DOI 10.26773/smj.220204

SportMont

ORIGINAL SCIENTIFIC PAPER

Shooting Speed Differences between Playing Positions in Top Level Handball

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Abstract

Scoring the goal in handball is performed by shooting action. Shooting speed is one of the most important attacking elements that influences successful performance in handball. Anyhow, there is a lack of scientific data considering shooting speed between different playing positions. The main aim of this study was to determine differences in shooting speed between playing positions in top level male handball players. Data used in this study was collected from official match reports of European handball championship held in Austria, Norway and Sweden 2020. Seven hundred and eighty-four (784) shoots were analyzed and variables included were shooting speed and playing position. Shooting speed was collected with iBall (SELECT, Denmark), with a built-in chip that tracks and distributes data in real time (Kinexon, Germany). Differences between playing positions were calculated with Kruskal-Wallis test. Significant difference in shooting speed was noticed between playing positions (Chi-Square=67.34). Post-hoc analysis revealed that line positions (wings and pivots) shoot significantly slower than outfield positions. No differences were noticed between wings and pivots, nor between left, right and center back. On the first sight, results of the study are biomechanically contradictable since faster shoots are from longer distances. Anyway, results could be easily explained if game dynamic is analyzed. Namely, line shoots are executed from narrow angle situations which more often require creative and wise, than strong shooting performance.

Keywords: *team handball, shooting velocity, throwing, over-arm throw*

Introduction

Handball is team sport game with high physical, technical and tactical demands (Karcher & Buchheit, 2014). Seven players compete for each team, and the game is played on a 40x20-m court. Games are divided into two halves of 30 min each. Main aim is to score more goals than the opponent. Demands of the handball game is seen through its dynamics. Specifically, it is one of the fastest team sport games in which players applicate specific movements in extremely fast and explosive manner (Michalsik & Aagaard, 2015).

Shoot on goal is one of the most frequent technique elements and have several modes of performance. It is divided in 2 bigger groups: shots from the ground and jump shots. Shot from the ground is executed with one leg extended forward although some players perform it with both legs parallel. Although slower, jump shot is most usual shot in handball and is physically and technically more demanding than ground shot (Rousanoglou, Noutsos, Bayios, & Boudolos, 2014). Approximately one half of all shots during a handball match are executed from the backcourt position and in 60% of them by means of the jump shot technique (Šbila, Vuleta, & Pori, 2004). Regardless shot type, shooting velocity is considered as most important facet of shooting efficiency (Fleck et al., 1992; Rivilla-Garcia, Grande, Sampedro, & Van Den Tillaar, 2011). Therefore, shooting velocity is very important factor of successful attacking performance in handball.

Different playing positions have different roles that puts them in different shooting situations (Büchel et al., 2019; Foretić, Rogulj, & Trninić, 2010; Gusic, Popovic, Molnar, Masanovic, & Radakovic, 2017). For example, wing and outfield players use jump shot in attack ending. Wing players have specific jump

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shot in which they jump as long as possible before shooting. Contrary, back players' jump shoot is mostly oriented on vertical dimension of jumping (Karcher & Buchheit, 2014). Scientific research reported that shooting velocity is dependable on four major factors; players morphology, strength and power capacity, shooting technique and fatigue. Zapartidis et al. (2009) found that back players achieved the highest values among all players in ball shooting speed and that they were the tallest (Zapartidis et al., 2009). Associations between players' strength, power and shooting velocity were recorded in several studies (Chelly, Hermassi, & Shephard, 2010; Havolli et al., 2020; Saavedra et al., 2018) while Şimşek (2012) reported negative effect of muscle fatigue on shooting accuracy and velocity in young male handball players (Şimşek, 2012). Analysis of playing position morphology lead to opinion that body height is one of the major selection criteria, especially for back position (Marković & Pivač, 2005; Vuckovic & Dopsaj, 2011). Since shooting situations demand from back players to overcome tall defensive blocks and goalkeeper it is expected that taller players would have more advantage in shooting actions. Beside of the game geometry, taller players would also have longer limbs that can produce longer lever and consequently faster shot (van den Tillaar & Ettema, 2004; Zapartidis et al., 2009).

Generally speaking, shooting ability, especially shooting speed, significantly influences selection of playing positions. Therefore, it is logical to say that shooting speed is very important ability in handball. Its' characteristics should be regularly analysed and monitored. The problem of monitoring is lack of instrument that could be used during official matches where players execute shots in real-game situations. Those situations are specific and have pretty much different demands than those created on simulated testing sessions. Lack of feasible and easily available measuring instruments of shooting speed influenced the lack of scientific researches in the area. As so, the main aim of our study was to determine differences in shooting speed between playing positions in top level handball.

Methods

Subjects in this study were 118 handball players that participated at European handball championship held in Austria, Norway and Sweden 2020. Just for scored goals shooting speed was reported. Total 784 shots/goals during 15 games were analysed. Shooting speed (SS) was collected with iBall (SELECT, Denmark), with a built-in chip that tracks and distributes data in real time (Kinexon, Germany). Values of shooting speed is presented in kilometres per hour (km/h). Except shooting speed, other variables included 6 playing positions; left wing (LW), right wing (RW), pivot (P), centre back (CB), left back (LB) and right back (RB).

Statistical analyses included the calculation of descriptive statistical parameters (arithmetic means and standard deviations, minimum and maximum measurement values and the Kolmogorov-Smirnov test for testing normality of distribution) and non-parametric ANOVA (Kruskal-Wallis test) to determine the differences between the observed variables. For all analyses, Statistica 13.0 (TIBCO Software Inc, USA) was used, and a p-level of 95% was applied.

Results

Table 1 show results of descriptive statistics calculated for shots taken from 6 playing positions. Uneven distribution is noticed in variables for shots taken from left back (LB) position. This result influenced irregularity of overall distribution (ALL) and caused need for applying nonparametric statistical method for determination of differences in shooting speed between playing positions - Kruskal-Wallis test.

Table 1. Descriptive statistics

Positions	N	Mean±SD	MIN	MAX	KS	p
LW	80	85.90±20.30	38.00	127.00	0.07	> .20
RW	149	87.33±20.68	28.00	136.00	0.04	> .20
P	131	91.07±19.98	25.00	130,00	0.07	> .20
LB	127,0	102.28±20.92	26.00	137.00	0.12 *	< .05
RB	136	102.92±20.18	30.00	137.00	0.07	> .20
CB	161	99.35±19.37	37.00	136.00	0.05	> .20
ALL	787	95.41±21.23	25.00	137.00	0.05 *	< .05

Legend: N – number of subjects; Mean – arithmetic mean; SD – standard deviation; MIN – minimum; MAX – maximum; KS – Kolmogorov-Smrinov test; LW – left wing shoot; RW – right wing shoot; P – pivot shoot; CB – center back shoot; LB – left back shoot; RB – right back shoot; * - irregular distribution

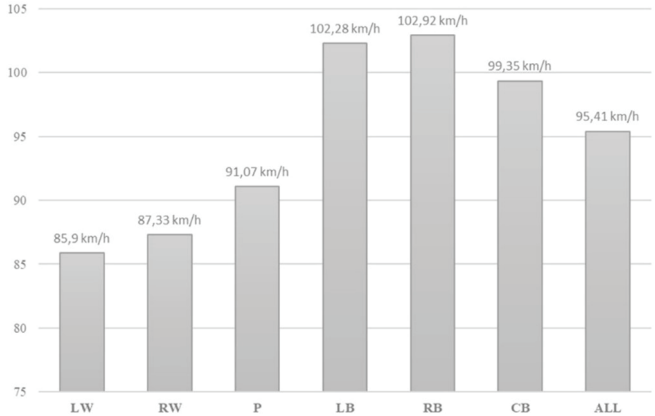

FIGURE 1. Average shooting speed distribution on different playing positions

Figure 1 presents shooting speed distribution on different playing positions. As shown, fastest shots were performed by centre back (CB), left back (LB) and right back (RB) (around 102 km/h), while slowest by left wing (LW) and right wing (RW) (around 86 km/h) playing positions. Pivot (P) players shoot the ball approximately 5 km/h faster than wing players.

Differences between playing positions is shown in table 2. Significant differences in shooting speed is noticed between: left back (LB) and pivot (P), right wing (RW) and left wing (LW), right back (RB) and pivot (P), right wing (RW) and left wing (LW) and between centre back (CB) and pivot (P), right wing (RW) and left wing (LW). No significant differences were noticed between pivot (P) and wing positions, nor between right back (RB), left back (LB) and centre back (CB), respectively.

Table 2. Differences between playing positions (Kruskal-Wallis test)

Positions	LB R:480.35	P R:340.96	RW R:301.74	RB R:474.49	CB R:432.78	LW R:286.04
LB						
P	4.94 *					
RW	6.53 *	1.45				
RB	0.21	4.82 *	6.43 *			
CB	1.77	3.45 *	5.09 *	1.58		
LW	6.01 *	1.71	0.50	5.91 *	4.74 *	

Discussion

Irregular distribution of left back position shooting speed could be discussed in context of left back player roles in defense and attack transition. Namely, left back players are often players that participate a lot in middle section defensive activities. When opponent loses the ball, and this is happening most frequent in this part of the court, left backs are closest to collect and shoot it on the empty goal. This is happening when opponent is playing 7 vs. 6 or when opponent have excluded player (Korte & Lames, 2019). In both situations there is no goalkeeper on the goal and players that come to the ball possession doesn't have to shoot the ball fast but precise. Obviously, left back players are most of the time in these situations and shoot a lot of "slow shots" on empty goal. These "slow shots" disturbs data distributions and make larger span between minimal and maximal results than in the other playing positions.

Significant difference between outfield and line playing positions should be associated with demands and characteristics of shots taken from different playing positions. When analysing wing players' shots, it can be stated that they have to be more "cunning" than other players. Without question, shots taken from wing positions have smallest angle. Small angle reduces shooting/aiming area (Srhoj, Rogulj, & Katić, 2001). Hence, wing players need to use different shot variations in which they try to trick the goalkeeper (Rogulj, V. Srhoj, & L. Srhoj, 2004). This is most obvious when wing player jumps from "narrow angle" and uses specific shots such as "rotational shot", "dry leave shot" or "lob". All those shots are technically demanding and are very slow in terms of ball speed. Wing players have largest share of "tricky shots" in shooting frequency which influences/decreases overall shooting speed. Slowest shooting speed of wing players was found in some other research. Shalfawi et al. (2014) found that back players had a significant higher ($p<0.05$) ball shooting velocity of 2.1±1.0 m·s-1 compared to pivots and 4.3±0.7 m·s-1 compared to wing players. Authors concluded that shooting speed in male handball is mostly influenced by playing position, age, shooting type and ball shooting placement (Shalfawi, Seiler, Tønnessen, & Haugen, 2014).

Fastest shooting speed was noticed at outfield players; left back, right back and centre back, respectively. When observing 9m shots it easy to spot that shooting efficiency is associated with completely different factors than the shoots taken from wing or pivot positions. In outfield shot, back players have to jump as high as possible and perform shot as explosive as possible. Biggest obstacle in 9 m shooting are defenders that constantly interfere shooter, either with physical contact or with blocking actions (Foretić et al., 2010; Karcher & Buchheit, 2014). Opposite to wing player that have small or no defenders' interference, during shooting action, back player needs to shoot the ball as fast as possible to avoid mentioned difficulties. Additionally, 9m shots are geometrically farthest, so "slow" or "tricky shots" are inefficient in these shooting situations. Last factor of difference in shooting speed between outfield and line positions could be players morphology. In particular, outfield playing positions have emphasised longitudinal body dimensions and body weight, in relation to line players (specially to wing players). Several studies showed that those morphological features have strong influence on throwing and shooting performance in various sport activities and games (Fieseler et al., 2017; Srhoj, Rogulj, Papić, Foretić, & Čavala, 2012; van den Tillaar & Ettema, 2004). Although, in our study we didn't consider morphological characteristics, it is logical to assume that back players analysed are highest and heaviest and that those features influence significantly on shooting speed.

Conclusion

Study bring interesting insight shooting speed differences between playing positions in top level handball. Results are in agreement with previous studies coaching intuition in which back players supposed to have faster shooting speed than line players. Authors associate results with specific playing position role and game situation. Wing players use more "tricky shots" than back players and this decreases overall shooting speed of wing players. Future studies should consider and explore some other factors of influence on shooting speed such as detailed players morphology, shooting situations, opponent quality and fatigue. Generally, results could direct handball coaches toward appropriate selection and efficient shooting conditioning on different playing positions.

Acknowledgements
There are no acknowledgements.

Conflict of interest
The authors declare that there are no conflicts of interest.

Received: 13 February 2021 | **Accepted:** 29 March 2021 | **Published:** 01 February 2022

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