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Research Article

## A Comparative Study of The Mechanical Determinants of The Elevation Phase During Shooting for Offensive Line Players in Handball and Basketball

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### Introduction and research problem

Offensive skills are one of the basic skills for the superiority of handball and basketball teams, and the skill of shooting is one of the most important to win matches.

Mary E. Ridgway, Jerry Wilkerson (1990), Mahmoud El-Tayeb (2004), Richard J. (1984), Guzansky (1983), (and Hay and Jensch (1985) indicate that, due to the marked discrepancy in the information available to each player and the coach about the ideal method of performance, as well as the difference between those interested in the most appropriate methods of technical performance, which called many specialists to be interested in the method of technical performance for the skill of preparation in basketball in order to reach the ideal method for technical performance. (7), (3), (8), (5), (6)

"Imad El-Din Abbas Abu Zaid" and "Medhat Mahmoud Abdel-Aal El-Shafei" (2007 AD) mention

that the nature of performance varies in handball and varies between sprinting with or without the ball to running and stopping, and performance must be done quickly in moving, passing, upgrading and shooting at a high degree of efficacy and the achievement, where the handball game is subject to different kinetic situations due to its connection with the opponent's movements and positions. (37:1)

Mary E. Ridgway and Jerry Wilkerson (1990) indicate that "in recent years, the method of technical performance of the preparation skill has developed and differed, and new methods and types have emerged as an inevitable result of the high level of performance at the global level, where the preparation skill is considered jumping from one of the most important of these new types of preparation skill and the most widely used in the implementation of planning performance (7)

In view of the importance of the promotion stage in shooting in handball and basketball, and the contribution it contributes to the team's success in winning matches, and based on what many statistics and scientific studies have indicated in the last days of the importance of good progression before the shooting process, as well as the similarity of the method of performance in the stage of paying with feet Upgrading to achieve maximum thrust to overtake the defender.

And the detection of the shooting area according to the responses of the players, as well as the ability to give information to guide the coaches towards training the players to the extent that suits them according to the target muscle groups to achieve an improvement in the level of propulsion for the feet in both games.

This is what prompted the researcher to make a comparison between the stage of upgrading in the light of some mechanical determinants For the stage of upgrading during shooting between handball and basketball due to the lack of mechanical information on the differences between the method of performance in the stage of upgrading during shooting between the game of basketball and handball And the extent to which that information can achieve in simplifying the training and education procedures on the one hand and raising the level of performance on the other hand.

**Research goal**

The researcher determined the general objective of this study in an attempt to

A comparative study of the mechanical determinants of the ascent stage during shooting

Among the offensive line players in the game of handball and basketball

which Can achieve it From During sum the stuff next

Compare some determinants mechanical 1-for stage Upgrade during Aiming between Offensive line players in the game of handball and basketball

2-Get to know on me nature Relationship the list between some determinants mechanical for stage Upgrade during Aiming between Offensive line players in the game of handball and basketball

reach to equation predictive for stage Upgrade during 3-Aiming between Offensive line players in the game of handball and basketball in terms of some Variables mechanical questions search:

Locate researcher question general From this is the study

"What Variables mechanical for stage Upgrade during Aiming between Offensive players in handball and basketball Can use semantics predictive" ?

which Can achieve it From During sum questions next 1-what determinants mechanical for stage Upgrade during Aiming between Offensive players in the game of handball and basketball ?

what nature Relationship the list between some determinants mechanical 2-Upgrade during Aiming between Offensive players in the game of? handball and basketball

Search question

Research method

The researcher used the descriptive method in the survey method to suit the nature of this study ,through the use of video imaging and computer analysis

Research areas

The research sample was selected from among the players of some Premier League clubs registered in the Egyptian Federation for the two games , where the total number of sample members ( 6 players ) were divided as follows: three volleyball players , three handball players.

**Table (1): The characteristics of the study sample**

Handball		Basketball		Discrimination	basic information
±	S	±	s		
2.2	23.6	2.5	25.3	Year	Chronological age
5.1	188	3.5	189	Centimeter	total length
5.5	79.2	6	83.2	Kg	Weight

**Time domain:**

The procedures of this study were applied in the period from Tuesday Corresponding to 13 / 4 / 2024 /4/302024 AD\_ \_ \_ \_

**Geographical area:-**

The basic study (photographing of the research sample members) was conducted in the indoor hall at Assiut University.

**Data collection methods and tools:**

The researcher used the following data collection methods and tools

Videography

Kinematic analysis ) 2 D (using the video system and the computer

The researcher used the kinematic analysis program ) SIMI (

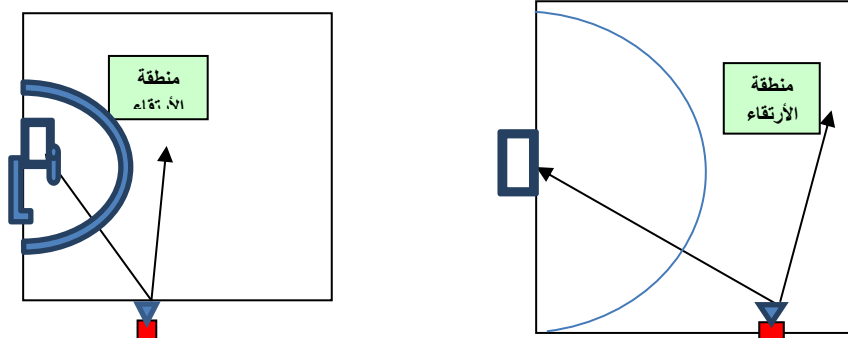
**Carry out the basic study**

The researcher performed the imaging process on the study sample using **Japanese-made** Panasonic nv.3000EM TN Video Camera with 25 Field/sec Frequency Where the cameras were placed according to Figure No. (1) and the players were equipped to identify the adhesive marks on the anatomical points according to Figure No. (2) and the number of those marks are 21 on each of the right and left sides of the points (head, ear, shoulder, elbow, wrist, The front of the fingers, the thigh, the knee, the ankle, the heels and the front of the toes ,(where five successful attempts

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were selected for each of basketball and handball for analysis and extraction of mechanical determinants, and the data were statistically processed using the

following treatments (arithmetic mean ,standard deviation, test value of T for differences.(



Shape (1) Locating the camera while shooting

**Presentation and discussion of results**

**Table (2): Mechanical determinants of body points and center of gravity for the ascent stage While shooting in handball and basketball**

morale level	T value	Elevation while shooting in handball		Rise while shooting in basketball		Mechanical	Limiters
		±	S	±	s		
0.01	**3.794	0.067 ±	1.712	0.032 ±	2.262	Vertical displacement of the wrist	
0	**16.010	0.047 ±	1.824	0.035 ±	1.826	elbow displacement	
0.01	**3.736	0.032 ±	1.036	0.043 ±	1.916	vertical displacement of the shoulder	
0.04	*2.503	0.068 ±	0.536	0.050 ±	1.078	femoral vertical displacement	
0.02	*3.014	0.066 ±	0.20	0.054 ±	0.628	Knee vertical displacement	
0.11	1.822	0.015 ±	1.172	0.018 ±	0.216	Ankle vertical displacement	
0	**4.16	0.258 ±	2.39	0.259 ±	1.212	The height of the center of gravity of the body	
0	**4.034	0.6077 ±	2.138	0.4093 ±	3.712	The net velocity of the center of gravity of the body	

\*Significant at the level of 0.5 \*\* Significant at the level of 0.01

illustrates table ( 1 ) There are significant differences at the level of 0.01 in favor of basketball over handball in each of the variables Vertical displacement (wrist , elbow ,shoulder (And the height of the center of gravity of the body **and** the resultant velocity of launching the center of gravity of the body , and these variables indicate that basketball is distinguished from handball by the optimal use of swinging the arms, where the swinging of the arms plays an important role as one of the important factors for increasing the flight distance (the maximum height that the body can reach), and this What Adel Abdel Baseer (2007 AD (indicated is the importance of swinging the arms before the stage of ascent “ : It is preferable when ascending to achieve the maximum possible height to use swinging the arms in front high at the moment before the launch, as the movements of the body parts lead to a change in the position of the center of gravity of the body supposed

to be at the level of The pelvis is in the state of normal standing, so the movement of the arms upwards will lead to the movement of the center of the body’s gravity in their direction for a few centimeters, which will eventually lead to its height before starting to set off” (2: 378.(

So the researcher sees This weighting is important due to its contribution to increasing the total amount of payment by up to 33% of the payment proceeds.

And what Liz explained. A (2007 AD) “Swinging the arms during ascent increases the height that the body may reach by an amount of 10%(4:261) ”%20 :

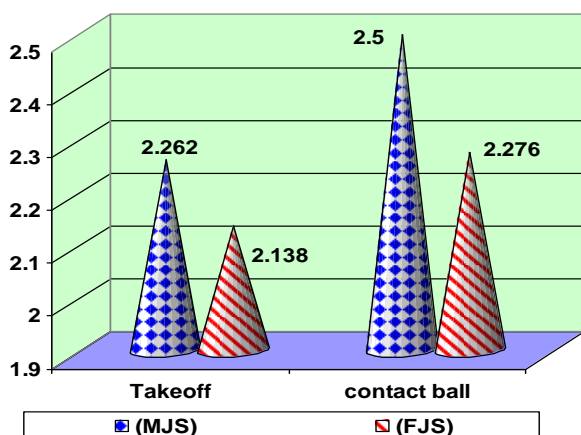
While there are significant differences at the level of 0.05 in favor of basketball for handball in each of the variable vertical displacement (thigh, knee ,(while there are no significant differences in each of the variables )vertical displacement of the ankle variable.(

Table (3): Mechanical determinants of body points and center of gravity for the ascent phase during shooting in basketball and handball

morale level	T value	Elevation while shooting in handball		Rise while shooting in basketball		Mechanical Limiters
		±	S	±	s	
0.01	**3.794	0.033	2.276	0.127	2.500	Vertical displacement of the wrist) m(
0	**16.010	0.041	1.972	0.022	2.304	elbow displacement (m(
0.01	**3.736	0.143	1.980	0.056	2.236	Shoulder vertical displacement (m(
0.04	*2.503	0.326	2.150	0.167	2.560	The net speed of the wrist (m/s(
0.02	*3.014	0.427	1.498	0.374	2.264	The net velocity of the elbow) m/s(
0.11	1.822	0.398	1.264	0.454	1.756	Resulting shoulder velocity (m/s(
0.03	*2.664	1.5961	7.12	3.4869	11.688	wrist angular velocity) degrees/sec(
0	**8.529	0.901	4.314	0.535	8.312	elbow angular velocity (°/s(
0.36	0.978	1.194	6.562	3.396	8.136	Shoulder angular velocity (°/s(
0	**4.16	0.040	1.568	0.028	1.658	The height of the center of gravity of the body

And it shows a table ( 2 ) There are significant differences at the level of 0.01 in favor of basketball over handball in each of the variables Vertical displacement (hand wrist , elbow, shoulder (and internal angle (elbow, shoulder (and angular velocity of the elbow and the height of the center of gravity of the body , while there are significant differences at the

level of 0.0 5 in favor of basketball over handball in each of the variable speed obtained ( wrist, elbow) and the angular velocity of the hand wrist, while there are no significant differences in each of the variables (the net velocity of the shoulder, the angular velocity of the shoulder(



4) Figure (

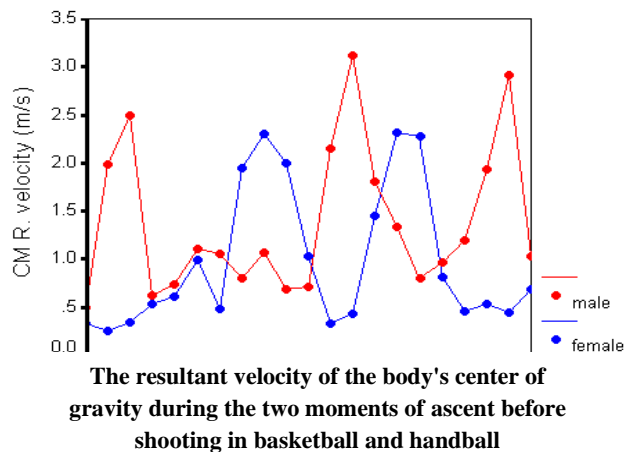
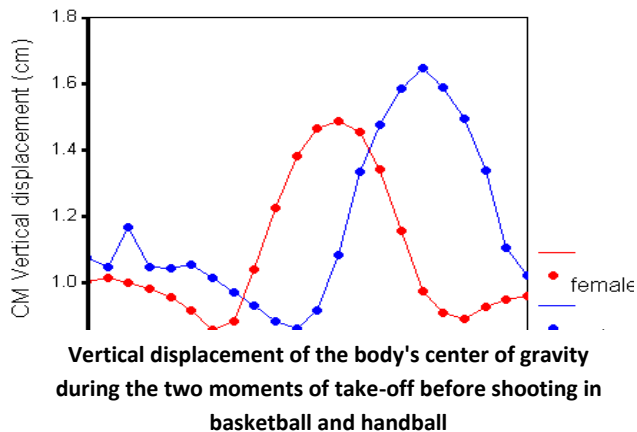
Table (4): Mechanical determinants of the ball's launch during the shot In basketball and handball

morale level	T value	handball		Basketball		Mechanical Limiters
		±	s	±	s	
0	**7.24	4.36	67.00	3.35	80.54	Ball launch angle ( degrees(
0	**4.46	0.04	89.2	0.09	2.55	tee height
0.02	*2.91-	1.05	2.194	0.62	0.600	horizontal speed Ball launch (m/s(
0.46	0.78	0.56	65.5	0.45	4.90	vertical speed Ball launch (m/s(
0.02	*2.95	0.22	33.8	0.33	6.07	net speed Ball launch (m/s(

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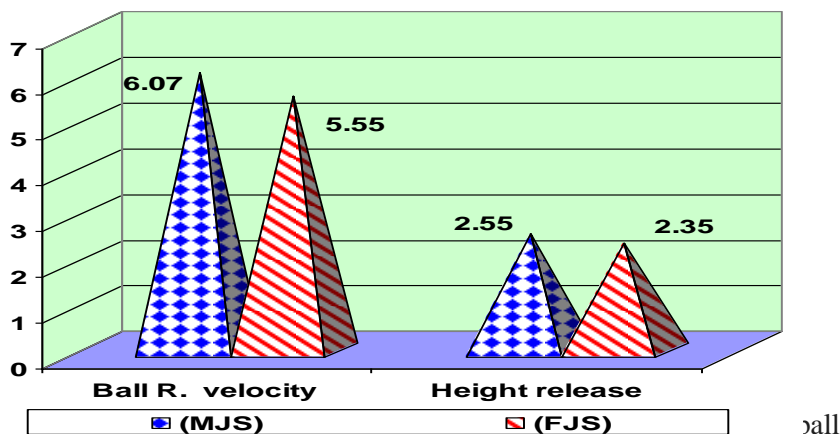
Table ( 3 ) shows that there are significant differences at the level of 0.01 in favor of basketball over handball in each of the variables The ball launch angle, the height of the starting point and significant differences at the level of 0.0 5 for the variable speed of the ball

launch , while there are significant differences at the level of 0.0 5 in favor of the handball over the basketball in the variable horizontal speed of the ball launch.



**Table(5): The simple and multiple correlation coefficient, the square of the multiple correlation coefficient, the contribution ratio, and the t-value of the mechanical variables contributing to the highest rise body center of gravity**

t value for addition t	partial regression coefficient B	Contribution %	Adjusted square multi-correlation coefficient R <sup>2</sup>	multiple correlation coefficient R	Simple Correlation Coefficient	independent variables
62.52-	4 4.7-	78.6	0.786	0.810	0.900	starting height
19.63-	2 0.0-	16.3	0.949	0.960	0.980	starting angle
21.11	4 10.9	2.6	0.975	0.983	0.992	vertical displacement
15.46-	1 0.3-	1.2	0.987	0.993	0.996	vertical speed for attachment
10.10-	1-	1.2	0.999	1.0	1.0	vertical displacement



Significant T-value at 0.05 = 2.306  
in the basic stage, including the two maximum  
Significant value of t at 0.01 = 3 355.

It is clear from table ( 4 ). The mechanical variables weighted moments, and the elimination that the starting point height variable He is considered the first

contributor to the accuracy of the performance of the skill of passing from above with jumping ,where the percentage of his contribution reached (78.6%) and the

starting angle variable The second contributor to performance and the percentage of its contribution amounted to (16.3%), and the vertical displacement variable of the center of gravity of the body ( weighted maximum moment ( The third contributor to performance and the percentage of his contribution amounted to ( 2.6 %) vertical speed Attachment (at the moment of disposal) The fourth contributor to performance and the percentage of its contribution amounted to ( 1.2 % ) and the vertical displacement variable of the center of gravity of the body (disposal) The fifth contributor in performance and the percentage of his contribution amounted to (1.2%)

**Therefore, the predictive regression equation becomes with a value of the highest rise in the center of gravity of the body in terms of mechanical variables during the moment of disposal**

**It is  $y = a + (b \times 1) + (b \times 2) + 0000000$  etc.**

The value of the highest elevation of the center of gravity of the body= (+0.194 **Height of the starting point** ( + ) 4 4.7-  $\times$  **launch angle**  $\times$  ) + ( 2 0.0- **the vertical displacement of the center of gravity of the body weighted maximum moment** ( + ) 4 10.9  $\times$  **vertical velocity for attachment** Clearance moment  $\times$  ( + ) 1 0.3-**The vertical displacement of the center of gravity of the body disposal moment**  $\times$  ( 1-

#### **Discuss the results**

It is clear from the tables numbers (3, 4, 5, 6, 7 ( regarding the simple correlation coefficients between the values of each of the determinants mechanical for points the body center its weight for stage Upgrade during Aiming in a ball basket And the a ball hand . , that the total number of significant correlation coefficients amounted to (21 (correlation coefficients that varied between direct (positive) and inverse (negative) coefficients, where the total number of extrusive coefficients amounted to (8) coefficients, and the total number of (13) inverse coefficients, and they also varied between the two moments The selected performance, the total number of significant correlation coefficients at a weighted maximum moment amounted to (11) correlation coefficient with the impact of (3) direct and (8) inverse coefficients, while at the moment of disposal it reached (10) significant coefficients of (5) direct and inverse coefficients.

In order to explain the results of the correlation coefficients and their nature, the researcher believes that given the nature of the skill test used to measure the determinants mechanical for points the body center its weight for stage Upgrade during Aiming in a ball basket And the a ball hand . We will note that achieving the highest degree of skill performance accuracy is related to the place of the ball falling in the area with the highest degree of accuracy, and therefore the player needs to be able to achieve the highest degree of accuracy to work on directing the ball to that area of the highest degree, which requires that the ball travel a flying distance Therefore, the flight distance traveled by the ball plays a decisive role in determining the degree of accuracy of performance, noting that the

area with a higher degree requires that the ball travel for a shorter flight distance than the same degree as shown in Figure (1) and this may explain The type of relationship, as the relations tended towards the inverse relationship, and based on what is confirmed by the mechanical laws of projectile motion (the ball), which indicates that the flight distance traveled by the ball (as a projectile (depends on three basic variables and factors, which are:

- The height of the starting point ,which is represented here (height of the ball at the moment of hitting(
- cruising speed
- The starting angle (12:308, 309(15:388) ,(

Accordingly, the mechanical variables that control the horizontal distance traveled by the ball, whether those factors that control the shape and movement of the ball as a projectile, or the variables that affect those factors, play an important and very important role in determining the horizontal distance and thus the degree of accuracy of skill performance.

Given the type of relationship that exists between the ball's height variable and both the launch speed and the launch angle, which in turn affects the distance traveled by the ball, as the horizontal distance traveled by the ball increases (as a projectile) as the height of the starting point and the launch speed increases, and this was confirmed by the following mathematical equation for calculating The horizontal distance traveled by the ball as a projectile

$$R = \frac{V_x}{g} \left[ V_y + \sqrt{V_y^2 + 2gh} \right]$$

whereas  $R$  is the horizontal distance traveled by the ball  
 $V_x$  is the horizontal velocity vehicle for the ball ,  
 $V_y$  is the vertical velocity vehicle for the ball ,  
 $h$  tee height  
 $g$  acceleration due to gravity

Where this equation is applied when both the starting level and the landing level differ so that the launch level is higher than the landing level, as this agrees with the nature of the skillful performance where the player shoots the ball from the highest point in the flight phase in order to land in the direction of the shooting tower.

This may be explained by tables (9, 10), where it becomes clear that the most important variables and contributing to the accuracy of the performance are the variables of the height of the ball at the moment of disposal, the angle of departure and the speed of launch. AD ,(Coleman Q. 0c (1997 AD) Ahmed Abdo Khalifa (1999 AD, 2007 AD) on the importance of the height of the starting point and its impact on both the starting speed and the starting angle, as these variables are the main determinants of the ball and its trajectory as a projectile (18: 81), (24:142), (25:25), (1:114 ,(2:205)

Adel Abdel Baseer (2004 AD) adds, "The height of the ball at the moment of the throw, the angle and the

speed of its launch are the main factors that determine the distance of the throw” (14: 289.(

Where the mechanical variables of the body’s work , which directly affect the variables of the ball as a projectile, are of great importance, because the movement of the body and its connections are the main influence on the ball’s gains for its movement . The center of gravity of the body has a weighted maximum moment and a positive direct correlation at the 0.05 level between the performance accuracy and each of the variables of the horizontal displacement of the hand wrist maximum weighted moment The vertical displacement of the center of gravity of the body at the moment of disposal

This was confirmed by Ahmed Abdo Khalifa (2007 AD ,(quoting from Talha Hossam El-Din, “The higher the ball’s starting point and therefore the center of gravity of the body mass, the more the player can focus to achieve the best speed and angle of launch for the ball, and therefore the best accuracy” (2: 202.(

While it is clear from Table No. (4) that there is a significant direct correlation at the 0.01 level between performance accuracy, vertical velocity variables and the outcome . of the wrist of the moment of disposal , and a direct correlation at the 0.05 level between the accuracy of performance and each of the horizontal speed variables of the wrist of the hand, a weighted maximum moment and speed horizontal For elbow and shoulder moment disposal.

Talha Hossam El-Din (1993 AD) indicates that “if the goal of the performance is to acquire the ejected object the greatest amount of linear velocity, then the responsible party, i.e. the party farthest from the original axis of the object, must move with the highest rotational velocity the moment the ejected object (a tool or a ball) is released. 12 : 276(

In agreement with the findings of S. Coleman. C (1997 AD) “to the existence of a relationship between the speed of the striking arm and the speed of the ball launching” (25:23. (

It is also evident from the tables (5) that there is a significant inverse correlation at the 0.05 level between performance accuracy and each of the variables of the internal angle values of the wrist and shoulder maximum weighted moment, and a significant inverse correlation at the 0.05 level between performance accuracy and the elbow angular velocity variable at the moment of disposal, and A positive direct correlation at the 0.05 level between the performance accuracy and the shoulder angular velocity variable at the moment of disposal

Where Omaima Al-Ajmi (1989 AD) indicated that the speed and angle of the ball launch depend on the work of the joints of the striking arm, as the angular change of the joints of the striking arm reflects the work of the muscle group working on the joints that mainly cause the ball’s launch speed, we must note that the angular speeds ultimately lead to Linear velocity of the ball, which is affected by the radii of rotation, which in turn is affected by the angles of the joints, and according to the principle of thrust transmission, the amount of

movement is transferred from the player to the ball. ( 5 : 120(

In addition to what Talha Husam al-Din (1993 m ( indicated, “the linear velocity of any point on the moving part or end is directly proportional to the angular velocity of this end” ( 12 :275(

Therefore, the angular velocity of the arms plays a very important role in determining both the linear velocity of the arms, and therefore the linear velocity with which the ball travels.

On the other hand, the grip of the elbow joint at a maximum weighted backward moment is of special importance in determining the amount of the starting angle and therefore in determining the vertical vehicle of the starting speed, meaning the decrease in the motor range in the grip of the elbow joint leads to a small launch angle, which determines the amount of height, as Adel Abdel Basir (1998 AD confirms) The starting angle, whether it is a human or a mathematical tool, is one of the most important variables affecting the flight curve, so knowing how to determine it from the implications of the kinetic path is an important matter that cannot be neglected. ( 13 : 156(

Muhammad Yusuf Al-Sheikh (1986 AD) adds to the importance of the starting angle, as he indicates that there is a relationship between the starting angle and the ends of the upper part of the body parts during the phase of disposal and the moment of its maximum ( 21 :299(

This was confirmed by many scientific references and previous studies, where Ahmed Kamel (1984 AD) and Amal Jaber (1989 AD) agreed on the importance of the angle of the arm joints (shoulder, elbow, wrist) at the moment of getting rid of the ball.

(13 : 4 ),(152 : 3 )

## **CONCLUSIONS AND RECOMMENDATIONS**

### **First: the conclusions**

#### **-1 During the upgrading phase**

-There are significant differences at the level of 0.01 in favor of basketball than handball in each of the variables Vertical displacement (wrist , elbow, shoulder (And the height of the center of gravity of the body **and** the resultant velocity of launching the center of gravity of the body, while there are significant differences at the level of 0.0 5 in favor of basketball over handball in each of the variable vertical displacement (thigh, knee), while there are no significant differences in each Variables ( Vertical Ankle Displacement Variable(

#### **-2During the touch phase**

-There are significant differences between the mechanical determinants of the climbing skill while shooting forward in favor of the basketball over the handball in each of the variables (the uplift speed of the center of gravity, displacement and vertical speed of the wrist and elbow, angular velocities) at the moment of contact with the ball (the moment of touch), While both the vertical velocity and the angular shoulder velocity variables achieved a greater average in favor of basketball than handball , although these differences were not significant.

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-There are also significant differences for the variables (ball launch angle, launch speed, launch point height) in favor of basketball over handball , while the resultant speed variable of ball launch achieved a greater average in favor of basketball than handball , although these differences were not significant. , There are also significant differences for the variable, the horizontal speed of the ball in favor of handball over basketball.

**Second: recommendations**

**English references**

1. A.Lees & P.Grimshaw : Sport and Exercise Biomechanics, publisher by Taylor & Francis Group, New York USA,2023
2. Gozansky, S. : Championship Volleyball chines and Drills. New York: Parker Publishing(2023) .
3. H., Hay & Gench, B. : Kinematics set *and* the row-set in volleyball. *In* J. rereads (Ed.), Sports, CA: Academic Publishers, pp. 298-303(2023).
4. Mary E. Ridgway and Jerry Wilkerson : A kinematic analysis of the front set and back set in volleyball, Texas Women's University (2024).
5. Richards. J. & Wilkerson, J. : The use of microcomputers for initiating the teaching of kinesiology through film analysis. *In* R. Shapiro (Ed.) Second National Sodium on Teaching" Kinesiology and Biomechanics in Sports. Colorado Springs, CO, J 147-149(2022).

-1The need to be guided by the arithmetic values of the averages of the mechanical determinants that have been reached

-2Paying attention to training on mechanical indicators that represent the essence of the difference between skill performance when trying to develop technical performance

-3Also the interest in building some qualitative exercises in light of the mechanical indicators which quantitatively differentiate between basketball and handball