RELATION OF KINEMATICS VARIABLES AND ACCURACY OF SHOOTING BY UPWARD LEAP FOR OMAN'S NATIONAL HANDBALL TEAM PLAYERS

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The relations between kinematics variables and the accuracy of shooting by upward leap for players of Oman National Handball Team were investigated. Three digital JVC video cameras of 25 images per second were used to capture the two styles of shooting from jumping vertically with defense wall, and without defense wall on five players. APAS, MAXTRAQ system and KINOVEA software were used for motor analysis. Descriptive statistics, Pearson correlation, regression and t-test were used to treat the data. A direct relation between the take-off angle and accuracy of shooting was found. Correlations between kinematics variations of the shooting skills of upward leap were also found. Significant differences between shooting with and without defense in favor of shooting without defense during the takeoff flight vertically were also determined.

KEY WORDS: team handball, shooting, accuracy, Kinematics.

INTRODUCTION: The main objective of the competition in the game of team handball is to score the ball into the opponent's goal keeper team from a convenient location without the presence of blocking defenders. Shooting is considered as one of the most important offensive skills that play a major role in tip the team on the other. The goal of proficiency and mastery of the fundamental skills provides an opportunity for one of the attackers to reach a suitable place to hit the target in different ways, without potential hazard. (Kilani & Dee, 1987). Various researchers have agreed that the most common shooting in team handball against the goal keeper was done by executing the upward leap (up-forward) in the games. Two basic factors are of importance with regard to the efficiency of shots: accuracy and throwing velocity. Naturally, the faster the ball is thrown at the goal, the less time defenders and goalkeeper have to save the shot (Kilani & Finsh, 2001). Handball coaches and scientists who have investigated overarm throwing agree that the main determinants of the ball velocity can be divided into three groups concerning technique of motion, somatic features and motor ability (physical fitness), respectively. By training, the physical fitness and technique can be improved, while biomechanical variables could be halted. The offensive players, however, attempt to throw a ball on goal from a position without being tackled or obstructed by the opposing defensive players. In competition, 73-75% of all throws during the game constitute jump throws, followed by the standing throw with run-up (14-18%), penalty throw (6-9%), diving throw (2-4%) and direct free throw (0-1%) (Wagner et al., 2008). Recent studies analyzing the throwing movement in team-handball suggest that different throwing techniques result in different ball velocities (Tillaar and Ettema, 2004; Wagner and Müller, 2008) scouting a game of the national team, the number of shots for the Omani team were 43 shots, including 14 shots executed by jumping up, and score only one goal. In the finals of the championships Gulf gaming attendant (Gulf 19) where Omani team had a match with the national team of Bahrain, the number of shots for the Omani team reached 64 shots; 25 shots of the jumping up, the team managed to score 6 goals and failed by 19 shots, the failure accounted of 76%, and scored goals ratio of shots by jumping up of the 9-meter line accounted of 21% only (Alsulaimi & Kilani, 2014). The purposes of this study were to investigate the relations between kinematics variables and the accuracy of shooting by upward leap for players of Oman National Handball Team and answer a number of questions such as: (a.) Is there statistical relation at the level of)α =0.05) between kinematics variables and the accuracy of shooting when leaping upward?; and (b) Are there moral statistical variations at the level of)α = 0.05) between kinematics variables and the accuracy of shooting by upward leap without defensive wall of Oman's National Handball Team Players?

METHODS: Five players from Oman's National Handball Team participated in the study. Four squares (50x50 cm) on the four corners of the goal angles were designed for shooting

accuracy measures. (Figure 1) Three digital JVC video cameras of (25 images per second were used to capture the two styles of shooting from jumping vertically with defense wall and without defense wall. APAS, MAXTRAQ system and KINOVEA software were used for motor and kinematical analysis. Descriptive statistics, Pearson correlation, regression and t-test were used to treat the data.
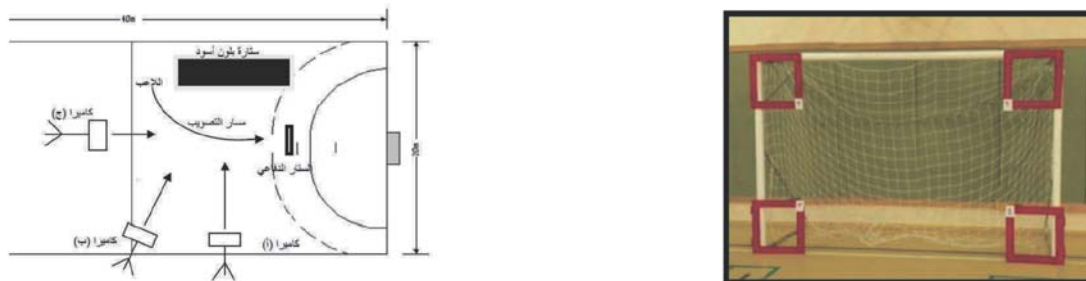

Figure 1: Shows the four squares (50x50 cm) on the four corners of the goal angles and the cameras orientation during the shooting.
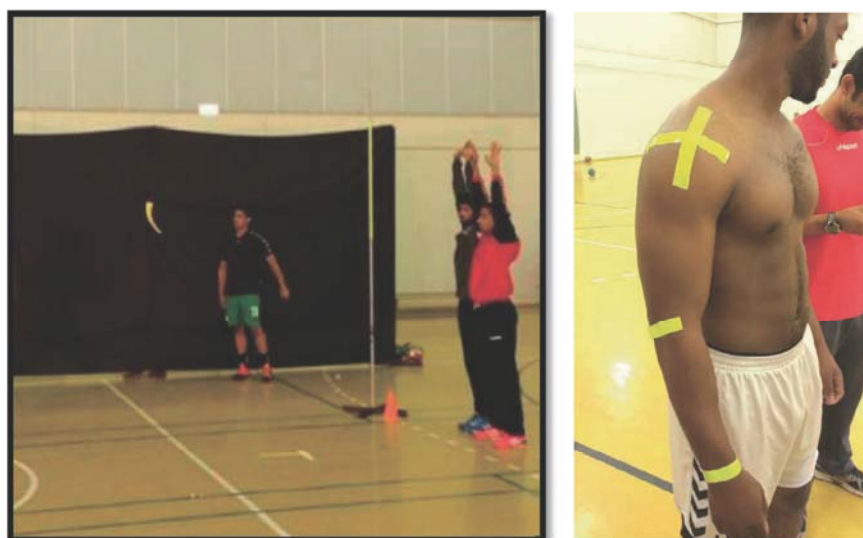

Figure 2: Shows the way that the standing of defensive wall and the player passing ball to the offensive shooter *(left)*. Display markers on the right side of the shooter *(right)*.

RESULTS: We found a direct relation between the take-off angle and accuracy of shooting, and there is a correlation between kinematics variations of the shooting skills of upward leap. The study also shows that there are differences in favor of shooting when there is a defensive wall in some of the kinematics variables such as take-off angle, vertical displacement of CG of body during the flight vertically. Significant differences has also been found between shooting with and without defense in favors of shooting without defense in the velocity of the ball release, vertical and horizontal displacement of CG of body during the flight vertically.
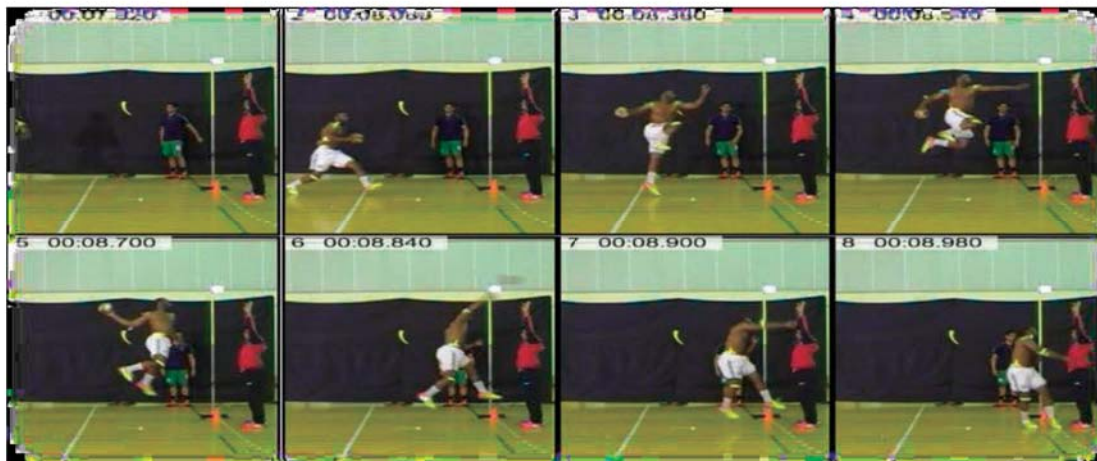
Figure 3: From the software trimming of the shooter in front of the defensive wall

Table 1 t-test samples correlated kinematics variables and accuracy of jumping up shooting in the cases of the presence and the absence of defensive wall

P value	T value	R	SD	mean		Kinematics
0.536	0.630	-0.024	1.11	3.10	with wall def	accuracy
			1.34	2.85	without wall def	
0.000	5.029	0.651	2.41	18.65	with wall def	Vlocity of ball releace m/s
			1.85	20.74	without wall def	
0.001	4.073	0.287	4.55	46.9	with wall def	Take off angle degree
			4.81	41.8	without wall def	
0.191	1.357	0.726	0.11	1.02	with wall def	Last stride length
			0.17	1.06	without wall def	M
0.000	8.587	0.667	0.13	0.58	with wall def	Horizontal displacement of
			0.16	0.81	without wall def	CG M
0.000	4.780	0.858	0.10	0.40	with wall def	Vertical displacement of CG
			0.13	0.32	without wall def	M
0.0000	6.996	0.572	0.10	0.71	with wall def	Resultant displacement of CG
			0.13	0.90	without wall def	M
0.010	2.840	0.210	0.40	2.00	with wall def	Horizontal velocity of CG m/s
			0.35	2.34	without wall def	
0.730	0.350	0.570	0.43	2.14	with wall def	Vertical velocity of CG m/s
			0.42	2.11	without wall def	
0.121	1.622	0.466	0.54	2.97	with wall def	Resultant velocity of CG
			0.48	3.16	without wall def	m/s
0.163	1.453	0.636	0.03	0.26	with wall def	Time of take off S
			0.02	0.25	without wall def	
0.395	0.940	0.884	0.07	0.32	with wall def	Flight time
			0.07	0.33	without wall def	S

DISCUSSION: From the observed results, it appears that most of the players' shooting accuracy was weak especially when a defensive wall was there. Meanwhile, there were significant differences in the variable "ball velocity release" in favor of the absence of wall defensive, a result consistent with the result of Garcia's study and others (Garcia et .al, 2011) where the velocity of the ball dropped when comparing the shooting when defender or goalkeeper, or both together were presence. (Tiller & Ettem, 2004) The results show that there is a direct correlation between accuracy variable and the takeoff angle, Pearson

correlation value was (0.510), and there is an inverse correlation between the variable accuracy and horizontal displacement of the center of gravity of the body at instant of take off up to the ball shot, Pearson correlation value was (0.448 -), and the variable accuracy and " horizontal velocity of center of gravity of the body after the takeoff.

CONCLUSION: It was suggested that coaches and athletes should consider in their training routine the significance of shooting when jumping vertically with defense wall and consider such kinematics variable to improve and develop their shooting accuracy, especially the proper timing when executing the shooting through the flight of jumping vertically when various types of defense exist.

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