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The effect of competitive exercises according to some biokinematic variables in the performance and accuracy of some types of shooting in basketball (One point-three points) for young corner players

Dr. Nidal Obed HamzaDOI: <https://doi.org/10.22271/journalofsport.2023.v8.i1b.2678>**Abstract**

Biomechanics is one of the important sciences in physical education in general and athletic achievement in particular, as it is a science that performs general analysis of different human movements and knowledge of good techniques for them. The study aimed to Identifying the effect of training using competitive exercises to develop some types of shooting according to some bio-kinematic variables of the group for the youth basketball category.

The researcher used the experimental method with one group for its suitability in solving the research problem and achieving its objectives. The sample was selected in a deliberate manner, represented by the players of Al-Ghadriyah Sports Club, the youth category, whose number is (8) players (corner) out of 24 players. Pre tests were conducted on 1/9/2022 and the main experiment on 2/9/2022 and ended on 2/11/2022, as for the post-test on 3/11/2022 at the Al-Ghadriyah Sports Club in Kerbala Governorate. A video camera was used during the experiment, and a program for analyzing mathematical skills (Dartfish) was also used to extract kinematic variables, and after processing the data with a computer according to the SPSS Ver 10 statistical program, the researcher concluded that the exercises used and applied in the training method using competitive exercises had a role in developing some kinematic variables related to developing the accuracy of shooting by free throws and shooting calculated by three points for the players of the distributor position in basketball. Also, some kinematic variables were developed to perform the free throw shooting, which are (maximum flexion angle of the knee joint, maximum flexion angle of the hip joint, maximum height of the ball in the air (maximum vertical distance), angle of the ball starting, angle of entry of the ball). The most important recommendations are: Adopting training using competitive exercises applied in the planned training program to develop free-throw shooting and long-range shooting calculated by three points in the training curricula for the players of the corner position in basketball. And the use of skill exercises according to the biomechanical variables according to the different playing centers (distributor - corner - pivot) because of their impact on providing effort (for the coach and the player) and addressing errors that may appear within the training units.

Keywords: Competitive exercises, biokinematic variables**1. Introduction**

Biomechanics is one of the sciences that have a major role in the sports field, through applied work and subjecting players to scientific experiments. Therefore, this science contributed greatly to the events of tangible progress in all sports fields by identifying the values of the most important biomechanical variables that have a positive impact in achieving the best level to perform or accomplish together, in addition to diagnosing aspects of weakness that are negatively characterized when implementing the bio-kinematic requirements of performance, through which skillful performance is evaluated, although most sports movements are fast, so the coach must use imaging and careful analysis of movements to identify performance variables so that the evaluation is more accurate and objective.

The game of basketball is one of the activities that this science contributed to supporting and raising the level of performance by achieving it by diagnosing the optimal performance that achieves the goal with the largest economy of effort and time. Recognizing and evaluating their levels that they reached during their training period, and then providing nutrition.

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The game of basketball has developed remarkably in recent years, which has led to a change in the nature of play and the multiplicity of its methods. As a result of this development, the countries of the world have taken programmed and careful planning to raise the level of their teams towards the best levels, relying on the sciences related to the sports field, including the science of biomechanics, which is concerned with the application of all Knowledge, information and research methods related to the structural and functional composition of the human locomotor system (Talha Hossam El-Din, 1993. p. 7) ^[1], Which thus reveals weaknesses and develops kinetic solutions for them, as well as enhancing strengths and setting motor paths for skillful performance as an ideal model upon which kinetic models are built. Shooting is one of the main offensive skills that help in achieving victory, as it is the basis for achieving one, two or three points from different distances. This is what all basketball players' aim for in the possibility of scoring points when a draw and convergence in the result take the character of playing those matches.

Hence, the importance of the research was evident in adopting bio-kinematic variables to study some types of shooting skill in basketball, which is one of the basic offensive skills in the game of basketball, a basis for developing performance and knowing the extent of the impact of competitive training in developing some types of shooting according to some biomechanical variables and working to provide and provide all Players and coaches with sufficient information that makes the shooting process and its biomechanical variables within their awareness and make this information in the interaction of their hands to reach the ideal technical performance.

1.1 Research problem

The skill of shooting in the game of basketball is one of the important skills, as it is the difference between winning and losing the match, as any failure in the level of technical performance of this skill causes a great failure to resolve the outcome of the match, so this skill requires sufficient proficiency in order to obtain the best results, and accordingly It was necessary to pay attention to this skill by trainers and researchers, not only in terms of teaching performance, but also in terms of training curricula in accordance with the ideal mechanical conditions and principles to raise the level of technical performance of this skill to the optimal state by focusing on training it and using auxiliary scientific devices and techniques to detect the subtleties of the skill and how development of its variables.

As a result of the researcher's observation and follow-up of developments in this game, the lack of studies and research on the shooting skill of the players of the corner center in terms of biokinematics was noted, as well as the presence of some technical errors associated with the performance of shooting with basketball, in addition to not using the appropriate training for it, which is training using competitive exercises, as Ali Albek mentions And Shaaban Ibrahim, "Unfortunately, we notice that most coaches do not allocate periods for training using competitive exercises, just as they deal with all the team players as if they were of equal specifications, and training using competitive exercises may stem from the player's tactical position. If we look at basketball players in particular, the pivot player completely different from the attacking player (Forward) from the Playmaker or Defender (Playmaker or Guard)" (Ali Albek & Shaaban Ibrahim, 1995, p. 92) ^[2].

Therefore, the researcher decided to study this problem by using training using competitive exercises to develop some types of shooting with basketball for the center of the corner according to biomechanical analysis and to obtain valuable

information that it became necessary to identify.

1.2 Research objectives

- Preparing competitive exercises using competitive exercises according to some biokinematic variables in developing some types of shooting (one point - three points) for youth basketball.

1.3 Research hypothesis

- There is a positive effect of competitive exercises according to some bio-kinematic variables in the development of some types of shooting (one point - three points) for young people in basketball.

1.4 Research fields

The human field: Players of Al-Ghadriyah Youth Sports Club in Kerbala.

Time field: from 15-8-2022 to 3-11-2022.

Spatial field: Al-Ghadriyah Club stadiums.

2. Research methodology and field procedures

2.1 Research Methodology

The researcher used the one-group experimental approach to suit the research problem and achieve its objectives.

2.2 Community and sample research

The sample was chosen by the intentional method represented by the players of Al-Ghadriyah Sports Club, the youth category, whose number is (8) players (corner) out of 24 players who represent all the club's players, and before the final team of (12) players is formed. They represent one group. The researcher conducted the homogenization process according to Table (1) and using the coefficient of variation.

Table 1: It shows the homogeneity of the sample in the search variables

N	Tests	Mean	Std. deviation	Difference coefficient
1	Mass /kg	74.65	0.61	0.82
2	Length / cm	177.5	0.7	0.39
3	Pulse / at rest	67.5	1.2	1.77
4	Long distance scoring with three points	6.5	0.35	5.38
5	Free throw	7.64	0.46	6.02

2.3 Devices and tools used

1. (2) Sony HDR-XR 520 video cameras with a frequency of 115 images / sec.
2. Dell Core i5 laptop.
3. Measuring tape.
4. Medical scale.
5. A drawing scale with a length of (1 meter).
6. Indicators number (4).
7. Terraces with a height of (30 cm).
8. A rope (two meters long)
9. A legal basketball court.
10. Basketballs (3 balls).

2.4 Research Procedures

2.4.1 Determine the types of shooting for the corner players

The message of Ali Mutair (Hamidi, Ali Mutair, 2005, p. 50) ^[3] was relied upon to determine the types of shooting for the players of the corner position, and it was chosen after sending it with a questionnaire to the experts, as it constituted a 100% agreement rate, and our selection included the following:

1. Long shot, calculated by three points.
2. The free throw

2.4.2 Exploratory experience

The researcher conducted an exploratory experiment on 8/15/2022 on the original research sample to find out the difficulties they face while applying the exercises, as well as introducing the trainer on how to apply them, in addition to rationing the exercises and knowing the intensity, volume and required rest.

2.4.3 Research Tests

The standardized tests (Fayez Bashir Hamoudat & Moayad Abdullah Jassim, 1987, p. 233)^[4] were used, which are based on the same environment and level of the research sample, which have high reliability, reliability and objectivity coefficients, which are:

1. Shooting test by jumping after performing the tap from the 3-point area
2. Free throw test.

2.5 Field Experience

2.5.1 Pre-test: 1/9/2022, Al-Ghadriyah Club Hall

2.5.2 The main experiment: 2/9/2022 and ended on 2/11/2022, four in the afternoon, in the Al-Ghadriyah Club Hall

2.5.3 Post-test: 3/11/2022, Al-Ghadriyah Club Hall

2.6 Suggested exercises

The exercises were applied in the main section of the training unit of the trainer for the group, taking into account the training period, which is the period of special preparation and the intensity of the exercises, which ranged between (75% - 100%). The size of the exercises ranged between (2-4 minutes) and the number of groups (2), for approval To increase the speed of performance of the skill, as for the rest between repetitions and groups, the researcher relied on the pulse as an indicator for it, which ranged between (120-130 ppm/ minutes) between repetitions with an increase in rest periods at times, especially at intensity (90%-100%) and it was (130-140 ppm. minutes) It is the appropriate period to perform the skill again with high concentration and without fatigue or a drop in level. The application of the exercises continued for two months, at the rate of (3) training units per week. The exercises were prepared after conducting the appropriate tests, imaging and analyzing the biomechanical variables to find the best biomechanical variables for shooting through successful shooting according to the test used. In light of this, the proposed exercises and auxiliary training methods were developed. For the purpose of developing correct and successful shooting.

3. Presentation and discussion of the results

3.1 Presentation and discussion of the results of the kinematic variables of the free throw performance in the pre – post-tests of the research sample

Table 2: Demonstrates the kinematics variables and the accuracy of the free throw scoring performance in the pre-post tests

Shooting from a free throw								
N	Kinematic variables	Pre-test		Post-test		Difference mean	Means of Std. error	Calculated (t) value
		Mean	Std. deviation	Mean	Std. deviation			
1	Maximum flexion angle of the knee joint	95.86	4.33	108.37	8.93	12.51	2.82	4.43
2	Maximum flexion angle of the hip joint	133.25	4.38	143.62	5.61	10.37	1.85	5.60
3	The angle between the upper arm and the torso at the moment of throwing	117.32	7.22	117.81	8.24	0.49	0.39	1.25
4	Maximum height of the ball in the air (maximum vertical distance)	393.31	10.68	424.77	5.92	31.46	3.47	9.06
5	The starting angle of the ball	50.55	2.22	56.36	2.31	5.81	0.32	18.15
6	Angle of entry of the ball	34.75	2.54	37.29	2.24	2.54	0.54	4.70
7	Performance accuracy	7.64	0.46	9.2	0.56	1.6	0.15	10.66

The tabular value of (T) at the degree of freedom (7) and below the level of significance (0.05) = 1.895

2.7 Specifications of the field of experiment and videography

In order to clarify and describe the biomechanical variables, the two researchers photographed the research sample using two (Sony) video cameras with a frequency of (115 images / second) and using a lens with a focal length of (50 mm), as the camera was installed on a tripod and the center height was Ground camera lens (1.48m), the camera was placed at a distance of (7 meters) from the center of the performance of the skill of shooting by jumping and on the right side of the player who performs the skill of shooting by jumping at a vertical angle with him on the basis of the transverse axis of the player's body, and the second camera was placed perpendicular to the path of the ball movement at a distance of (8.50 meters). And a height of (1.50 m) measured from the surface of the earth to the focus of the camera lens and on the right side, as it ensures tracking the variables of the ball until it enters the basket, and this ensures that the performance of the skill is depicted in its integrated form in the research sample.

2.8 Computer analysis

Computer analysis was performed with the following steps:

1. The image material was converted from a videotape into a file format using a conversion card (Snazy) and then onto a CD, in order to facilitate the analysis steps.
2. The movement was cut by the (video cutter) program into images to extract the specified variables and store those clips in the form of files stored in the calculator files folder (My Document).
3. Then these files (sections) were transferred to the (dartfish) program installed on the (dell) Core i5 calculator, which is a program dedicated to analyzing mathematical movements.

2.9 Biomechanical variables

1. Maximum flexion angle of the knee joint
2. Maximum flexion of the angle of the hip joint
3. The angle between the upper arm and the torso at the moment of throwing
4. The starting angle of the ball
5. The maximum height of the ball in the air (maximum vertical distance)
6. The angle of entry of the ball

2.10 Statistical means

Statistical treatment was done using spss system.

- Arithmetic mean.
- Standard deviation.
- T-test for correlated samples.

3.2 Presentation and discussion of the results of the kinematic variables of the long shooting performance calculated by three points in the pre-post tests of the research sample.

Table 3: Demonstrates the kinematics variables and the shooting accuracy of the long shooting performance calculated by three points in the pre-post-tests

Shooting from a free throw								
N	Kinematic variables	Pre-test		Post-test		Difference mean	Means of Std. error	Calculated (t) value
		Mean	Std. deviation	Mean	Std. deviation			
1	Maximum flexion angle of the knee joint	125.32	3.61	131.8	3.72	6.48	1.18	5.49
2	Maximum flexion angle of the hip joint	137.8	2.56	138.06	2.02	0.26	0.34	0.76
3	The angle between the upper arm and the torso at the moment of throwing	137.55	4.13	138.57	2.26	1.02	1.55	0.65
4	maximum height of the ball in the air (maximum vertical distance)	391.79	9.30	406.29	8.36	14.497	4.06	3.56
5	The starting angle of the ball	51.77	2.25	56.46	0.58	4.69	0.56	8.37
6	angle of entry of the ball	31.86	1.73	36.01	2.37	4.15	1.05	3.95
7	performance accuracy	6.5	0.35	7.2	0.21	0.7	0.22	3.18

Tabular value (T) at a degree of freedom (7) and below the level of significance (0.05) = 1.895.

It appears from tables (2) and (3) that there is a significant difference in the values of the variable of maximum flexion angle of the knee joint between the pre and post-tests when performing shooting from the free throw and long shooting. This is due to the application of exercises that were developed in the curriculum in a way that makes the player able to control correctly with the rest of the kinematic variables without relying on pushing with the two legs, which increases in the event of not perfecting the perfect performance, so that the player relies on pushing with the two legs more, this means not taking advantage of the mechanical foundations that, when applied correctly, contribute to providing a good trajectory for the ball without having to produce great force in the legs. And when the player becomes obligated to perform the swing in the correct way for the aiming arm, the amount of need for the two men decreases in proportion to the requirements of the change in performance.

4. Discussing the results

From the observation of tables (2) and (3), we find that there is a significant difference in the variable of the hip angle in shooting from the free throw, while no difference appeared in this variable in the long shooting. The knee joint so that it reaches as shown in the table as an arithmetic mean in the pre-test (96) degrees, as well as in the post-test, as it did not exceed (109) degrees. The degree of this bending means that the thigh is very close to the torso, and this reduces the amount of the angle of the hip, but we find that there is a development in the amount of this bending, as by changing the angle of the knee joint, there has been a clear development in the angle of the hip, and the presence of exercises requires the player to obtain a certain field of vision It is imperative for the player to work on extending the hip joint by the appropriate amount for the type of performance required.

It was found that there were no differences in the angle variable between the humerus and the torso at the moment of throwing between the pre and post tests and in both performances, whether for the free throw or shooting from afar.

It also appeared that there was a difference in the ball launch angle variable between the pre and post-tests when performing shooting from the free throw and the long shot. The correct performance in this type of shooting, which is determined from (49-55) degrees, and the greater the angle of departure, the better the angle of entry will be achieved (Youssef Al-Bazi & Mahdi Najm Abdullah, 1988, pp. 301-304) [5]. It is worth noting that it can reach an angle of (73)

degrees, which is the largest possible angle for shooting (Risan Kharibet & Najah Mahdi Shalash, 1992, p. 397) [6] and that obtaining a suitable angle for the launch of the ball is very important in mastering the performance, as the exit of the ball at a greater angle leads to an increase in the vertical component at the expense of the horizontal component and thus The ball does not reach the basket, in addition to the greater need to bend in the knee joint, and this means an increase in the performance time, which gives the defender the opportunity to move towards the player who is shooting.

It also appeared that there was a difference in the variable of the maximum height of the ball in the air (maximum vertical distance) between the pre and post-tests when performing shooting from the free throw and long shooting. The development of the angle of the ball's launch is what led to obtaining a suitable height for the ball, which means that it will take a path in the form of an arc that provides a good angle, especially if the horizontal speed of the ball is appropriate to achieve the required distance. It is worth noting that the height of the ball is during its direction towards the basket. The vertical vehicle is responsible for it and the vertical vehicle increases due to the increase in the angle of departure.

It also appeared that there was a difference in the variable angle of entry of the ball between the pre and post-tests when performing the scoring from the free throw and the long shot. The departure angle is large or suitable whenever a correct angle of entry is achieved ((Youssef Al-Bazi & Mahdi Najm Abdullah, 1988, pp. p. 295) [5].

As for the accuracy of the skill, the reason for its development is due to the use of specialized skillful exercises for the corner center, in addition to choosing various exercises and according to the correct mechanical requirements, and thanks to multiple repetitions according to the appropriate load size, all of which led to the development of the skills of the three-point shooting and the free throw, as Wajih Mahjoub mentions (Wajih Mahjoub, 2001, p. 104) [7], (Excessive repetition without errors leads to automatism). Hanafi Mahmoud (Mukhtar, Hanafi Mahmoud, 1998, p. 96) [8] points out that proper planning and selection of appropriate exercises enable the coach to develop physical attributes and at the same time work on the player's mastery of basic skills.

5. Conclusions and recommendations

5.1 Conclusions

1. The exercises used and applied by the method of training using competitive exercises had a role in developing some kinematic variables related to developing the accuracy of shooting by free throws and shooting

- calculated by three points for the players of the corner position in basketball.
- Some of the kinematic variables were developed to perform the free throw shooting, which are (maximum flexion angle of the knee joint, maximum flexion angle of the hip joint, maximum height of the ball in the air (maximum vertical distance), angle of the ball starting, angle of entry of the ball).
 - Some kinematic variables have been developed to perform the long shooting calculated by three points, namely (maximum flexion angle of the knee joint, maximum height of the ball in the air (maximum vertical distance), angle of the ball's launch, angle of entry of the ball).
 - The accuracy of the close shooting skill represented by the free and long throw, calculated by three points, was developed according to the kinematic variables required to perform these two skills.

5.2 Recommendations

- Adopting training using competitive exercises applied in the planned training program to develop free-throw shooting and long-range shooting calculated by three points in the training curricula for the players of the corner position in basketball.
- The use of skill exercises according to the biomechanical variables according to the different playing centers (distributor - corner - pivot) because of their impact on providing effort (for the coach and the player) and addressing errors that may appear within the training units.
- Carrying out similar research on other kinematic variables to develop different basic skills and other playing positions according to training using competitive exercises.

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7. Appendix 1

Suggested exercises

Week: First

Stadium: Al-Ghadriya Sports Club

Training unit: 1-2-3

Number of players: 8

Unit sections	Time	Exercises	Intensity	Size	Rest	
					Between Repetition	Between groups
Main section	32.4) minutes, plus rest time between repetitions and totals	A player from the right side passes the ball to the player from the left side who took his place on the free throw line and runs to receive it from him and shoot the basket directly.	70%	3.30 ×2	Pulse return 120/130	Pulse return 120/130
		The same exercise as the previous one, with the start of running from the middle of the arena and also the scoring by jumping and from the free-throw line again.		3.30 ×2		
		Run from the middle of the arena to the shooting area, then lean on the bench and jump vertically while shooting		3.20 ×2		
		Dribbling from the middle of the arena to the specific shooting area, then shooting in front of the teammate who is defending passively.		3.30×2		
		Rotating backwards, receiving the ball, and then shooting by jumping in front of a colleague.		3.10×2		

Week: 2nd

Stadium: Al-Ghadriya Sports Club

Training unit: 4-5-6 Number of players: 8

Unit sections	Time	Exercises	Intensity	Size	Rest	
					Between Repetition	Between groups
Main section	(30) minutes and rest time is added between repetitions and totals	Shooting by jumping continuously from the designated area for shooting after receiving the ball from a colleague once on the right and once on the left, and over a rope tied to two figures at a height of 1.85 meters.	80%	2.40×2	Pulse return 120/130	Pulse return 120/130
		The player takes his place near the final line with the ball and handles it to the fellow player, who in turn maneuvers and advances towards the goal to shoot by jumping.		3.40×2		
		Attempting to pass a defender who is defending in a man-to-man manner and passively, and after reaching the designated area for shooting, the shooting is done by jumping from outside the three-point arc.		3×2		
		Each player has a ball, as one of the players shoots for (5) throws and the other takes turns, then they exchange shooting.		3.20 ×2		
		Aiming by jumping after making deception movements, fumbling left and right, then turning and aiming.		3 ×2		

Week: Third

Stadium: Al-Ghadriya Sports Club

Training unit: 7-8-9

Number of players: 8

Unit sections	Time	Exercises	Intensity	Size	Rest	
					Between Repetition	Between groups
Main section	(32) minutes and rest time is added between repetitions and totals	Double jumping over five terraces, then receiving the ball from a colleague, and shooting by jumping from the three-point arc and over a rope tied to two people, 1.95 meters high.	75%	3.30×2	Pulse return 120/130	Pulse return 120/130
		Dribbling between five figures and then shoot by jumping.		3 ×2		
		Shooting by jumping continuously from the areas specified for shooting after receiving the ball from a colleague once on the right and once on the left. (Outside and inside the arc)		3.20 ×2		
		Each player has a ball, as one of the players shoots for (5) throws and the other takes turns, then they exchange shooting.		3.40×2		
		Climb onto the platform, then double jump, shoot and land on the ground.		3.10×2		

Week: Fourth

Stadium: Al-Ghadriya Sports Club

Training unit: 10-11-12

Number of players: 8

Unit sections	Time	Exercises	Intensity	Size	Rest	
					Between Repetition	Between groups
Main section	(26.7) minutes, plus rest time between repetitions and totals	Attempting to pass a defender who is defending in a man-to-man manner and passively, and after reaching the designated area for shooting, the shooting is done by jumping from outside the three-point arc.	85%	2.30 ×2	Pulse return 120/130	Pulse return 120/130
		Shooting by jumping in front of a defender, then following the ball and back again.		3 ×2		
		Aiming by jumping after making deception movements and camouflaging left and right, then turning and aiming, and over a rope tied to two people and a height of (2) meters.		2.50×2		
		Aim by jumping and following and then flapping to the middle of the arena and back again.		3×2		
		Dribbling, then a peaceful one, and in the last step, climb onto the terrace and aim by jumping over it.		2.55×2		

Week: Fifth

Stadium: Al-Ghadriya Sports Club

Training unit: 13-14-15

Number of players: 8

Unit sections	Time	Exercises	Intensity	Size	Rest	
					Between Repetition	Between groups
Main section	(31.9) minutes, plus rest time between repetitions and totals	Aiming by jumping over a rope attached to two people, at a height of (2.5) meters above the player's height, after performing a tapping.	80%	3.20 ×2	Pulse return 120/130	Pulse return 120/130
		The same previous exercise, provided that the shooting is by jumping successively on the two baskets back and forth, provided that the player receives the ball from a colleague.		3.10×2		
		Each player has a ball, as one of the players shoots for (5) throws and the other takes turns, then they exchange shooting.		3.30 ×2		
		The same as the first exercise, provided that the player jumps over the bench placed before the rope at a distance of (50 cm).		3.15×2		
		Shooting by jumping in front of a defender, then following the ball and back again.		3.20×2		