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Analytical Study to Indicate the Comparison in Biomechanical Variables of Handball Scoring

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Abstract—*The aim of this study is to identifying the scoring biomechanical variables as per of the distance from the goal and to understand those variables. We have approached the case study descriptively by using the survey mode and the sampling is 10 professional handball players from Basra Council Team for the sport season 2018/19. A special video camera with Kinovea sport skill analysis programme were used to determine the biomechanical variables. All data were treated by SPSS-Ver 21 Statistical programme.*

The research results confirmed that there are significant differences in biomechanical variable of reaction index due to the three distance selected from the goal (M#, M%andM). M*is the longest distance more than (M#andM%), where the player needs to satisfy enough height to overcome the baffle defender wall. The vertical work shows a significant differences in biomechanical variable in the three distance areas. M*again showed the best result as it is depend on the vertical velocity needs via goal rounding run.*

Keywords— *Biomechanical and sport, Handball scoring , Kinetic analysis*

I. INTRODUCTION

Handball is deemed to be one of most distributive game across the world, where the players possessed high principle skills and high goal approaching and scoring skills. The nature of performance skills in today handball is distinguishing multi-type of interrelated and integrated motions. The player should be able to act due to the case requirements faced throughout his attempt to score a goal depending on his physical capability. As a result, the job have to be done in such a quickly way, scrolling and shooting with high accuracy (achievable and performance). Good scoring is a compulsive, harmonic and an effectiveness skills characterized as powerful, speedy and accuracy in shooting the ball toward the goal without breaching the play rules, Hussam Mohamed Gaber and others (2017) points out that the aiming is only the final result of the attack in the hope of scoring a goal where a suitable situation is created in which a team member can perform a direct throw with a good opportunity to score [1].

The accuracy is increased when the two competing teams level is converged and wasting any scoring opportunity may lead to loss of the game. This why all players need to be professional scorers regardless to their positions in the playground [2] This type of skill with skipping ability from any playground positions is so important and it is a key proficiency of operations performed by players , Dhurgham Abdulsalam (2014) points out that the player needs to have a high level of accuracy in the implementation of the proximity of the attacking player to the goal as he tries to reduce the distance between the area from which the player and the goal, which is an important

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factor and the main handball, the closer the distance, the more likely the success Shoot more [3].

Biomechanical science can determine the match mistakes and this is make it important in athletics. Biomechanical variables are players motion and the use of power by the effect of friction, work and other variables which depend on force as a fundamental element. The mechanical solution is the best for sorting out kinetics problem required to gain better result. Improvement of technical performance is one of the most important factors affecting the match results[4]. At this point, we selected few footballers to take part of this research and study the scoring skills from different distances and determine the biomechanical variables to be implemented in coaching in the future. The information can considered on a high level of attention from the point view of coaching. It is also determine the obstacles faced by the players in an early stage of training and to improve the performance as a result.
Biomechanical Science is the key factor in identifying performance variables and mistakes which hard to discover visually by coach. Skill analysis is converted to a minor intervals to perceive the mistake clearly. Variables like friction and work which are affecting player ongoing performance and the result is depend on force element in variables equation. Force element is the movement performance main factor, so the force bigger the body weight will divert the posture.

Hollman, defined the force element as muscle force or group of muscles reached by the athlete after developing kinetic vs. resistance pathway [5]. However, speed element is strongly affecting the biomechanical variables. Usually, handball is fast action game by increasing the vertical speed component and transmitted to the tool which the hand ball. As much the gaining speed is big as much the force element is great and the resultant ball speed is high , Dhurgham Abdulsalam Neamah and Wael Kassem Jawad (2015) point out that anything the player or team does is a contribution towards creating scoring chances because it is the winning team in the game that has brought the ball into the opponent's goal more often and legally, and that this process is not done Only through scoring [6].

The observation shows that the scoring skill is weak in the team under investigation. Even from different distances or in case of abstracting from opponent player. So the right way of the use of speed and force and implementing them correctly, will reduce the possibility of mechanical mistakes.
Dissatisfactory of the training to the factors will affect directly the biomechanical requirements. For these reasons the researchers decide to study the analysis of biomechanical variables in view of various scoring distances from the goal.

II. METHODOLOGY

The research method is depend on the nature of the study and therefor, descriptive approach in survey mode was selected to achieve the aims. Sampling is taken from Basra Council Team for the season of 2018/19. 10 handball players were selected to this purpose with an effective percentage of 62.5% from the original sampling group reviewed. To ensure the homogeneity of the sampling to the investigated variables of this study which, may affect the conduct of the experimental work, the Statistical treatment for coefficient of variation was applied. The result was very encouraging as it shows that coefficient of variation is (> 30%)[7]. Anthropometry

variables for this value is indicating homogenic sampling as (Arithmetic Mean/Standard Deviation) ratio for the variables are as follow:

$Totallengt$- (185.7/2.881)

$Mass$ (75/4.750)

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Age (23.4/1.685)

$Trainingage$ (9/0.858)

The result needs to be examined accurately, very small error and the result can be approved for The arithmetic technique. To get a high accuracy, special video camera (Sony HDR-XR520) type, frequency speed 100 $Photos/sec$contacted to the PC with photo analysis system (Kinovea-v18). This technique is implemented to measure scoring accuracy from leaping position in Revisionist Dhurgham Test which was developed in 2012 at the Faculty of Physical Education / University of Basra/ Iraq[8]. Biomechanical variables were calculated by using equations (1) and (2)[9]:

1 - Reactive Strength Index = Centre of Gravity Maximum Hight / Thrust Time .

2 – A standard Vertical Work = Work required to lift the body to a specific height against the gravity

3 - Physical impulse is determined by using equation (3)[10]:

Impulse = Force required * Time taken

III. EXPERIMENTAL WORK

A standard Olympic handball hall were used for the environment of this experiment. Three free zones from the gaol line were nominated for the scoring skill performance test ($M_{\#}$ = 9m, $M_{\%}$ = 11$m and M_{*}$ = 13m) with the fact of 10 trails for each player in each zone.

Video camera was fixed 4m away from the player stand point and 1.27m height from the ground point to the lance central of the camera. To find out Player Anthropometry Variables (PAV), the recorded film was analyses by Kinovea programmer. The best trials were selected and the PAVs were extracted.

On stage two of the statistical analysis is by using (Spss-v21) programmer to calculate Arithmetic Mean (AM), Standard Diversion (SD), Percentage (%), F-test of equality of variances (F) and L.S.D [11].

IV. RESULTS AND DISCUSSION

The data analysis for this study is the backbone to indicate the scientific quantitative and qualitive indexes which can approve the acceptance or rejection of the resultant values(12). Table (1) is the primarily data treatment and it will be followed several stages of extracted treatment.

Table 1: Primarily experimental data

No	Biomechanical Variables	measuring unit	M_1		M_2		M_3	
			AM	SD	AM	SD	AM	SD
1	Reaction Index	Cm / s	3.260	0.456	3.641	0.291	3.666	0.052
2	Vertical work	Jules	409.150	60.953	432.209	36.226	465.490	36.810
3	Strength Impulse	Net * m	47.832	5.944	49.609	5.230	54.760	6.009

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Table 2: Contrast analysis for F Index

No	Biomechanical Variables	Sources of variation	Sum ofsquares	df	Mean square	F	Sig
1	Reaction Index	Between groups	1.035	2	0.518	4.846	0.016
		Within groups	2.884	27	0.107		
		Total	3.919	29			
2	Vertical work	Between groups	16045.219	2	8022.610	3.771	0.036
		Within groups	57444.588	27	2127.577		
		Total	73489.807	29			
3	Strength Impulse	Between groups	258.959	2	129.480	3.932	0.032
		Within groups	889.181	27	32.933		
		Total	1148.140	29			

Table 3: The mean and L.S.D. values for energy system Fatigue Index'

No	**Biomechanical Variables**	**(I)VAR – (J)VAR**	**Mean Difference**	**Sig.**
1	Reaction Index	M1--M2	-- 0.381*	0.015
		M1--M3	-- 0.406*	0.010
		M2--M1	0.381*	0.015
		M2--M3	-- 0.025	0.864
		M3--M1	0.406*	0.010
		M3--M2	0.025	0.864
2	Vertical work	M1--M2	-- 23.059	0.273
		M1--M3	-- 56.340*	0.011
		M2--M1	23.059	0.273
		M2--M3	-- 33.280	0.118
		M3--M1	56.340*	0.011
		M3--M2	33.280	0.118
3	Strength Impulse	M1--M2	-- 1.777	0.495
		M1--M3	-- 6.928*	0.012
		M2--M1	1.777	0.495
		M2--M3	-- 5.151	0.055
		M3--M1	6.928*	0.012
		M3--M2	5.151	0.055

4-1 Reaction Index (RI)

Factor for the reaction Index of the variables showed table (1), it can be seen in table (2). A significant differences is indicated in the result of this table, and we need to determine the less significance (L.S.D.) to clarify the contrast in the results. Table (3) show the (L.S.D) values and it demonstrate the differences between free zone areas scoring. RI for *M*# illustrates higher value than *M*# and *M*% for the height leaping scoring performance. The

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demanding principles of the handball is ability of the player to shoot toward the goal from long distance, especially the rarer players line out of the free zone who they are having a strong skill of long distance shoot-scoring. The highest reaction force is essential to dispose of defender and that needs extraordinary momentum to achieve the right height to subject shoot-scoring , This is confirmed by Dhurgham Abdulsalam Neamah and Ali Mohammed Hadi (2018) that due to the different shooting areas, which are medium or far so it depends on the possibility of the player first and how well his ability to shoot near or near in addition to the near or after the player aiming from the opposing player [13] .

The force applied on the ground is related to uppermost point possible due to Newton third law [14]. This pushing reactional process is so important for fast transfer from landing to pushing to optimize the force within a short time. Therefore, the sampling of the free zone of ($M\# - M*$) didn't achieve a remarkable result because of the attachment time. Time of contact is an element of the equation skill performance by taken approaching steps which increase the time, optimizing the player height and decreasing the push power. This is consider as a negative indication on reaction force index. On other hand, the variable for the same sampling players in free zone $M\%$ is difference. Time of contact somehow is larger and better record than the other 2 zones. The height is better which increase ground reaction force index. Sarih, has mentioned this result in his published article [15].

4-2 Vertical Work

The calculated value of F factor for the vertical work is more than the tabular value which means a significant differences is exist, as shown in table (2). Therefor the less significance (L.S.D.) value was use for this purpose and as shown in table (3). There is such a clear contrast between the 3 free zones, demonstrating one fact which is the vertical work needs from $M\#$and $M\%$ is less than $M*$ for scoring with high leaping. It is obvious that the power used in $M*$ is high because the player try to avoid the defender by keeping enough distance and the best way to secure this distance is by leaping as high as possible to have a free view and un obstructing scoring area.

Dhurgham, in 20118 confirmed that the actinal process is start when the player managed to optimized his height and then he can move the shooting arm with enough speed toward and downward (Whip movement) and then continued toward to be the longest possible distance with and assuring that the wrist orientation is correct [16]. By increasing the approaching speed, the motion momentum will rise, the net force will be increased with independence on leaping speed or vertical speed. Iman, in her publication confirmed that the vertical speed is the mean source to possess a vertical height after pushing with a reduction in departure speed [17]. Sa'ibetal, indicated that the size of height approached by the player is depend on the vertical speed from the time he left the ground, the pushing force applied on the ground and the time taken. The multiplication of this force and time is the pushing power [18]. The player also needs to surge his Hip height at the time of shooting-score.

4-3 Impulse

For the same conclusion in the previous section(Vertical work), $M*$ is the highest value. To avoid the defender, this variable is essential in optimizing the height and rising the shooting point as a result. Therefor, gaol-shoot from long distance is preferable and the vertical work is depend on the force which made a good preference in zone $M*$. This is confirmation, that the player achieve strong pushing through scoring process.

The angle bent in knee joint is a key factor to improve the resultant power. Pleating the two knees is effecting the rebound-time and then the impulse power in short time. It is also effecting the muscles to produce larg force to extend the joint to get more impulse power in shorter time.

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Resan and Najah, mentioned that there is a direct proportion between power and time. The pushing power means, power in short time which changes body momentum from one direction to another following the impulse law [19]:

$$Impulse = Force \times Timetaken$$

The researchers thinks that the impulse having a direct proportion with force and revise proportion with time. Therefore, as the time is longer, the impulse force is less and this indicates small speed. Leg muscles plays such a good role in generating enough power to produce an optimized height in zone $M*$.

Newton second law states that the acceleration or the change in motion is in direct proportion with generation power and the motion will be obtained [20].

V. CONCLUSIONS

We have concluded the following:

1 - There is a significance differences in biomechanical index of reaction as a result of distances contrast of ($M_{\#}$, $M_{\%} and M_{*}$) and the player needs to optimized enough height to avoid the defender.

2 - There is significant differences in vertical work (mechanical variable) between the three zone with and advantage to zone $M*$ depending on the vertical speed.

3 - Impulse power is the same in zone $M*$ because of the reduction in repound-time and wasting in power and the vertical speed.

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