with the speed of 25 images/sec, whistle, and drawing scale.

- Performance description: The tested player performs the facing (forward) spiking skill from the specified front and back area and to the opposite court, provided that the ball crosses the net with a high speed and appropriate accuracy as shown in Figure (1).

- Registration method: Five successful attempts are recorded regardless of where the ball falls to the front area and five successful attempts to the back area.

**Exploration experience:**

The exploratory experiment is "a preliminary experimental study carried out
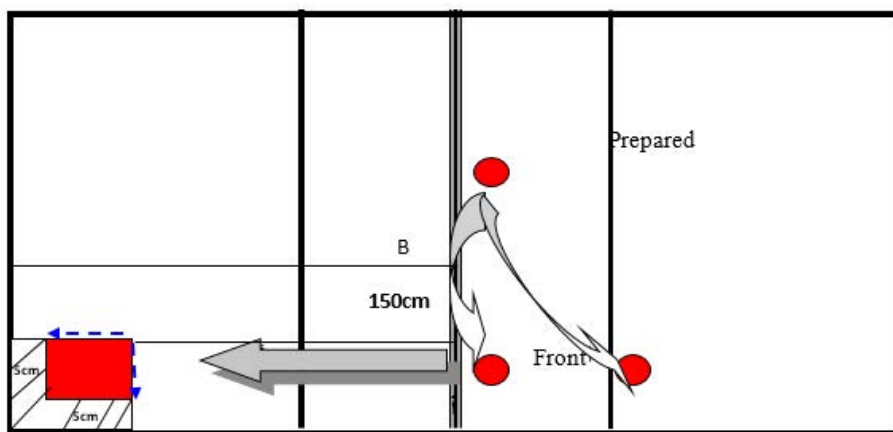


**Figure 1:** shows the accuracy of the technical performance test for the skill of spiking facing (front) in volleyball.

by the researcher on a small amount before carrying out his research, with the aim of choosing research methods and tools" (Al-Saadi. 1988).

**First exploratory experiment:**

For the purpose of standing on the performance of the devices used, testing them, and knowing the negative aspects and variables that will face the work, the researcher conducted a first reconnaissance experiment on Sunday 3/7/2019 in the afternoon in the closed hall of Al-Amanah Sports Club in Baghdad Governorate on a sample of Al-Amanah Sports Club players that amounted to (5) Female players from outside the research community, through the application of the technical performance test for the skill of facing (front) spiking in volleyball, aims behind this to:

- The suitability of the test to the research sample.
- Knowing the time taken to take the test and implement it.
- Ensuring the convergence of the biomechanical variables for the performance of the four stages (approach, rise, spiking, and landing) in spiking facing (front) in volleyball and for the five attempts.
- How prepared the testers are to take the test.
- Ensure the adequacy of the assistant staff.
- Obtaining confirmation of the results of the sources related to the stability of the mechanism for technical performance
- The distances and heights at which cameras and drawing scales should be placed, as well as the appropriate lighting have been identified.

**Results reached:**

- There was the possibility of conducting tests in terms of the players' ability to implement, as well as the time used and the suitability of the test.
- All the biomechanical variables under study were relatively stable when performing for the four stages (approach, rise, spiking, and landing) in spiking facing (front) in volleyball and for the five attempts.
- The field of movement for the cameras appeared clearly from the beginning of the movement to its end, as well as for the distances (dimension) and heights of the cameras.
- The lighting was sufficient with a good clarity of movement in photography.

**Second exploratory experiment:**

The researcher conducted an exploratory experiment on 10/7/2019 at 4:00 p.m. in the closed hall of the gymnasium in Al-Amanah Club in the governorate of Baghdad on the members of the experimental group through the application of special biomechanical corrective exercises. The following matters were verified:

- Determine the maximum time for each exercise used from the special exercises.
- Knowing the recovery time (rest) and returning to the player's ability to perform the next exercise with the same performance.
- The suitability of those special exercises to individualize the research sample.
- Knowing the time required to apply the vocabulary of the exercises.
- Determine the appropriate heights of the boxes for the research sample.
- Identifying the field difficulties that the researcher may face during the application of the exercises.

**Measured biomechanical variables:**

The researcher relied on the most important biomechanical variables affecting the performance of spiking facing volleyball through previous sources, references and studies. The front-facing spiking skill is divided into:

- The first stage: is approaching.
- The second stage: getting up and rise.
- The third stage: spiking.
- Fourth stage: landing.

**Videography**

The best means of kinematic analysis (obtaining information) is the analysis using video imaging, through which the movement and its paths and biomechanical changes are studied, and then the application of mathematical and physical sciences to provide us with the final results and also provide us with the curves of the characteristics to be studied to compare them with the ideal curves of those characteristics.

In order to identify the biomechanical variables that affect the performance of the frontal (frontal) spiking, and in order to obtain a scientific formula for studying these variables, the researcher used video photography, as video photography is one of the important means in discovering errors and controlling the convergence or distance of the levels of technical performance of the players and from it. By drawing the paths of the body points, the researcher can describe the movement and analyze it to know the extent of the convergence of the levels of a certain group of players. The geometric path of the body can also be determined by using the drawing scale. On this basis, the research sample was photographed by means of two video cameras (Sony Digital 8) with Frequency speed (25 images/sec) on two videotapes (Sony 8mm), and the video camera was installed on a large tripod, and one of the two cameras was placed perpendicular to the player, and the height of the middle of the lens was (1,56) m from the ground and on the After (9.40) m from the performance of the movement, the other camera was placed behind the player and at a distance of (7.25 m) and (1.56 m) above the ground. Measurements to extract the distances later. he filming process was carried out in the closed hall of the Al-Amanah Sports Games, as the researcher placed phosphorous marks on the anatomical joints of the body (ankle joint, knee, hip, elbow, shoulder, palm, wrist) on the player's body in order to identify these anatomical points when transferring and analyzing the image After connecting the lines between the marks. From all of the above, the researcher was able to obtain data specific to the mechanical variables for the purpose of studying and analyzing them to reach the research objectives (Figure 2).

**Computer kinematic analysis goes through the following steps:**

After the file has been transferred to the hard disk in the calculator, the movements to be cut are selected by opening the program (VDCD - Cuter), which is for dividing the movie into parts and storing them in folders. The movements were analyzed and values were extracted using the following programs:

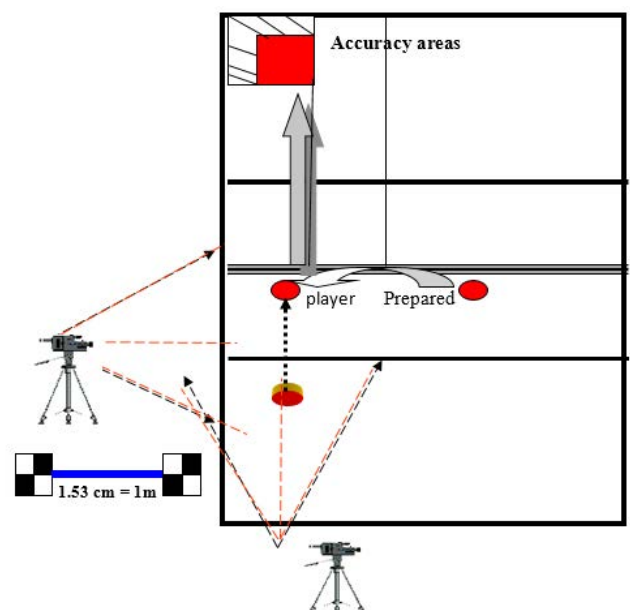Then the application of the Adobe Premier Ver 0.6 program, which is a global



**Figure 2:** Shows the location of the experiment and the tools used.

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**Table 3:** Shows the values of arithmetic means, standard deviations, and the calculated and tabulated (T) value of the values of biomechanical variables for the two tests, pre and post-tests, of the control group in front-facing spiking.

| | No. | Biomechanical variables | front spiking (pre-experimental) | | front spiking (post-experimental) | | T value calculated | T value tabular | degree of freedom | level Sig | Type Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | standard deviation | Mean | standard deviation | | | | | |
| (approach)) | 1 | Approach distance | 2.64 | 0.194 | 3.70 | 0.42 | 4.18 | 1.658 | 39 | 0.05 | Sig |
| | 2 | Approach speed | 2.69 | 0.17 | 5.69 | 0.76 | 7.23 | | | | Sig |
| | 3 | Last step time | 0.49 | 0.031 | 0.35 | 0.053 | 3.78 | | | | Sig |
| | 4 | Horizontal distance of the last step | 0.81 | 0.24 | 1.25 | 0.071 | 6.09 | | | | Sig |
| | 5 | Maximum flexion of the knee joint | 140.3 | 5.13 | 125.8 | 9.13 | 8.26 | | | | Sig |
| (rise)) | 6 | Starting angle | 79.33 | 9.34 | 66.67 | 5.72 | 3.19 | | | | Sig |
| | 7 | Starting speed | 3.87 | 0.18 | 7.52 | 0.85 | 9.21 | | | | Sig |
| | 8 | Distance between the elbow joint and the longitudinal axis | 0.271 | 0.055 | 0.33 | 0.092 | 5.64 | | | | Sig |
| | 9 | Maximum torso arc angle | 161.6 | 8.53 | 135.8 | 6.52 | 10.4 | | | | Sig |
| (spiking)) | 10 | Wrist joint angle | 173.1 | 10.15 | 159.4 | 6.29 | 4.57 | | | | Sig |
| | 11 | Elbow joint angle | 169.5 | 7.46 | 175.8 | 8.92 | 5.18 | | | | Sig |
| | 12 | Shoulder joint angle | 169.6 | 6.21 | 174.2 | 6.18 | 3.72 | | | | Sig |
| | 13 | Circumferential speed | 7.17 | 1.32 | 9.31 | 0.87 | 6.11 | | | | Sig |
| | 14 | High hip point to spiking the ball | 1.59 | 0.08 | 1.65 | 0.073 | 3.93 | | | | Sig |
| (landing)) | 15 | Distance between leaving the earth and returning to it | 0.90 | 0.087 | 1.07 | 0.061 | 4.77 | | | | Sig |

program used in film editing, and through this program, the films that have been stored and arranged in folders are converted into a group of sequential images (Frames) as follows:-

After opening the Adobe program, it is placed on the Pal video system to obtain 25 images per second, and from the (Open file) list, the movie to be cut into frames is selected. The selected movie is divided into a group of sequential images, taking into account the image size, which must be (450 x 400) pixels, and these images are stored in the same folder from which the file was opened, for each player.

**Extracting search variables:**

The variables related to the research skill were extracted by applying the AutoCAD 2004 program, which is a global engineering program used in the creation of high-level engineering designs. Movement and analysis to determine the extent of convergence of the levels of a certain group of athletes, and the kinetic path of the body can be determined by using the drawing scale (1 m), as a drawing scale, and the time path is determined by the change in the number of images per second.

**Main search procedures:**

The research procedures consisted of the pre-tests and special corrective exercises used on the experimental group, and then the post-test.

**Measurements and pre-tests:**

Measurements, tests and a pre-test for the research sample (control and experimental) were carried out on (Monday) 15/7/2019 in the indoor volleyball hall at Al-Amanah Club. On the first day, measurements of length, weight and age were performed, and a counter-spiking accuracy test was performed. The researcher has proven the conditions related to the test in terms of time and place, the tools used, the method of implementation and the assistant work team, in order to work on providing them in the post-test.

**Special exercises**

**Purposes of specific corrective exercises:**

Special exercises prepared according to the mechanical characteristics of performance purpose to achieve the following:

The skill becomes a motor habit.

- Decreased effort exerted in performance as a result of low levels of muscle tension.

- Relatively stable performance and not fluctuating in performance attempts.

- Achieving the highest degree of accuracy.

- Streamlined and uninterrupted performance.

- Make the least effort possible while performing at a high level.

- Disappearance of performance defects (motor appendages that are of no use in skill).

- The scarcity of feedback from the trainer.

- Reaching the degree of performance mechanism through the specifications of the previous goals combined.

- An appropriate degree of adaptation to the conditions surrounding the performance during the competition (audiences, equipment and tools, a competitive field, weather, etc.).

**Post-test:**

The post-test of the research sample was conducted on Sunday, 18/8/2019 in the gymnasium in the Secretariat Club after the completion of the period of applying the special exercises, which took (4) weeks, and the researcher was keen to provide the conditions for the pre-test and its procedures for the technical performance test ) for the skill of spiking facing volleyball (front).

**Statistical methods**: The search data was processed through the Statistical Package for the Social Sciences (SPSS).

**Presentation and discussion of the results**

**First: Presenting the results of the differences in the values of biomechanical variables on the performance of the spiking skill in the front end of the pre and post-tests of the experimental group, their analysis and discussion:**

Table (3) shows the values of the arithmetic means, standard deviations, and

the calculated and tabulated (T) value of the values of the biomechanical variables for the pre and post-tests of the experimental group in front-facing spiking

Under the data extracted for the members of the research sample, Table (3) shows the differences in the values of some biomechanical variables when performing the forward-facing spiking skill in the pre and post-tests of the experimental group. Biomechanics and in favor of post variables.

The researcher believes the reason for this is due to the special corrective exercises used to develop the biomechanical variables, which oblige the player to perform the correct according to the biomechanical variables, which contributed to the development of the performance of the players in the skill of the Serbs front facing in all variables

Here we conclude that for the members of the research sample in the experimental group and in the post-test of the front-facing hitting, there was a close and codified relationship between each stage of performance (technique) on the one hand, and the curve of the biomechanical characteristics (kinetic structure) according to the principles and laws of motion on the other hand. Moreover, knowing these relationships is in itself a prerequisite and necessary in order to improve and develop the performance of the skill and find ways to solve by mechanical laws of the kinetic problems presented. Therefore, it was possible to solve the kinetic problems in performance by applying the mechanical properties and principles of the locomotor system of the player in the performance of confronting spiking and this is what was done by improving and increasing the amounts of some biomechanical variables as soon as a relative change of the movement exits, which affects the result on the rest of the variables to reach the goal at a high level and with less effort.

**Second: Presenting the results of the differences in the values of some biomechanical variables when performing the front-facing spiking skill for the pre and post-tests for the control group, their analysis and discussion**

Under the data extracted for the members of the research sample, Table 4 shows the differences in the values of some biomechanical variables, and when performing the forward-facing spiking skill in the pre and post-tests of the control group. The values of the variables in the four stages and using the t-test of the interconnected samples to extract the differences were significant in the variables (Approach speed, Last step time, horizontal distance of the last step, maximum flexion of the knee joint, Starting angle, Starting speed,

High hip point to spiking the ball, Distance between leaving the earth and returning to it) The researcher attributes the reason for this to the training curriculum used by the trainer, who worked to develop some special physical characteristics when performing the skill, especially at the lower extremities, and thus the result was the emergence of significant values for the variables. The lack of development of these variables leads to the failure to use the possibility of movement characteristics represented by mechanical properties when training and the adoption of the training curriculum used by the trainer on qualitative observation through achievement only without standing on the areas of strength and weakness in the characteristics of the movement (Table 4).

**Third: Presenting the results of the differences in the values of some biomechanical variables when performing the spiking skill, the front-facing test, of the post-test for the control and experimental groups, as well as their analysis and discussion:**

Under the data extracted for the members of the research sample, Table 5 shows the differences in the values of the biomechanical variables when performing the forward-facing spiking skill in the post-test for the control and experimental groups. As shown in the table above, the nature of the sample members showed differences between the two groups in the values of some biomechanical variables (Table 5).

We conclude from this that we can formulate a principle for any movement of the body when performing the skill, so that it is hoped to reach a high final speed and at the end of each stage of the skill, by exploiting the most appropriate mechanical values, taking into account the special conditions and taking into account the level of available muscle strength. And the ability to agree, as the geometric path of the movement stages is an important factor in using force in an optimal way and with the least effort through codifying and regulating the movement.

### Conclusions and Recommendations

**Conclusions**

Under the results of the research and statistical analysis of the data obtained through video imaging, the researcher reached the following conclusions:

- It turns out that the preparatory stage represented by the approach stage directly affects the goal of the skill, as it determines from where and when the player begins to perform the next stage and that any influence in this stage and for any reason leads to a deficiency in the

**Table 4:** Shows the values of arithmetic means, standard deviations, and the calculated and tabulated (T) value of the values of biomechanical variables for the two tests, pre and post-tests, of the control group in front-facing spiking.

| | No. | Biomechanical variables | front spiking (pre-control) | | front spiking (post-control) | | T value calculated | T value tabular | degree of freedom | level Sig | Type Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | standard deviation | Mean | standard deviation | | | | | |
| (approach) | 1 | Approach distance | 2.642 | 0.214 | 2.83 | 0.75 | 1.43 | 1.658 | 39 | 0.05 | Non sig |
| | 2 | Approach speed | 2.78 | 0.21 | 4.42 | 0.27 | 7.38 | | | | Sig |
| | 3 | Last step time | 0.459 | 0.027 | 0.38 | 0.04 | 4.21 | | | | Sig |
| | 4 | Horizontal distance of the last step | 0.727 | 0.129 | 0.80 | 0.76 | 1.95 | | | | Sig |
| | 5 | Maximum flexion of the knee joint | 139.5 | 6.124 | 129.6 | 3.58 | 6.05 | | | | Sig |
| (rise) | 6 | Starting angle | 75.85 | 6.01 | 69.25 | 2.48 | 2.87 | | | | Sig |
| | 7 | Starting speed | 3.446 | 0.474 | 5.27 | 0.92 | 8.32 | | | | Sig |
| | 8 | Distance between the elbow joint and the longitudinal axis | 0.249 | 0.019 | 0.26 | 0.061 | 1.26 | | | | Non sig |
| | 9 | Maximum torso arc angle | 158.1 | 4.91 | 154.8 | 2.78 | 0.79 | | | | Non sig |
| (spiking) | 10 | Wrist joint angle | 170.1 | 7.61 | 168.9 | 4.54 | 1.1 | | | | Non sig |
| | 11 | Elbow joint angle | 165.5 | 4.41 | 168.8 | 2.24 | 1.54 | | | | Non sig |
| | 12 | Shoulder joint angle | 162.6 | 5.11 | 165.1 | 2.64 | 1.09 | | | | Non sig |
| | 13 | Circumferential speed | 6.63 | 1.66 | 7.90 | 0.95 | 2.27 | | | | Sig |
| | 14 | High hip point to spiking the ball | 1.51 | 0.042 | 1.95 | 0.053 | 2.51 | | | | Sig |
| (landing) | 15 | Distance between leaving the earth and returning to it | 0.79 | 0.092 | 0.97 | 0.098 | 5.10 | | | | Sig |

**Table 5:** Shows the values of the arithmetic means, standard deviations, and the calculated and tabulated (T) value of the values of the biomechanical variables for the post-test of the control and experimental groups in front-facing spiking.

| | No. | Biomechanical variables | front spiking (post-control) | | front spiking (post-experimental) | | T value calculated | T value tabular | degree of freedom | level Sig | Type Sig |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | standard deviation | Mean | standard deviation | | | | | |
| (approach)) | 1 | Approach distance | 2.83 | 0.75 | 3.70 | 0.42 | 3.21 | 1.658 | 78 | 0.05 | Sig |
| | 2 | Approach speed | 4.42 | 0.27 | 5.69 | 0.76 | 2.63 | | | | Sig |
| | 3 | Last step time | 0.38 | 0.04 | 0.35 | 0.053 | 1.48 | | | | Sig |
| | 4 | Horizontal distance of the last step | 0.80 | 0.76 | 1.25 | 0.071 | 4.15 | | | | Sig |
| | 5 | Maximum flexion of the knee joint | 129.6 | 3.58 | 125.8 | 9.13 | 1.63 | | | | Sig |
| (rise)) | 6 | Starting angle | 69.25 | 2.48 | 66.67 | 5.72 | 1.97 | | | | Sig |
| | 7 | Starting speed | 5.27 | 0.92 | 7.52 | 0.85 | 2.26 | | | | Sig |
| | 8 | Distance between the elbow joint and the longitudinal axis | 0.26 | 0.061 | 0.33 | 0.092 | 3.41 | | | | Sig |
| | 9 | Maximum torso arc angle | 154.8 | 2.78 | 135.8 | 6.52 | 5.28 | | | | Sig |
| (spiking)) | 10 | Wrist joint angle | 168.9 | 4.54 | 159.4 | 6.29 | 2.89 | | | | Sig |
| | 11 | Elbow joint angle | 168.8 | 2.24 | 175.8 | 8.92 | 3.27 | | | | Sig |
| | 12 | Shoulder joint angle | 165.1 | 2.64 | 174.2 | 6.18 | 4.19 | | | | Sig |
| | 13 | Circumferential speed | 7.90 | 0.95 | 9.31 | 0.87 | 2.87 | | | | Sig |
| | 14 | High hip point to spiking the ball | 1.59 | 0.053 | 1.65 | 0.073 | 2.52 | | | | Sig |
| (landing)) | 15 | Distance between leaving the earth and returning to it | 0.97 | 0.098 | 1.07 | 0.061 | 1.86 | | | | Sig |

main stage.

- Any biomechanical change at any stage clearly affects the subsequent stage due to the stability of performance determinants, whether it is related to the law of the game on the one hand or in terms of exploiting biomechanical laws on the other hand.

- The results in the field of kinetic analysis showed that the four stages when performing confrontational spiking are effectively affected by three basic variables that are involved in building the principles of movement in spiking, namely the approach speed, the starting angle and the circumferential speed of the striking arm through which we can obtain information that can contribute as much as Effective in studying performance details and setting standards that govern it.

- Increasing the values of the player's starting angle variable has an important effect in achieving the appropriate height through the values of the hip point height variable now of spiking the ball.

**Recommendations:**

- Paying attention to the variables of the stage of advancement by reducing the stopping time and increasing the speed in the final momentum of the movement in the approaching stage so that the maximum potential of the players available can be utilized in achieving the appropriate level according to their abilities.

- Necessity for those in charge of the training process to be familiar with the rules of kinetic analysis that depend on the basic principles of kinesiology, anatomy, biomechanics and other sciences related to movement.

- Necessity of focusing on the biomechanical laws that control each of the

four stages of performance through what these values have achieved in terms of moral differences that have effectively contributed to a higher level of performance with less effort.

- Paying attention to exercises based on biomechanical foundations and training on them according to the performance stages and in a sequential manner until the basic biomechanical conditions and requirements for motor performance in frontal spiking are achieved.

- Necessity of the training programs prepared by the trainers to contain biomechanical exercises based on quantitative kinetic analysis for contributing to the development of basic skills in volleyball, the most important of which is spiking of its various types.

- Conducting similar studies to find out the effect of special exercises prepared according to kinetic analysis in developing basic defensive and offensive skills in volleyball.

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