

Biomechanics Modeling to Evaluate the Performance Level of Skill Correction Jump of the Junior Handball Players

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Abstract: The research aims at doing a biomechanical modeling to evaluate performance level of the skill of aiming by jump among handball young players. The researcher adopted the descriptive survey method by using video camera and computer analysis through K1-3D program. The research sample for both fundamental and investigation studies was taken from players of super tournament of Assiut governorate. The sample contained 6 players skilled at aiming by high jump and aiming by front jump. Physical dynamic analysis was done using video and computer program (K1 -3D) at the dynamic analysis laboratory of the Faculty of Physical Education, Assiut University. The most important result was that physical ability contributed by 64.521% in the accuracy of performing the skill of aiming by front jump among the basic study sample. The variable of handball passing on the wall is considered the physical variable most related to the accuracy of performing the skill of aiming by front jump among the basic study sample since its percentage of contribution reached 67.813%.

Key words: Biomechanics • Handball • Training

INTRODUCTION

Studying and evaluating physical movements can be done through three fundamental aspects (psychological, physiological and biomechanical). The last aspect is considered the most valuable, as being distinguished with subjectivity of evaluation for it depends on a number of quantitative variables such as time – space – velocity – force – dynamic path in studying physical movements; particularly those skills that require speed to be performed the matter that urged the researcher to attempt setting biomechanical patterns through using various statistical methods for some performance skills (aiming by high jump- aiming by front jump) in accordance with different variables such as biomechanical variables and physical abilities [1].

These variables are used to contribute in understanding these performances and practicing the effect of changing any of these variables or the other variables and consequently evaluating the Performance in order to direct the training towards a great performance. The research aims at doing a biomechanical patterning to evaluate performance level of the skill of

aiming by jump among handball young players in order to recognize:

- Biomechanical variables and physical abilities of the aiming skill (aiming by high jump and aiming by front jump).
- Nature of the relationship between biomechanical variables and physical abilities and accuracy level of the skills of aiming by high jump and aiming by front jump.
- Identification of biomechanical patterns for some aiming performances with regard to biomechanical variables and physical abilities via using some predictable equations.

Research Inquiries:

- What are the biomechanical variables, physical abilities of the aiming skill (aiming by high jump and aiming by front jump)?
- What is the relationship between biomechanical variables, physical abilities and the level of accuracy for the skill of aiming by high jump and aiming by front jump?

Table 1: Properties of research sample consistency in the variables (Age, length, weight and training age) N = 16

Variables	Unit of measurement	Statistical treatments			
		Average	Moderator	Standard deviation	Inflection
Age	Year	18.77	18.75	0.49	0.122
Tall	Cm	183.63	183.5	4.49	0.089
Weight	Kg	79.80	78.96	3.66	0.35
Training age	Year	7.01	7.8	2.91	0.34

Table 2: Sample consistency in the physical variables (force, ability, fitness, muscular endurance, balance, compatibility and flexibility) N =16

Physical variables	Unite of measurement	Average	Moderator	Standard deviation	Inflection
Force	Kg	38.5	40.1	6.77	0.126
Ability	Cm	35.68	35.25	7.22	0.77
Fitness	Time	9.45	8.35	3.21	0.578
Muscular endurance	No.	12.60	11.2	3	0.914
Balance	Degree	4.56	2.52	3.85	0.858
Compatibility	No.	13.5	12.25	4.09	0.750
Flexibility	Cm	3.71	2.07	2.89	1.15

MATERIALS AND METHODS

The researcher adopted the descriptive survey method by using video camera and computer analysis through K1-3D program. The research sample for both fundamental and investigation studies was taken from players of super tournament of Assiut Governorate. The sample contained 6 players skilled at aiming by high jump and aiming by front jump.

From Table 1 we can recognize the arithmetic average, standard deviation, moderator and inflection coefficient of the basic variables and that this infection is confined to ± 3 which prove that the data is correct and free of distribution faults.

From Table 2, we can recognize the arithmetic average, standard deviation, moderator, inflection coefficient of the physical variables (force, ability, fitness, muscular endurance, balance, compatibility and flexibility) and that this inflection is confined to ± 3 which confirms the accuracy of data and compatibility of the sample with these physical variables.

RESULTS AND DISCUSSION

Table 3 indicates the differences in the resultant averages of displacement, velocity and acceleration for the skills of aiming by high jump and front jump during the three stages of performance.

Results presented in Table 4 show differences between the resultant averages (push and force) for the body's center of gravity during stages of performing the skill of aiming by high jump and aiming by front jump.

First: Preliminary stage including (receiving the ball – approaching) during performing the skill of aiming by high jump.

Primary stage including (connection interruption – utmost height – leaving the ball and aiming): average total time of performance during the stage of interrupting connection with the ground was (1.08sec) – resultant average displacement (226.1cm) – resultant average velocity (400.7 cm/sec) – resultant average acceleration (5421.8 cm/sec²). Stage of utmost height for the body's center of gravity during performance: average time of performance reached (1.4sec) – resultant average displacement (325.4cm) – resultant average velocity (409.2 cm/sec) – resultant average acceleration (2089.7cm/sec²). Stage of leaving the ball: average time of performance (1.6sec) – resultant average displacement (24.5cm) – resultant average acceleration (7542.8 cm/sec²) resultant average velocity (870.1 cm/sec).

Second: Stages of performance concerned with the skill of aiming by high jump.

Stage of leaving the ball or aiming: average time of performance reached (1.6sec) – out of total time for performance - resultant average displacement (99.7cm) – resultant average velocity (388.6cm/sec) – and resultant average acceleration (970.1 cm/sec²).

Table 5 Indicates that the total number of significant correlation coefficients reached 32, varied from proportional correlation coefficients (positive) and non-proportional correlation coefficients (negative). The total number of proportional coefficients was 20 and non-proportion coefficients were 12 since these coefficients varied during the three stages of performance.

Table 3: Differences among resultant averages (displacement, acceleration and velocity) of the body's center of gravity for the skills (aiming by high jump and aiming by front jump) during stages of performance.

Stages of performance	Parts of performance	Time	Skill of aiming by high jump			Skill of aiming by front jump		
			Average resultant			Average resultant		
			D	V	A	D	V	A
Preliminary stage	-receiving the ball	0.16	-151.1	217.1	847.4	-107.5	122.1	639.9
	approaching	0.76	-189.6	252.6	4729.1	-92.6	243.2	827.6
Primary stage	-connection interruption	1.08	226.1	400.7	5421.8	287.8	375.4	344.8
	- utmost height	1.4	325.4	409.2	2089.7	123.8	304.8	1240.1
	- leaving the ball	1.6	24.5	870.1	7542.8	99.7	388.6	970.1
Final stage	-connection resumption	1.7	98.82	437.4	16.6	-264.5	677.3	655.2

Table 4: Differences between resultant averages of push and force for the body's center of gravity during stages of performing the skills of aiming by high jump and aiming by front jump

Stages of performance	Parts of performance	Time	Skill of aiming by high jump		Skill of aiming by front jump	
			Average resultant		Average resultant	
			Push	Force	Push	Force
Preliminary stage	-receiving the ball	0.16	50.4	-60.0	59.1	66.3
	- approaching	0.76	-54.1	145.4	58.6	154.1
Primary stage	-connection interruption	1.08	85.8	636.9	101.3	599.2
	- utmost height	1.4	752.1	431.5	878.7	442.3
	- leaving the ball	1.6	302.4	420.8	415.5	576.2
Final stage	-connection resumption	1.7	-466.2	350.4	452.1	404.2

Table 5: Simple correlation coefficients for values of angles and velocities of the aiming hand angles at stages of performance and accuracy of performing the skill of aiming by high jump and front jump

Stages of performance	Parts of performance	Points and joints of the body	Values of angles		Velocities	
			Aiming by high jump	Aiming by front jump	Aiming by high jump	Aiming by front jump
Preliminary stage	Receiving the ball	Wrist	0.381	0.462	-0.425	-0.498
		Elbow	0.401	0.499	0.623	-0.452
		Shoulder	0.422	0.165	0.128	-0.335
	Approaching	Wrist	0.443	0.503	0.497	0.523
		Elbow	0.212	0.501	-0.328	-0.122
		Shoulder	0.471	0.532	-0.477	0.235
Primary stage	Connection interruption	Wrist	-0.501	-0.485	0.487	0.511
		Elbow	-0.523	-0.392	0.605	0.721
		Shoulder	-0.533	-0.521	-0.612	0.516
	Utmost height	Wrist	-0.505	-0.535	0.543	0.721
		Elbow	-0.530	-0.621	0.456	0.601
		Shoulder	-0.536	-0.721	0.316	0.477
	Leaving the ball and aiming	Wrist	0.493	0.751	-0.218	0.394
		Elbow	0.502	0.623	-0.106	0.521
		Shoulder	0.530	0.572	0.496	0.626
Final stage	Connection resumption	Wrist	0.498	-0.635	0.512	0.632
		Elbow	0.385	0.159	0.498	0.505
		Shoulder	0.501	0.535	0.603	0.635

Significant performance correlation at 0.05 = 0.497, at 0.01 = 0.223

Table 6: Simple and multi correlation coefficient, square of the adjusted correlation coefficient, percentage of contribution and the value of t and f for the variable of velocity angles of the right arm as the most important mechanical variable contributed in the accuracy of performing the skill of aiming by high jump

Mechanical variable	Simple-correlation coefficient	Multi-correlation coefficient R	Square of multi-correlation coefficient R ²	Percentage of contribution%	Coefficient of partial-regression β	Value of (t)	Value of (f)
Velocity angles of the right arm	0.7194	0.6881	0.59155	59.55	3.534	2.763	36.0311
Fixed value = -24.2453							Value of (t) at 0.01 = 1.75
Standard deviation = 0.03491							Value of (f) at 0.05 = 5.05
Value of (t) at 0.05 = 2.13							Value of (f) at 0.01 = 10.97

Table 7: Simple and multi correlation coefficient, square of the adjusted correlation coefficient, percentage of contribution and the value of t and f for the variable of angle of the ball starting off as the most important mechanical variable contributed in the accuracy of aiming by high jump

Mechanical variable	Simple-correlation coefficient	Multi-correlation coefficient R	Square of multi-correlation coefficient R ²	Percentage of contribution%	Coefficient of partial-regression β	Value of (t)	Value of (f)
Angle of the ball starting off	0.7219	0.5961	0.5843	0.5843	4.721	2.438	35.0422
Fixed value = -21.5431							Value of (f) at 0.05 = 4.17
Standard deviation = 0.2364							Value of (f) at 0.01 = 17.21

Table 6 indicates that the velocity variable of the right arm angles is considered the first contributor in the accuracy of aiming by high jump since the percentage of contribution reached 95.55%. The calculated value of (f) (36.0311) was greater than table value of (f) at the significant level 0.01 and the predictable equation of regression for the accuracy value of aiming by high jump with indication of velocity angles of the right arm will be:

$$\begin{aligned}
 S &= X + m_1 \times n_1 \\
 &= \text{fixed value} + (\text{velocity angles of the right arm} \times \\
 &\quad \text{coefficient of partial regression}) \\
 &= 24.2453 + (\text{velocity angles of the left arm} \times 3.534)
 \end{aligned}$$

Table 7 Indicates that the variable of angle of the ball starting off is considered the first contributor in the accuracy of aiming by front jump since the percentage of contribution reached 58.43%. The calculated value of (f) (35.0422) is greater than the table value of (f) at the significant level 0.01 and the predictable equation of regression for accuracy value of aiming by front jump with indication of angle of the ball starting off will be:

$$\begin{aligned}
 S &= X + m_1 \times n_1 \\
 &= \text{Fixed value} + (\text{angle of the ball starting} \times \text{coefficient} \\
 &\quad \text{of partial regression}) \\
 &= -21.5431 + (\text{angle of the ball starting} \times 4.721)
 \end{aligned}$$

In accordance with what have been reached by the researcher and with the aid of the results of previous studies related to the current research, the researcher will follow the same method of presenting the results according to the following arrangement:

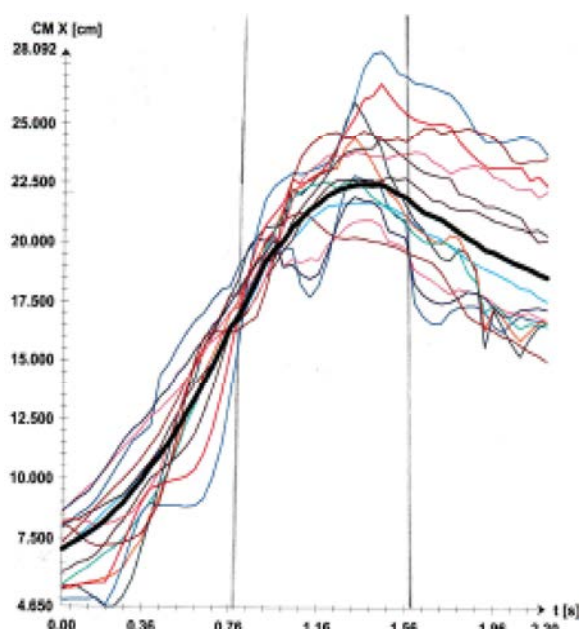


Fig. 1: Averages resultant values for the displacement of the body's center of gravity during stages of performing the skill of aiming by front jump

Tables 1-7 and Figures 1-7 show the simple and multi-correlation coefficients-square of adjusted correlation coefficient – percentage of contribution – and value of (f) at the variable of velocity for angles of the right arm as the mechanical variable most related for the right arm angles and it is considered the first contributor in the accuracy of skillful performance, according to the first performance of aiming by high jump, the percentage of contribution reached 59.551% the variable of angle of the ball's starting is considered the first contributor in accuracy of

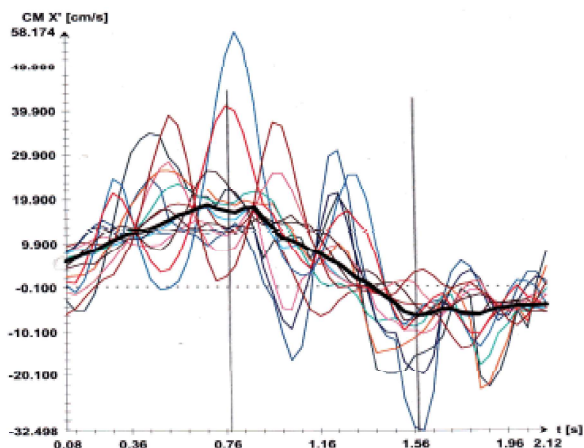


Fig. 2: Averages resultant values for the velocity of the body's center of gravity during stages of performing the skill of aiming by front jump

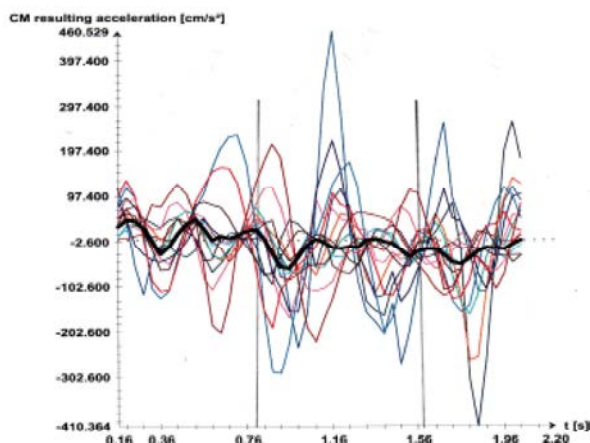


Fig. 3: Averages resultant values for the acceleration of the body's center of gravity during stages of performing the skill of aiming by front jump

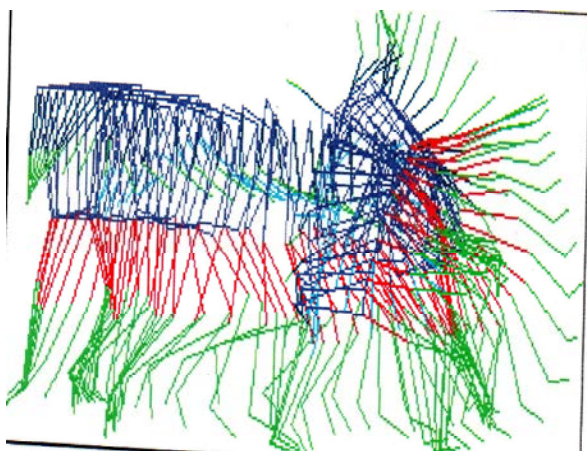


Fig. 4: A consecutive dynamic track for the skill of aiming by high jump

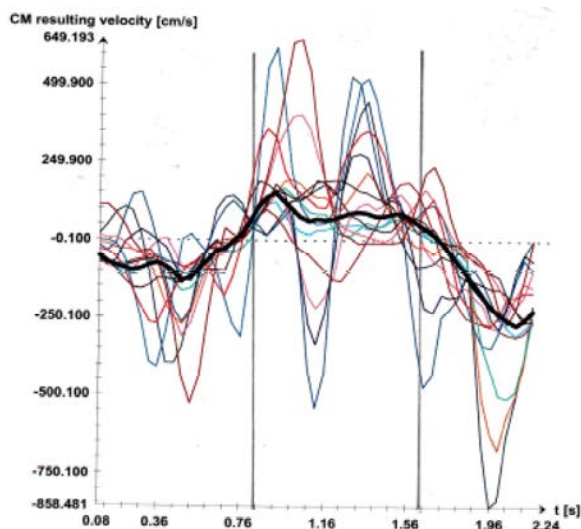


Fig. 5: Average resultant displacement for the skill of aiming by high jump

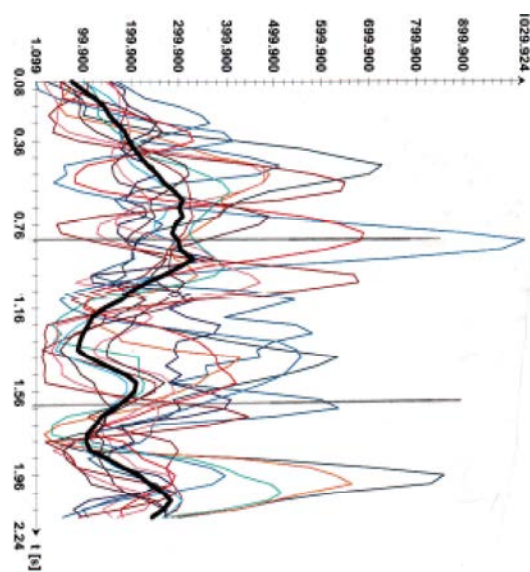


Fig. 6: Average resultant velocity for the skill of aiming by front jump

performing the skill of aiming by front jump since its percentage of contribution reached 58.43% according to the second performance. Therefore, the researcher regarded the importance of the height of the starting point and its influence on both the starting velocity and starting angle for these variables are considered the basic factors determining the path of the ball as a throwing object.

Tables 4-9 concern simple and multi-correlation coefficient, square of adjusted correlation coefficient, percentage of contribution and the value of (F) for the variable of physical abilities most related to the accuracy

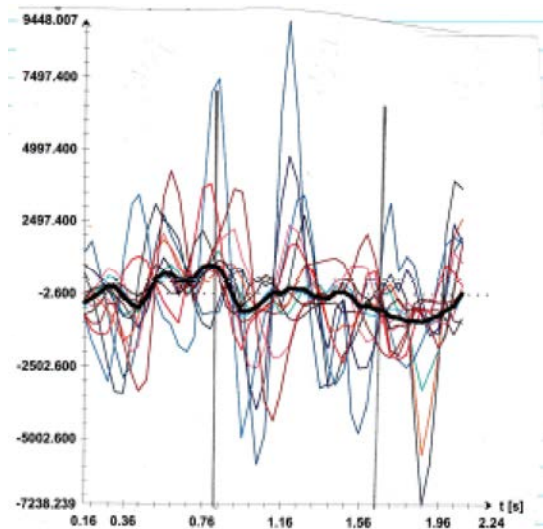


Fig. 7: Average resultant acceleration for the skill of aiming by high jump

of performing the skill of forwarding, indicated that "the force variable distinguished by velocity of the legs (height of vertical jump) is considered a physical ability not contributed in the accuracy of performing the skill of aiming by front jump among the basic study sample since its percentage of contribution reached 64.012%.

The force variable distinguished by velocity of the legs (space of wide jump from stability) is considered the most important physical ability most related to the accuracy of performing the skill of aiming most related to the accuracy of performing the skill of aiming by high jump among the study sample for its percentage of contribution reached 66.0234%. The force variables of the legs (Force of quadriceps) is considered the most important physical ability contributed in the accuracy of performing the skill of aiming by front jump among the basic study sample since its percentage of contribution reached 64.521%. The force distinguished by velocity connects with the accuracy of skillful performance. Whenever the degree of skillful performance increases, the conformity between fibers and muscles increases and consequently the best the dynamic distribution of the motional performance [2]. Also, the force distinguished by velocity is one of the essential physical components of some individual and team physical activities such as volley ball especially for stages and movements of upgrading and attack throwing [1, 3].

The variable of aiming at overlapping rectangles is considered the most important physical ability high related to the accuracy of performing the skill of

aiming by high jump among the study sample for its percentage of contribution reached 63.531%. The variable of handball passing on the wall is considered the physical variable most related to the accuracy of performing the skill of aiming by front jump among the basic study sample since its percentage of contribution reached 67.813%.

The researcher mentions that the force distinguished by velocity and utmost force are regarded as the most important basic kinetic abilities determining the accuracy level. A large number of references agreed to the importance of the force distinguished by velocity as the most important physical ability of the handball player especially for the skill of aiming by jump.

CONCLUSION

There is a close relationship between the variables of physical and mechanical variables.

There are differences in the performance of high-skill correction and correction of the front and there are also differences among them in the physical variables for each type of them.

RECOMMENDATIONS

- The need to apply more research in this area to improve skill performance in all games.
- The training program must be applied appropriately for the development of the performance of players based on the results as mechanical variables.
- The need to apply this kind of research on young players, whether collective or individual games.

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