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Research Paper

An Analytical Study According to Some Biomechanical Variables of The Arm at the Moment of Its Initiation of Movement and the Point of Contact with the Ball for The Skill of Spike the Volleyball

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ABSTRACT

The research problem is summed up in the period from the moment the hand of the arm begins to perform the skill of spike the volleyball until the hand touches the ball, because of its great role in achieving positive results by the outcome of the movement, as the main objective of the research is identifying the relationship between some biomechanical variables and the movement part of the arm from the moment of initiation of movement and contact with the ball to the skill of spike the volleyball, a community has been identified And the research sample according to international models to perform the skill of spike hitting in the World Volleyball Championship for men in 2022 and for a height of 3 meters above the net or what is known as high spike hitting. After that, a model was randomly selected to analyze the performance and extract the results, and after processing the data statistically, the most important conclusions were reached the speed of movement of the performance arm does not mean the strength of the correlation of kinetic energy with time, as the movement position may change from the stock of kinetic energy and suppression of the actual energy output.

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KEYWORDS: Analytical, biomechanical variables and movement

1. INTRODUCTION

The world today is experiencing a state of great qualitative progress in various fields of life, especially the sports field, which is the main pillar for the renaissance of peoples and the gateway to intellectual and spiritual civilization for various vital and life orientations. Various sciences are racing with each other to find different ways to develop the body's kinetic biology to produce movement with the best available capabilities, by providing mechanical and physical means related to the type of sport practiced.

From here, the orientation of the different sports sciences has become towards the overlapping of the rest of the pure sciences to develop the motor performance output according to the biokinetic foundations. Therefore, we find that biomechanics today is a basic pillar for the development of performance for various sports events, especially volleyball.[1]

Biomechanics is one of the important sciences concerned with studying the structure of the body and its various functions related to movement. The human body is subject to the basic laws of mechanics that govern simple metal or plastic structures. Biomechanics is referred to as the link between the body structure and the various functions of movement. The study of biomechanics gave a better understanding of the function of the joint and the dysfunction of the body and performance in particular, which led to improvements in the design of devices such as various orthotic systems.[2]

Therefore, the overlap of biomechanics with the concept of volleyball, specifically the spike skill, gives an accurate description of the motor behavior of the performance, as the biomechanical understanding of the performance arm in the spike skill gives a clear perception of the amount of positive and negative changes related to improving the output of the movement and achieving better results for the team.[3]

Through the foregoing, the importance of research appears in analyzing the movement of the performance of the arm from the moment of initiation of the movement and the point of contact of the hand with the ball in the skill of spike damage with the volleyball and the height of one meter in the global model.

2. RESEARCH OBJECTIVES

1. Analysis of the movement of the performance arm in the skill of spiking the volleyball from the moment of initiation of the movement until contact with the ball.
2. Identifying the relationship between some biomechanical variables and the movement part of the arm from the moment of initiation of movement and contact with the ball to the skill of spiking the volleyball.

3. RESEARCH METHODOLOGY

The research community included 30 models of players from around the world in the volleyball game within the volleyball tournament for men 2022, and for the spike hitting skill at a height of 3 meters. The best model was chosen from them to analyze the biomechanical variables of arm movement for the spike hitting skill from the moment of initiation of the movement until the moment of contact with the ball, as shown in Figure 1.

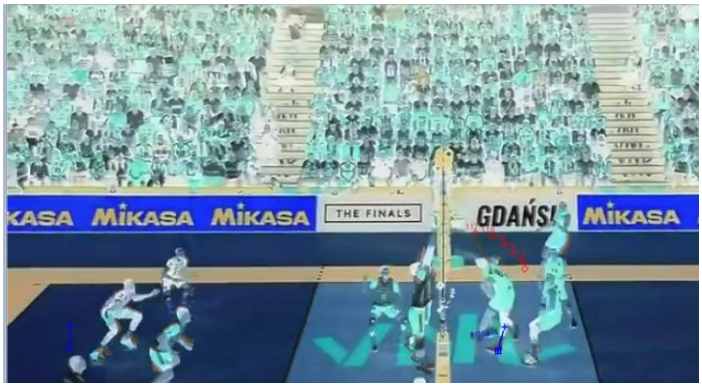

Figure 1: Shows the kinetic analysis of the performance arm from the moment of initiation until touching the ball in the skill of spike

Research procedures

The videotape of the match of one of the international teams that was chosen randomly for the 2022 men's volleyball championship was transferred to the program (Tracker 6.1.3 - 2023), and after the program was fed with the required data, the results related to some biomechanical variables were extracted to obtain a clear view of the movement results after the analysis.

Units

The units concerned with the variables under study were used according to what was mentioned in Figure 2.

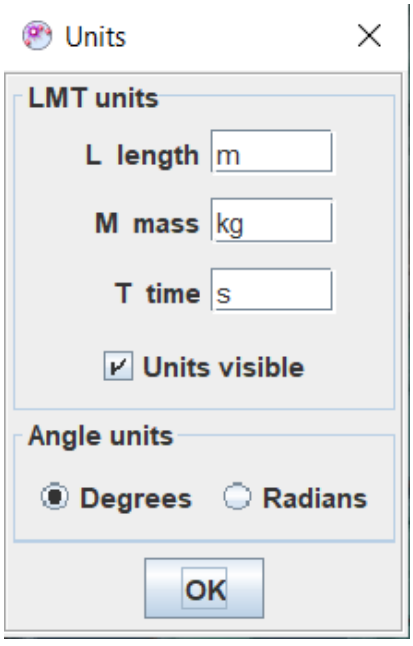

Figure 2: Units concerned with the variables under study

4. RESULTS AND DISCUSSIONS

Table 1: Shows the results of the arm movement from the moment of initiation until touching the ball for the skill of spike hitting in volleyball in some biomechanical variables

Time (t)	Position magnitude (r)	Velocity (v)	Angular velocity (α)	Momentum magnitude (P)	Kinetic energy (K)
1.4	18.32	20.76	176.9	20.76	215.5
1.44	18.24		178.2		
1.48	17.51		181.5		

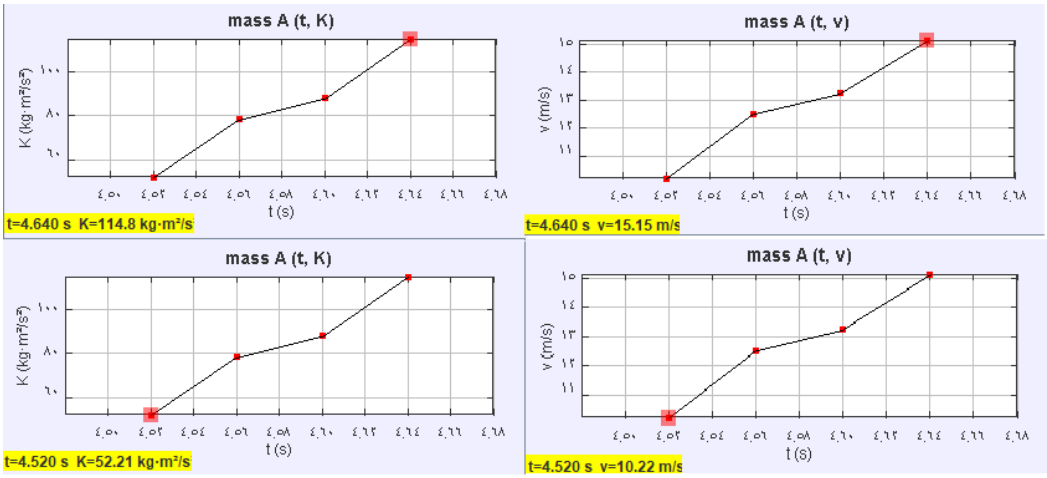

Figure 2: Shows that the highest value of kinetic energy is at the moment of contact of the hand with the ball in the spike skill

Table 2: Shows the statistical description of the research variables

Variables	t	x	y	r	v	p	K
mean	1.44	-18.01	-0.36733	18.02333	20.58667	20.25333	200.1667
std	0.04	0.434051	0.751368	0.446356	1.507492	1.092032	15.25068
min	1.4	-18.29	-1.005	17.51	19	19	185
max	1.48	-17.51	0.461	18.32	22	21	215.5

Table 3: Shows the relationship between the search variables

Variables	t	x	y	r	v	p	K
t	1	0.898513	0.975554	-0.90735	0.99503	0.915724	0.491781
x	0.898513	1	0.973011	-0.99979	0.850338	0.646417	0.059672
y	0.975554	0.973011	1	-0.97755	0.948822	0.805036	0.288408
r	-0.90735	-0.99979	-0.97755	1	-0.86098	-0.66197	-0.08018
v	0.99503	0.850338	0.948822	-0.86098	1	0.951184	0.57604
p	0.915724	0.646417	0.805036	-0.66197	0.951184	1	0.800197
K	0.491781	0.059672	0.288408	-0.08018	0.57604	0.800197	1

Through the results presented in Table (3) it is clear that there is a strong correlation between the research variables under study, and that the highest point of correlation is embodied in the point where the hand of the arm involved in the movement touches the ball, as the movement of the arm begins with a gradual acceleration reaching the peak At the point of contact of the hand with the ball.[4]

With regard to the variable concerned with the location with the function of time, it results from the principle that the movement of the organism is linked to the function of time. According to the sport concept, it indicates the amount of time it takes for the organism to produce movement in a specific direction, and it is evidence of the amount of improvement or development in the performance of the athlete in general and the volleyball player. Especially for the spike skill.[5]

As for the variable of time with kinetic energy, the average relationship between them was average, and this indicates that there is a greater amount of kinetic energy that was not shown in the performance of the movement. This results in a lower motor force output.[6]

What was shown by the speed variables of the results of the moment of contact with the hand of the performing arm of the spike hitting skill recorded the highest correlation with time, and this indicates the amount of great agreement and the amount of accuracy in achieving contact with the ball at the moment of implementing the spike hitting skill. When looking at the large relationship of speed with the point of contact with the ball, [7] we

notice that the amount of momentum achieved with the ball reached the highest amount of correlation that was embodied in the movement axes concerned with the axis (x) and the axis (y) and as shown in Figure (3).

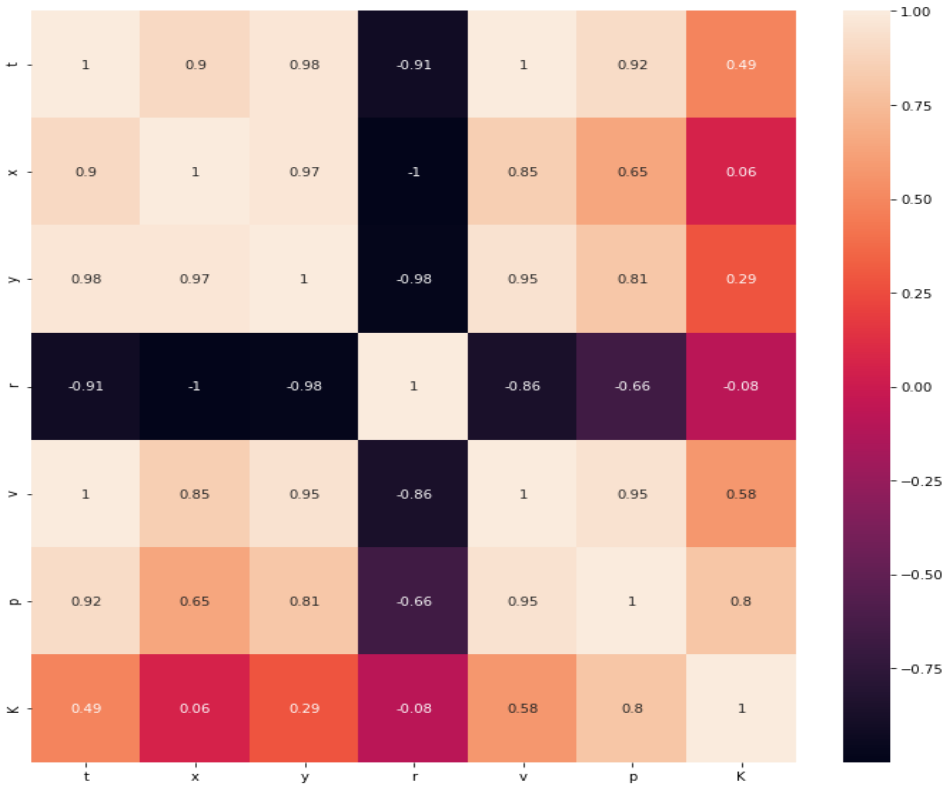

Figure 3: Shows the relationship between the search variables

5. CONCLUSIONS

1. The results of some biomechanical variables showed a significant correlation with the time variable of the spike hitting skill, the moment of contact of the hand of the performance arm with the ball.
2. The speed of movement of the performance arm does not mean the strength of the correlation of kinetic energy with time, as the movement position may change from the stock of kinetic energy and suppression of the actual energy output.
3. The results showed that there is a great agreement indicating the great mechanism of the player in achieving compatibility with the hand and the ball at the moment of implementing the spike hitting skill with the volleyball.

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