

Goalkeeper's Efficiency in Relation with Throws from Different Attacking Court Areas in Team Handball

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Abstract

The aim of the study was to examine goalkeepers' efficiency in relation to the throws from different court areas. The sample consisted of 25 games analyzed for goalkeeper's efficiency in three different distances (<6, 6-9, >9m.) in relation with different court areas. Descriptive statistics and χ^2 test were applied. The results showed 629 (29.7%) saves. Most of them were made from central area and from 6 - 9 m. The majority were achieved at the left side of the goal and at a middle height. Saves from <6 m. in the central area of the court had a significant difference with the left corner $p = 0.033$, the right-side $p = 0.035$ and with right corner area $p = 0.022$. From 6 - 9 m. saves in the central area had a difference with the left side $p = 0.000$, the right-side $p = 0.000$, while the left side had a difference with the right-side area $p = 0.012$. From >9 m. in the central area saves had a difference with the left side $p = 0.007$ and with the right-side area $p = 0.021$. Conclusively, goalkeepers' efficiency depends on the distance of the throw and on the specific court area.

Keywords: saves, analysis, distance, field position

1. Introduction

In modern sports science the coaches of a sport try to plan the training every day and also, they try to make their plans for the game. These people are called to assess the performance of the players and to calculate their efficiency. Moreover, they try to evaluate the performance of the players and to predict if a player is ready for the game (Bilge, 2012). Debanne and Laffaye (2017), state that in some sports, team performance study led to success sometimes, as a consequence of a prediction which comes from the analysis of athletic performance. One possible way to do this, is to assess and to evaluate the games and particularly to rank the players determining their possible lack of success or their great achievement (Bilge, 2012).

In team handball the final result of a match depends on the goals which scored by the players. Each player tries to overtake goalkeeper's blockade (Marques, van den Telaar, Vesca, & Gonzalez-Badillo, 2007). Thus, goalkeeper in this sport plays an important role during a game and determine, at some point the final result. Furthermore Dumitru (2010), states that goalkeeper has a special role in the overall performance of a team and is one of the most crucial factors of this sport as he has a particular role for the efficiency of the defense and the counterattack (Czerwinski, 1997).

Fuertes et al. (2010), reported that at high level teams have better goalkeepers than the other teams which are not so good. Espina-Agulló (2016), states there was a differentiation in goalkeepers' effectiveness between 1982 -2012, although goalkeeper's actions did not differ importantly. It is clear that goalkeeper's efficiency builds upon shot efficiency of the players. Thus, there is a relation between shot efficiency of the players and the efficiency of the goalkeeper.

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Team handball in Greece is not very well developed if we take into consideration many different conditions elements and forms of this sport (Mavrikou, 2015). For better understanding the level of the sport in one country it is necessary to do regularly analysis on specific indicators that are recognized as reliable worldwide. One possible example is to analyze the efficiency of the players or the efficiency of the goalkeepers in one season of a championship. Meletakos, Noutsos, Manasis and Bayios (2014), state that the overview of the statistics of the championships in the Greek territory helps and contributes to the European and World indicators and that, one may know better the individual aspects of the game in Greece and also abroad. This happens because many times a national team in a sport represents and shows the real image of the competitiveness and the performance of the various championships. From all the above it is obvious that analysis of the game and specifically analysis of goalkeeper's efficiency plays an important role to the scientific knowledge of this sport. This led to the aim of the present study which was to examine the efficiency of the goalkeepers in relation to the throws from different attacking court areas.

2. Material and Method

The sample of the study was 25 high-level handball matches during men championships in Greece, which took place between 2017-2018 and 2018-2019. The method followed was video-analysis. In total, 13 teams who played matches at home and away were evaluated. Study's variables that have been recorded and then analyzed were attack variables and defense variables. In particular, attack variables were: 1. The throwing efficiency from 6 to 9 meters (throws <from 6m., goals <from 6m., throws from 6m. to 9m., goals from 6m. - 9 m., throws> from 9 m., goals> from 9 m.), 2. The result of the throw (goal, post-out, save) 3. The direction of throwing (direction of throw in the low, medial, upper, left, center and right position of the goal), 4. The distance from the goal (throws from near <6m., middle 6-9m. and long distance> 9m.). Defense variables were the goalkeepers' saves.

2.1 Statistical analysis

For the purpose of this study's statistical analysis, descriptive statistics and the non-parametric method χ^2 were used. More specifically, the frequency of values and their percentage were used, as well as the mean and standard deviation (SD). In addition, the differences among distance throws in relation to their effectiveness (goals) from the different shooting areas and the players' positions were examined and analyzed with the χ^2 test. The significance level was set at 0.05. Statistical processing of this study's data, was made with SPSS 22.

3. Results

From the results it appeared that all the teams made 2118 throws from which 1206 (56.9%) throws were goals, 629 (29.7%) throws were saves and 283 (13.4%) throws were out of the goal and at the post. Table 1 shows the frequency values and their percentage of the saves that were made from all the court areas for the total number of the teams involved. It seems that most of the saves were made from central area and from the distance between 6 - 9 meters.

Table 1. Distance and area of saves of all teams.

Court area	Distance < 6 meters	Distance 6–9 meters	Distance >9 meters
Variables	Frequency – (%)	Frequency – (%)	Frequency – (%)
Left corner	38 (6.1%)	13 (2%)	2 (0.3%)
Left side	27 (4.3%)	48 (7.6%)	49 (7.8%)
Central area	69 (11%)	123 (19.5%)	75 (12%)
Right side	34 (5.4%)	68 (10.8%)	37 (5.9)
Right corner	40 (6.4%)	5 (0.8%)	1 (0.1%)
Total	208	257	164

Moreover Table 2 shows the frequency values of the throws from all teams, the throwing effectiveness (goals), and the frequency values of the throws which were out of the goal and at the post from all the court areas.

Table 2. Total throws and their final outcome from all the court areas.

Court area	Distance < 6 meters	Distance 6 – 9 meters	Distance > 9 meters
Variables	Frequency	Frequency	Frequency
	Throws-Goals-Post-out	Throws-Goals-Post-out	Throws-Goals-Post-out
Left corner	112 - 56 - 18	42 - 26 - 3	3 - 1 - 0
Left side	99 - 64 - 8	157 - 92 - 17	132 - 63 - 20
Central area	246 - 158 - 19	416 - 263 - 30	274 - 141 - 58
Right side	153 - 91 - 28	191 - 89 - 34	119 - 57 - 25
Right corner	150 - 90 - 20	22 - 15 - 2	2 - 0 - 1
Total	760-459 -93	828- 485 - 86	530- 262 - 104

In addition, regarding the specific direction of the ball in the goal when a save was made, data analysis reveals that, most of the saves from all teams were achieved at the left side of the goal and at a middle height. Table 3 shows the frequency of values and their percentage concerning the direction of the ball towards the goal when a save was made and the exact point (height) among the teams studied.

Table 3. Goal area and height of saves among teams.

Height	Left side of the goal	Centre of the goal	Right side of the goal
Variables	Frequency	Frequency	Frequency
High	63 (10%)	42 (6.7%)	64 (10.2%)
Middle	118 (18.8%)	45 (7.1%)	84 (13.3%)
Low	106 (16.9%)	37 (5.9%)	70 (11.1%)
Total	287	124	218

Test χ^2 showed that, for the total amount of the games analyzed there were significant differences in areas of attack and hence in the players' positions, in terms of goalkeeper efficiency and distance. Table 4 shows the significant differences from test χ^2 from the distance <6 meters.

Table 4. Differences in frequency and significant differences from the χ^2 test in attacking areas, with regard to goalkeeper efficiency (saves) from the distance <6 meters.

Court area	Saves < 6 m.	Saves < 6 m.	Saves < 6 m.	Saves < 6 m.	Saves < 6 m.
Variables	Left corner	Left side	Central area	Right side	Right corner
Left corner	38 vs 38	38 vs 27(ns)	38 vs 69*	38 vs 34(ns)	38 vs 40(ns)
Left side	27 vs 38(ns)	27 vs 27	27 vs 69(ns)	27 vs 34(ns)	27 vs 40(ns)
Central area	69 vs 38*	69 vs 27(ns)	69 vs 69	69 vs 34*	69 vs 40*
Right side	34 vs 38(ns)	34 vs 27(ns)	34 vs 69*	34 vs 34	34 vs 40(ns)
Right corner	40 vs 38(ns)	40 vs 27(ns)	40 vs 69*	40 vs 34(ns)	40 vs 40

Note. * 0.05, ** 0.01, *** 0.001, (ns) no significant

Table 5 shows the significant differences from test χ^2 from the distance of 6-9 meters.

Table 5. Differences in frequency and significant differences from test χ^2 in attacking areas with regard to goalkeeper efficiency (saves) from the distance of 6 to 9 meters.

Court area	Saves 6 - 9 m.	Saves 6 - 9 m.	Saves 6 - 9 m.	Saves 6 - 9m.	Saves 6 - 9 m.
Variables	Left corner	Left side	Central area	Right side	Right corner
Left corner	13 vs 13	13 vs 48(ns)	13 vs 123(ns)	13 vs 68(ns)	13 vs 5(ns)
Left side	48 vs 13(ns)	48 vs 48	48 vs 123***	48 vs 68*	48 vs 5(ns)
Central area	123 vs 13(ns)	123 vs 48***	123 vs 123	123 vs 68***	123 vs 5(ns)
Right side	68 vs 13(ns)	68 vs 48*	68 vs 123**	68 vs 68	68 vs 5(ns)
Right corner	5 vs 13 (ns)	5 vs 48 (ns)	5 vs 123(ns)	5 vs 68(ns)	5 vs 5

Note. * 0.05, ** 0.01, *** 0.001, (ns) no significant

Table 6 shows the significant differences from test χ^2 from the distance > 9 meters.

Table 6. Differences in frequency and significant differences from test χ^2 in attacking areas with regard to goalkeeper efficiency (saves) from a distance > 9 meters.

Court area	Saves > 9 m.	Saves > 9 m.	Saves > 9 m.	Saves > 9 m.	Saves >9 m.
Variables	Left corner	Left side	Central area	Right side	Right corner
Left corner	2 vs 2	2 vs 49(ns)	2 vs 75(ns)	2 vs 37(ns)	2 vs 1(ns)
Left side	49 vs 2(ns)	49 vs 49	49 vs 75**	49 vs 37(ns)	49 vs 1(ns)
Central area	75 vs 2(ns)	75 vs 49**	75 vs 75	75 vs 37*	75 vs 1(ns)
Right side	37 vs 2(ns)	37 vs 49(ns)	37 vs 75*	37 vs 37	37 vs 1(ns)
Right corner	1 vs 2(ns)	1 vs 49(ns)	1 vs 75(ns)	1 vs 37(ns)	1 vs 1

Note. * 0.05, ** 0.01, *** 0.001, (ns) no significant

More specifically:

From a distance of <6 meters:

The goalkeepers' efficiency (saves) from a distance of <6 meters in the central area of the court (mainly the position of the line player) had a significant difference with the goalkeepers' efficiency (saves) from the left corner area (position of the left winger) $p = 0.033$. Still the goalkeepers' efficiency (saves) from a distance of <6 meters in the central area of the court (mainly the position of the line player) had a significant difference with the goalkeepers' efficiency (saves) from the right-side area (position of the right back and the line player) $p = 0.035$. Furthermore, the goalkeepers' efficiency (saves) from a distance of <6 meters in the central area of the court (mainly the position of the line player) had a significant difference with the goalkeepers' efficiency (saves) from the right corner area (position of the right winger) $p = 0.022$.

From the distance of 6 - 9 meters:

The goalkeepers' efficiency (saves) from a distance of 6 to 9 meters in the central area of the court (position of the center back) had a significant difference with the goalkeepers' efficiency (saves) from the left side area (position of the left back) $p = 0.000$. Moreover, the goalkeepers' efficiency (saves) from a distance of 6 to 9 meters in the left side area of the court (position of the left back) had a significant difference with the goalkeepers' efficiency (saves) from the right side area (position of the right back) $p = 0.012$. Furthermore, the goalkeepers' efficiency (saves) from a distance of 6 to 9 meters in the central area of the court (position of the center back) had a significant difference with the goalkeepers' efficiency (saves) from the right-side area (position of the right back) $p = 0.000$.

From the distance > 9 meters:

The goalkeepers' efficiency (saves) from a distance of >9 meters in the central area of the court (position of the center back) had a significant difference with the goalkeepers' efficiency (saves) from the left side area (position of the left back) $p = 0.007$. Still the goalkeepers' efficiency (saves) from a distance of >9 meters in the central area of the court (position of the center back) had a significant difference with the goalkeepers' efficiency (saves) from the right-side area (position of the right back) $p = 0.021$.

4. Discussion

From the results of our study the goalkeepers' efficiency was 29.7%. Hansen et al. (2017), reported the same percentage (30%). In his study the goalkeepers were at high level in contrast with our study which analyzed goalkeepers from medium and low level and standards. As we know Greek championship is not so strong and so competitive than other championships which are more advanced. Bilge (2012), reported a percentage between 33.5% - 34.7% in Olympics, World and European championships. Furthermore, the percentage of the saves during the 2013 World Championship was 31%. One possible reason for the slight low percentage of goalkeepers' efficiency at these previous years is some minor improvements in the throwing skills of field players.

Furthermore another reason is that despite conducting specialist goalkeeper training regimes, the effectiveness of goalkeepers decreased by few percent within the last several years (Maciej & Bartosz, 2017). Our results also showed (Table 1) that the most efficiency court area for the goalkeepers' saves was the central area and from the distance between 6-9 meters. If we consider that most throws (416) were made from this specific area of the court, we can understand why goalkeepers in our study had the highest efficiency from this area. Besides Maciej and Bartosz (2017), reported in the recent years there is an increase in throws. Hatzimanouil, Giatsis, Kepesidou, Kanioglou & Loizos (2017), reported that regarding the playing position, the largest number of throws were made from the back-position players. Moreover Oscar and Pascual (2011), state that these players (left back, center back and right back) are the players with the highest number of throws in a game in team handball. The distance between 6-9 meters is an area where, center back player has the advantage due to its position, to catch and possess the ball most of the time, to make a lot of actions in a variety of ways by moving parallel and vertical to the defense and thus to have more opportunities for throwing the ball to the goal (Hatzimanouil et al., 2017). In our result (Table 2) it appears that central area from all distances (<6 m., 6-9 m., and >9 m.) have the highest number of throws and the highest number of goals. At this area usually backcourt players are moving while changing continuously their basic positions in the court. Another reason that, the most efforts are been made from this particular area of the court in this sport, is because in this part of the attack there is the biggest throwing angle and therefore the best conditions for a successful attempt. (Hatzimanouil, 2019).

Meletakos, Vagenas and Bayios (2011), reported that defense is struggling to avoid all the actions from the line player, mainly in the central part of defense. This kind of actions focalized defense to concentrate on to the line player and allow back players to make many throws from 6-9 meters or from longer distance (>9 meters). At the same time high-level back players that are good shooters give the chance to the attack, and in particular to these players, to score from a long distance. As a consequence of this, defense suddenly leaves the concertation on to the line player and tries at the same time to block these players (back players). Thus, this kind of condition gives the opportunity to these players not only for shooting but also to be able to co-operate with the line player. Besides, this game situation is a key element of modern handball.

Moreover, with regard to the specific direction of the ball in the goal when a save was made, our results reveal that, most of the saves from all teams were achieved at the left side of the goal and at a middle height. The efficiency at this area of the goal was 18.8%. These findings are in accordance with those of Hansen et al. (2017), who reported that most saves have been achieved at the left side of the goal and at a middle height. The same authors stated that, one possible explanation for this may be goalkeepers' ability. Hatzimanouil (2019), reported in his study that, most of the throws for Greek teams are heading to the low left side of the goal. This result was consistent with other research that suggests that most of the throws in team handball are directed at this point of the goal (Hianik, 2007; Oscar & Pascual, 2011). Oscar and Pascual (2011), in their study, reported that the most efficient area of the goal for the players is the high left side of the goal. This means that goalkeeper is less efficient in this area of the goal. In our results this area had the minor percentage of goalkeeper's efficiency (10%) if we exclude the central area of the goal where goalkeeper is standing.

Finally, with regard to the results of the χ^2 test, it appeared that for the total amount of the games analyzed there were significant differences in areas of the attack and hence in the players' positions, in terms of goalkeeper efficiency and distance. Particularly the goalkeepers' efficiency (saves) from a distance of <6 meters had significant difference between the position of the line player and the position of the left wing. This means that, goalkeepers execute more saves from throws coming from the line player and this is normal because, as we mentioned before,

there is a trend in modern handball for backcourt players to co-operate with the line player very often during attack phase and so to have more attempts from this playing position. Maciej and Bartosz (2017), stated that in recent years there is a rise of the effectiveness of the element of saves from the line player at the expense of the effectiveness of saves of wing throws.

Furthermore, it seems that goalkeepers' efficiency (saves) from a distance of <6 meters had significant difference among the positions of the line player and the right back and also, the line player (from different angle). This means that goalkeepers execute more saves from the line player at the center area than from the right side of 6 meters area.

If we consider that players try to attempt more efforts from the central space of 6 meters area and many times in Greek championship there are right handed backcourt players, who prefer for example not to execute a break throw from a difficult angle (right handed – right side), it is clear why goalkeepers do more saves from this point of the court. Another reason is that first line players haven't had the opportunity to optimize their throwing technique for shots from shorter distances (mainly shoot from short distances) due to their position on the field during matches compared with the second line players (Rivilla - Garcia, Calvo & Tillaar, 2016).

Goalkeepers' efficiency (saves) from a distance of <6 meters had also significant difference between the position of the line player and the position of the right wing. Thus, goalkeepers execute more saves from the line player and this happens because as we mentioned before there is a trend for backcourt players to co-operate with the line player more often than to co-operate with the wing players. Besides, in modern handball there is a trend for back players and pivots to cooperate very well. As a consequence, a large number of shots from this position is applied by the teams in order to complete the offensive tactic. In this way backcourt players have to maximize their chances to score not only executing shots from medium and long-distance areas, but also from the line positions (Uzelac - Šćiran, 2017). Besides as we mentioned before Maciej and Bartosz (2017), reported a rise of the effectiveness of the element of saves from the line player instead of the effectiveness of saves of wing throws.

The goalkeepers' efficiency (saves) from a distance of 6-9 meters had significant difference between the position of the center back player and the position of the left back player. If we see the throws from the central area (416) and the throws from the left side area (157), it is clear why goalkeepers executed so many saves from the position of the center back. This happens because even the left back player tries to throw the ball from this position and from this distance it is better for the players to throw the ball from the center area because the angle is bigger and the efficiency is better (more chances to score). The reason that goalkeepers' efficiency (saves) had significant differences between left back player and right back player is because as we mentioned before in Greek championship there are still a lot of right - handed players at the position of right back. Thus, a lot of times it is easier for a goalkeeper to block the ball from a right-handed right back player than from a right-handed left back player. Finally, the reason that goalkeepers' efficiency (saves) had significant differences between center back player and right back player is because as we mentioned before it is preferable for a player to throw the ball from the center area of the court. That's why there are less throws (191) from right side of the court instead of the center area (416).

Goalkeepers' efficiency (saves) from a distance of >9 meters had significant difference between the position of the center back player and the position of the left back player. If we consider the number of throws from these two areas of the court (274 vs 132) we understand why goalkeepers in the present study executed more saves from the center area of the court. In my opinion, for the same reason goalkeepers, block the ball from the center area more often than from the right side of the court (274 vs 119). Hatzimanouil et al. (2017), regarding 9m shots, stated that goalkeepers stand at a long distance from the shot point and have more time to react and watch the trajectory of the ball. As a consequence, this leads to an increase in the goalkeepers' effectiveness at 9m shots. If we consider that in Greek Championship, when a player throws the ball from a long distance, the speed of the ball is limited comparing with other high-level players, it is easy to understand why there are so many saves from the center area and from medium and long distances shots. In addition, it is logical and it is expected from backcourt players to make most shots due to their positioning in the playing court, as they have the longest control time, the longest contact with the ball and then they can operate at optimal spatial positions (the central part of the handball court). That opens for them the best view and the greatest shooting angle in relation to the opponent's goal (Uzelac - Šćiran, 2017).

5. Conclusion

It is obvious that team handball day by day becomes faster and more offensive. The main component of this sport is the goal. Every player tries to score with high efficiency while the goalkeeper tries to block the shots.

Goalkeeper's efficiency depends on the distance and on some other parameters such as the specific court area where a player executes a throw. In some field areas goalkeeper rather has more chances to save the ball than in some others. The advantages - disadvantages of the goalkeeper and the advantages - disadvantages of the player at these court areas are based on some parameters such as the speed of the ball, the angle of the throw, the level of the player, the level of the championship etc. Because there is a clear need for further research, is suggested that additional analysis on goalkeeper's efficiency should be completed to clarify these scientific data.

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