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Original Article

Analysis of defence activities in Hungarian national handball league matches with a focus on gender and positions.

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Abstract
The aim of our research is to evaluate defence activities by analysing the Hungarian first league handball matches and to compare the results between positions and genders. The matches from the 2019/20 league season that were close (within a 6-goal difference) were chosen; thus, 5 men's and 5 women's matches were selected. Within a match, both the home and away teams were analysed; a total of 20 teams were analysed (n = 20). In our study, a post-match observation method was used. To ensure accurate observations, a total of 120 observers participated in the analysis of matches; thus, each observer focused only on one player from one team playing in one specific position in one match (i.e., 6 data collectors per team; a total of 12 people per match). The following variables were observed: tackling, blocking, stealing the ball and tactical activity. In our research, SPSS 25.0 statistical software was used to visualize the results. Descriptive statistics were used to present the mean and standard deviation results. A two-sample t-test was used to detect differences between genders, and a one-point analysis of variance was used to demonstrate differences between positions. A general examination of tackling revealed that diverting tackles were used three times as often in matches than halting tackles and were significantly more frequently performed on the ground than in the air. When comparing gender in the case of blocking goal shots, it was found that males showed significantly higher values than females for the blocking jump shot variable. No significant difference was found when analysing the statistics by gender for stealing the ball. When analysing tactical activity by gender, a significant difference was found only for forcing a technical error, in favour of male players. Our results provide valuable insights for the design of optimal training plans and draw attention to the importance of differentiation by position, which clearly reinforces the importance of individual training in the preparation of professional handball players.
Keywords: handball, tactical analysis, decisive factors, defence positions

Introduction

In both the preparation of a team and the individual training of players, it is expected that professional work is determined by the performance (technical, tactical and physical) during the match. Therefore, in coaching planning work, it is necessary to analyse top-level handball matches to determine match performance for each position. Most studies on the subject emphasise the importance of physical attributes as decisive factors of performance. In professional handball, success is affected by various factors. Top clubs require athletes with optimal human biological characteristics (body composition, anthropometry), outstanding physiological values (VO2max), above-average physical abilities, excellent sport specific skills and a high level of mental stamina.

The relationship between body composition and body fat percentage and sport performance was demonstrated several decades ago (Leedy et al., 1965). Bayios, et al., (2006) compared the body composition of Greek female volleyball, basketball and handball players and concluded that the differences were due to selection criteria, training hours and sport-specific physiological demands during the game. Furthermore, other researchers (Urban et al., 2008, 2010; Vila et al., 2011; Visnapuu et al., 2011) found a strong relationship between body composition and position on the court for both male and female handball players. Delamarche & Bideau (2011) agree that certain anthropometric measurements (such as height and arm span, as well as aerobic fitness) are important for the success of elite handball players. Milanese et al., (2011), similar to the study by Sibila, Bon, Mohorič (2011, 2013) and Vila et al. (2011), concluded that there are definite differences in anthropometry and body composition of female handball players at different levels related to position.

Although physical attributes, age and position-specific selection play some role in the performance of a successful handball team (Moncef et al., 2012), the level of fitness is also a determinant of success in elite athletes. Michalsik et al., (2011, 2013, 2015) addressed the dynamics and physical demands of matches. Over five years, they studied the relationship between heart rate and oxygen uptake capacity in elite male and female players playing in different positions. Similar to Roglan (2006) who studied the recovery time of Norwegian handball players, Michalsik et al. concluded that the trend towards faster match play leads to an increase in the physical demands on elite handball players. Consequently, coaches should prioritise physical workload and

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recovery time as well as high aerobic capacity when designing short-, medium- and long-term training plans (Platen & Manchado, 2011). The abovementioned researchers went a step further by analysing sprint acceleration profiles versus corresponding heart rate in a match between the Norwegian national team and a German first division team. Their results are in line with those in previous studies, but they also found that position-specific needs should be taken into account when designing conditioning training programmes for athletes. This is confirmed by Sosa et al., (2013), who claim that wing players need the highest level of aerobic capacity to promote recovery after high-intensity play. According to Vala et al., (2022), trainers should also consider the match parameters when creating a training plan as well as during the development process. Continuing his decades of research in this area, Michalsik (2018) stated that well-trained physicality alone is not sufficient for good performance in elite team handball and these factors need to be complemented by various technical and cognitive skills.

When looking for ways to improve performance in terms of the handball technique, most previous studies focused on ball dexterity and ball speed in particular (Laffaye & Debanne, 2011). Wagner et al., (2011) investigated the throwing motion of overarm and jump shots, with a particular focus on pelvic rotation. Chagneau et al., (1992) and later Van den Tillaar & Etterma (2007) investigated the effect of different body parts on the velocity of the ball. Hermassi (2013) found a remarkable correlation between explosive power, arm power and throwing speed in a study of 41 elite handball players throwing from a running motion.

González-García et al., (2016) developed a tool, HandballTAS, which collects valuable data from real-time movements in handball matches. Later, during the European Handball Federation Champions League Final Four 2019, to assess the on-court demands of handball players during the match, a team of experts consisting of Manchado et al., (2020) determined the time-movement characteristics of players (playing time, distances covered) in both attacking and defending situations. Currently, with the live tracking technology of EHF's partner KINEXON, shooting speed, jumping height and time in the air, passing accuracy, sprint speed, metabolic load and other valuable metrics can be recorded and automatically processed in real time.

For position-by-position comparison, we also observed that prior studies mostly focused on physiological and physical ability measurements. Karcher & Buchheit (2014) investigated the circulatory/metabolic workload of Portuguese handball players by position in relation to individual maximal heart rate. It was determined that goalkeepers had the lowest values, and pivots and centre backs had the highest values. Póvoas et al., (2014) and Cardinale et al., (2017), when examining locomotor load per position, found that pivots performed the least and wingers performed the most high-intensity movements during matches. Marczinka (2019), in a study of men's and women's European Championship matches, quantified that on average, the back court players (360.5/measure) performed more than twice as many movement elements as the pivots (158/measure) and more than three times as many as the wingers (109/measure).

Although many studies analyse men's matches, Michalsik et al., (2015) attempted to compare the match load of men and women. Their study showed that women had more distance covered (+ 700 m) and produced higher average intensity (+ 0.9 VOmax), whereas men, although they did more standing and walking (men: 36.8% vs women:10.8%), performed more tempo changes and rapid start–stops (1.4% vs. 0.7%). The gender differences are also reflected in the number of occurrences of attacking technical elements. Men on average attempt 9 more goal shots (55 vs. 46 goal shots), and men also attempt more jumps (46 vs. 34 jump shots) than women (Marczinka, 2019). In his study, Marczinka (2011) showed how differences in physical parameters between male and female handball players affected their preparation. A questionnaire survey was conducted in the early training period among elite youth handball players (Kőnig-Görögh et al., 2017). Previous studies showed various differences in personality characteristics among junior handball players in terms of gender. Ökrös at al., (2020) suggested that for the successful preparation, the coach's knowledge of how the athletes mentally cope as well as the players' self-knowledge are essential.

Bilge et al., (2020) compared the indicators of men's and women's national team top players with respect to some points in the official statistics of the Tokyo Olympic handball tournament and concluded that there was no significant difference between the genders in terms of the goal shots, assists, blockings, and positional efficiency. However, there were significant differences in turnovers and the efficiency of attack completion between the two genders.

In reviewing the research on the analysis of domestic and international adult handball matches, we found that, first and foremost, the researchers approach the subject from a physical perspective. With this study, we aim to describe the defence activity based on the analysis of Hungarian top-level handball league matches and compare the results between positions and genders.

Materials and methods

Sample

Expert sampling was used in this study. The matches were chosen where the final score was 6 goals maximum. Then, the top 5 matches from each group with most similar scores were selected. Thus, 5 men's matches and 5 women's matches were selected. Within a match, both the home and away teams were analysed; therefore, the total number of analysed teams is 20, which is 71.42% of the 14 men's –14 women's teams in the Hungarian First League.

Analysed matches

Table 1: Men's handball matches analysed in this study

Men's matches	**Date**	**Final score** (and 1st half)
Ferencvárosi TC – Grundfos Tatabánya KC	09.14.2019	32:31 (18:17)
HE-DO B.BRAUN Gyöngyös – Sport36-Komló	11.23.2019	32:32 (16:17)
Telekom Veszprém – MOL-Pick Szeged	11.23.2019	29:28 (15:15)
Csurgó KK – Balatonfüredi KSE	12.14.2019	26:25 (12:13)
SBS-Eger – Mezőkövesdi KC	02.08.2020	27:27 (10:11)

Table 2: Women's handball matches analysed in this study

Women's matches	**Date**	**Final score** (and 1st half)
Kisvárda Master Good SE-DVSC – SCHAEFFLER	01.08.2020	28:28 (13:14)
Dunaújvárosi KKA – Váci NKSE	01.17.2020	35:36 (15:17)
FTC-Rail Cargo Hungaria – ÉRD	01.22.2020	33:32 (16:15)
Siófok KC –- Győri Audi ETO KC	01.22.2020	34:29 (21:12)
MTK Bp. – Motherson Mosonmagyaróvár	02.28.2020	27:27 (15:15)

Sampling process

In our study, we used the post-match observation method. Observation is a qualitative method that is based on purposeful, planned, systematic and objective facts (Wolcott, 1990). Match observations were conducted by 20 qualified coaches (an average of 6 matches per observer) with a minimum of 10 years of handball experience. To ensure accurate observation, one observer focused on one player from one team playing in one specific position during one match (6 data collectors per team, with a total of 12 people per match). The observers downloaded the selected matches from the website of the Hungarian Handball Federation, with the permission of the federation, and then performed the observation from a recording; thus, the replay could be used to more accurately record the actions on the statistical sheet. The observers were jointly trained on the analysis procedure prior to the analysis.

Sampling sheet

An A4 statistical sheet, which has been developed and tested on a pilot-project sample, (Bako et al., 2022) contains horizontal and vertical fields (Appendix 1). The observation criteria include technical and tactical parameters of the defence (Table 3).

Table 3: Observed variables of defence activity

Defence activity	**Observed variable**	
Tackle	Diverting	on the ground or in the air
	Halting	
Blocking goal shooting	Overarm shot	individually or with a teammate
	Underarm shot	
	Curved shot	
	Jump shot	
Stealing the ball	Intercepting a pass	
	Knocking the ball away	
Tactical activity	Individual defender's error	
	Causing a 7-m penalty throw	
	Earning attacker's foul	
	Forcing a technical error	

The observed variables provide useful information for planning individual or team training sessions. In the left column of Table 3, the areas of studied defence activities are listed, provided with a collective name, and then subdivided into further sub-units.

Sampling method

While watching the recorded match on video, the actions occurring at the observed defence position were recorded on a statistics sheet with a line drawn to the corresponding category. At the end of each half, by summing the categories horizontally, it was possible to determine the total number of executions and then, by summing the two halves, it was possible to calculate the match performance for the observed variables. During the data collection, only the settled defensive play against the settled attack was analysed because, unlike the offensive play during fast break, it is possible to clearly define the defence positions. Of note, contrary to the previous practice, we did not focus on a specific player; rather, we focused on a player who was occupying the position at that time. This means that we did not measure the total match performance of a defender (who was possibly playing in several positions) but the number of actions in that position. The players were analysed at the following six positions: Right 1, Right 2, Right 3, Left 3, Left 2 and Left 1. The abbreviations of the official nomenclature of the International Handball Federation were used to signify the players (Marczinka, 2016).

Applied statistics

In our research, we used SPSS 25.0 Statistical software to visualize the results. Descriptive statistics were used to present the mean and standard deviation results. A two-sample T-test was used to detect differences between the genders, and a one-point analysis of variance was used to demonstrate the difference between the playing positions (ANOVA, post hoc). The level of significance was set at the 5% margin of error ($p < 0.05$), which is the most commonly used margin of error in sports science research.

Results

The aggregate defensive performance of 20 teams (10 men and 10 woman) in a total of 10 observed matches is presented by position and gender to identify statistically significant differences between the groups. Because significant differences were found between genders in several cases when examining the measured variables, we present the performance of the positions separately by gender.

Table 4: Comparison of the collision variable values between genders

Defence activity	Observed variable		Men (mean ± standard deviation)	Women (mean ± standard deviation)	F	p
Tackling	Diverting	On the ground	9.50 ± 7.68	11.55 ± 7.98	0.06	0.15
		In the air*	1.77 ± 3.05	0.83 ± 1.25	11.25	0.03
	Halting	On the ground	3.18 ± 2.67	2.77 ± 3.15	0.19	0.43
		In the air*	0.60 ± 0.96	0.25 ± 0.70	10.81	0.02

*Significant difference between genders ($p < 0.05$)

When looking at tackling in general, it is striking that the cumulative average number of diverting tackles is more than three times the number of halting tackles; in both cases, it is observed that diverting tackles are performed significantly more often on the ground than in the air. In terms of gender, it is observed that both women and men perform tackles on the ground with similar frequency. However, there is a significant difference in the number of tackles in the air, in favour of men. The standard deviation values show the largest difference from the mean for diverting tackles on the ground and the smallest difference from the mean for halting tackles in the air. There is no significant difference in the standard deviation between the values of male and female players.

Table 5: Comparison of the changing variables values between genders

Defensive activity	Observed variable		Men (mean ± standard deviation)	Women (mean ± standard deviation)	F	p
Blocking goal shooting	Overarm shot	Individually	0.18 ± 0.50	0.25 ± 0.50	1.49	0.47
		With a teammate	0.08 ± 0.33	0.22 ± 0.45	12.79	0.07
	Underarm shot	Individually	0.18 ± 0.46	0.08 ± 0.46	4.41	0.24
		With a teammate *	0.15 ± 0.48	0.18 ± 0.11	27.82	0.01
	Curved shot	Individually	0.03 ± 0.18	0.14 ± 0.08	8.73	0.15
		With a teammate	0.05 ± 0.22	0.12 ± 0.08	13.84	0.08
	Jump shot	Individually *	0.82 ± 1.40	0.33 ± 0.91	12.1	0.02
		With a teammate *	1.00 ± 1.47	0.50 ± 1.22	2.53	0.04

*Significant difference between genders ($p < 0.05$)

When comparing by gender, it is clear that male players tend to more frequently block goal shots, and this is reflected in the overall average result per match (M:2.31 > W:1.82). When analysing blocking against different shooting techniques by category, it is observed that blocking overarm and curved shots at approximately head height occur with similar frequency both individually and with a teammate. Female players block significantly more with a partner for underarm shots closer to the ground. On the other hand, males block significantly more than females both with a partner and individually in the air when attempting to stop jump shots.

Table 6: Variable comparison of ball handling between genders

Defence activity	Observed variable	Men (mean ± standard deviation)	Women (mean ± standard deviation)	F	p
Stealing the ball	Intercepting a pass	0.55 ± 0.83	0.45 ± 0.76	0.55	0.49
	Knocking the ball away	0.43 ± 0.89	0.20 ± 0.40	17.72	0.06

If we divide the assessed ball stealing techniques into two categories, we can see that on average, intercepting a pass has a larger share of the balls gained possession, while knocking the ball away from an opposition's hand has a smaller share. When analysing the statistical data by gender, it is striking that, although men gain possession of more balls per match than women, these differences are not significant, and the data does not show any significant deviation from the average. The only notable difference in favour of men is in the sub-category of knocking the ball away (0.43 > 0.20), but there was no statistically significant difference for this variable.

Table 7: Gender comparison in terms of tactical activities

Defence activity	Observed variable	Men (mean ± standard deviation)	Women (mean ± standard deviation)	F	p
Tactical activity	Individual defender's error	1.90 ± 2.31	1.45 ± 1.56	5.55	0.24
	Causing a 7-m penalty throw	0.53 ± 0.79	0.48 ± 0.77	0.37	0.72
	Earning attacker's foul	0.87 ± 2.16	0.43 ± 0.64	3.4	0.14
	Forcing a technical error *	0.57 ± 0.99	0.25 ± 0.54	13.92	0.03

*Significant difference between genders ($p < 0.05$)

Although the four categories analysed under the collective name of tactical activity greatly benefit from defence activity, the number of items in each subcategory is low for both genders. A significant difference in the performance of male and female players is only found for forcing a technical error, which has the lowest number of elements in the total defensive activities. A significant difference can be established between variables when forcing the opponents to have a technical error, in favour of males.

Table 8: Comparison of the tackle variable values between positions (males)

Defence activity	Observed variable		Right1[a]	Right2[b]	Right3[c]	Left3[d]	Left2[e]	Left1[f]	F	p
Tackling	Diverting	G.**	2.7 ± 2.49[b,c,d,e]	10.30 ± 6.94[a,f]	14.4 ± 8.22[a,f]	14.09 ± 6.86[a,f]	12.56 ± 6.85[a,f]	2.80 ± 2.70[b,c,d,e]	7.9	0.00
		A.*	0.30 ± 0.6[c]	2.00 ± 2.26	2.80 ± 3.36[a]	3.64 ± 5.27[a,f]	1.44 ± 1.59	0.20 ± 0.42[c,d]	2.3	0.05
	Halting	G.**	1.3 ± 1.33[b,c,d]	4.00 ± 1.33[a,f]	4.40 ± 3.71[a,f]	4.73 ± 2.83[a,f]	3.44 ± 2.12[d]	1.10 ± 1.5[a,c,d,e]	4.64	0.00
		A.**	0.10 ± 0.31[d,e]	0.10 ± 0.31[d,e]	0.80 ± 1.03[f]	1.27 ± 1.10[a,b,f]	1.33 ± 1.22[a,b,f]	0.09 ± 0.07[c,d,e]	5.7	0.00

*Significant difference between positions ($p < 0.05$)

**Significant difference between positions ($p < 0.01$)

Tackles account for the largest proportion of total defence activities and for three quarters of the average defence activities per position. When examining the diverting and halting tackles on the ground (G) and in the air (A), it is striking to see a significant, and in some cases a highly significant, difference between the average number of executions per position: the combined number of executions of tackles is the highest for defender No.3, decreasing less for defender No.2 and decreasing more significantly for defender No.1. When comparing the sides of the court, there is no significant difference between the values of the defenders in the middle (R3 and L3) and at the wing (R1 and L1). However, in the zone between the two areas (R2 and L2), there is a significant difference in the number of tackles on the ground and in the air, in favour of the left side.

Table 9: Comparison of the tackle variable values between positions (females)

Defence activity	Observed variable		Right1[a]	Right2[b]	Right3[c]	Left3[d]	Left2[e]	Left1[f]	F	p
Tackling	Diverting	G.**	3.40 ± 1.77[b,c,d,e]	12.40 ± 5.73[a,f]	16.00 ± 7.91[a,f]	16.50 ± 8.88[a,f]	15.50 ± 6.83[a,f]	5.50 ± 3.37[b,c,d,e]	8.32	0.00
		A.**	0.04 ± 0.02[c,d,e]	0.10 ± 0.31[c,d,e]	2.00 ± 1.41[a,b,f]	1.50 ± 1.65[a,b,f]	1.30 ± 1.05[a,b,f]	0.10 ± 0.31[c,d,e]	7.53	0.00
	Halting	G.*	1.70 ± 2.05	4.20 ± 4.29[f]	3.60 ± 3.86[f]	4.10 ± 3.28[f]	2.60 ± 2.01	0.40 ± 0.51[b,c,d]	2.57	0.03
		A.	0.10 ± 0.31	0.40 ± 0.96	0.30 ± 0.48	0.50 ± 1.26	0.20 ± 0.42	0.09 ± 0.05	0.68	0.63

*Significant difference between positions ($p < 0.05$)

**Significant difference between positions ($p < 0.01$)

As with the men, tackles account for the largest share of the examined defence activity and for approximately three quarters of the average defensive actions per position. When examining diverting tackles, it is striking that a highly significant difference is observed between the average per-position values on the ground (G): the number of tackles are three times higher between the wing areas (R1 and L1) and the No.2 defensive positions (R2 and L2), and four times higher compared to the middle zone (R3 and L3). A smaller difference is observed only between the values of positions L1 and L2. A comparison of tackling on the ground shows a small but significant difference between the different sides and positions (except for R1 and L1 defenders).

Table 10: Comparison of the stealing the ball variable values between positions (males)

Defence activity	Observed variable	Right1	Right2	Right3	Left3	Left2	Left1	F	p
Stealing the ball	Intercepting a pass	0.20 ± 0.42	0.80 ± 0.78	0.30 ± 0.67	0.55 ± 1.29	0.44 ± 0.52	1.00 ± 0.81	1.37	0.25
	Knocking the ball away	0.10 ± 0.31	0.50 ± 1.08	0.80 ± 1.31	0.45 ± 0.82	0.56 ± 1.01	0.20 ± 0.42	0.79	0.56

Stealing the ball is the smallest unit in all tested areas, averaging less than 1 per position. Owing to passing the ball around the goal-area and the type of zone defence, players have almost the same chance of attempting to steal the ball in all defence positions. Thus, there is no significant difference in the number of gaining possessions in any of the defensive areas. If we divide the assessed ball winning techniques into two, we can see that intercepting a pass has a higher share of the balls won, while knocking the ball away has a lower share.

Table 11: Comparison of the stealing the ball variable values between positions (females)

Defence activity	Observed variable	Right1	Right2	Right3	Left3	Left2	Left1	F	p
Stealing the ball	Intercepting a pass	0.80 ± 1.03	0.80 ± 0.63	0.12 ± 0.07	0.10 ± 0.31	0.40 ± 0.69	0.60 ± 1.07	2.22	0.06
	Knocking the ball away	0.20 ± 0.42	0.10 ± 0.31	0.30 ± 0.48	0.20 ± 0.42	0.10 ± 0.31	0.30 ± 0.48	0.47	0.79

The performed statistical test shows no significant difference between either the two techniques of stealing the ball, positions or sides. In general, it is established that stealing is more frequent than knocking away at all defensive positions, except in the middle zone (R3 and L3); stealing the ball is more frequent in the areas to the left and right of the middle zone (R2, R1 and L2, L1).

Table 12: Comparison of tactical activities between positions (males)

Defence activity	Observed variable	Right1	Right2	Right3	Left3	Left2	Left1	F	p
Tactical activity	Individual defender's error	1.30 ± 1.76	2.80 ± 2.20	2.80 ± 3.36	2.73 ± 2.32	1.11 ± 1.96	0.50 ± 0.70	2.15	0.07
	Causing a 7-m penalty throw	0.40 ± 0.51	1.20 ± 0.91	0.50 ± 0.85	0.55 ± 0.93	0.44 ± 0.72	0.10 ± 0.31	2.34	0.05
	Earning attacker's foul	0.60 ± 0.69	0.40 ± 0.96	2.50 ± 4.74	0.36 ± 0.50	1.22 ± 1 .56	0.20 ± 0.42	1.71	0.14
	Forcing a technical error	0.30 ± 0.67	0.70 ± 1.25	0.50 ± 0.70	0.82 ± 1.25	0.33 ± 0.50	0.70 ± 1.33	0.44	0.81

Individual tactical activity is difficult to measure, and its effectiveness can be somewhat quantified by individually analysing the subcategories and then in aggregate. The main area of attack organisation and completion is the central defensive area; thus, it is not surprising that the highest scores in each subcategory are found for area No.2 or No.3 defenders. However, there is no significant difference between the values of the sides or positions. It is also observed that left-sided defenders on average commit more individual defensive errors and cause more 7-m penalty shots than right-sided defenders. Furthermore, in the sub-category of earning attacker's fouls, we can find an outstanding performance on both sides, while forcing an attacker to commit a technical error is the most evenly distributed result between the defensive positions.

Table 13: Comparison of tactical activities between positions (females)

Defence activity	Observed variable	Right1	Right2	Right3	Left3	Left2	Left1	F	p
Tactical activity	Individual defender's error	1.50 ± 1.26	2.30 ± 2.31	2.00 ± 1.33	1.40 ± 1.50	1.00 ± 1.24	0.50 ± 1.08	1.86	0.11
	Causing a 7-m penalty throw	0.20 ± 0.42	0.50 ± 0.97	0.30 ± 0.48	0.50 ± 0.85	0.70 ± 0.67	0.70 ± 1.05	0.68	0.63
	Earning attacker's foul	0.50 ± 0.52	0.70 ± 1.05	0.40 ± 0.51	0.20 ± 0.42	0.40 ± 0.51	0.40 ± 0.69	0.61	0.68
	Forcing a technical error	0.10 ± 0.31	0.40 ± 0.69	0.40 ± 0.69	0.20 ± 0.42	0.40 ± 0.69	0.13 ± 0.09	1.06	0.38

When comparing the tested areas, it is observed that the number of individual defensive errors is higher than that for the other subcategories and that the right side shows more executions than the left side at all defence positions. On average, the players on the left side cause twice as many 7-m penalty throw fouls as the players on the other side. The areas indicating positive action (earning attacker's foul or forcing a technical error) have the lowest execution numbers. No significant difference is found between the sides or between position values. Interestingly, among the two groups of tactical actions analysed, the proportion of negative actions (top two subcategories) is almost three times the number of positive actions (bottom two subcategories).

Discussion and Conclusion

A review of national and international studies on this research topic has shown that researchers approach the decisive factors of performance primarily from a physical perspective. In this study, we aimed to extend this knowledge by examining the use of defence positions in relation to male and female gender as well as position. Thus, we aimed to provide handball professionals with an additional valuable information to achieve a more effective match performance.

A general examination of *tackles* revealed that diverting tackles were used more than three times as often in matches than halting tackles and were performed significantly more often on the ground than in the air. However, in contrast to the study on the game elements of the attack (Bilge, et al., 2020), a significant difference in the number of tackles in the air was found in favour of men. This clearly places a greater demand on the male player's body, which, in agreement with a previous study (Platen & Manchado, 2011), should be taken into account when planning the workload (in particular aerobic capacity and recovery time). When examining the diverting and halting tackles on the ground and in the air, a significant and in some places highly significant difference between the average execution number per position is observed: the highest for No.3 defenders, decreasing less for No.2 defenders and decreasing more significantly for No.1 defenders. This correlates with research on the overall execution number of movement elements at the attacking positions (Marczinka, Z., 2019); thus, it can be concluded that the players' demand decreases from the centre to the wings during both attacking and defending. This confirms previous research findings (Urban, et al., 2008, 2010; Vila, et al., 2011; Visnapuu, et al., 2011) that stature and body composition significantly influence the choice of playing position. Thus, taller and stronger players should be positioned at defence positions because the frequency of physical contact and collisions requiring significant effort in this area is higher for both male and female handball players. However, when comparing the sides, it is observed that there is no significant difference between the values of positions in the central (R3 and L3) and peripheral (R1 and L1) defensive areas.

Among the *blockings* studied, entrenchment accounts for 8.7% of the total defensive activity (11.1/match) and only for a small proportion of the average defensive effort per position (21.18). Knowing the way that handball game is played and how the attacking players perform goal shooting, it is not surprising that the number of goal shooting attempts and the attempts to stop them is not significant at the wings than that in the longitudinal direction of the playing court; the number of attempts gradually increases in the inner defensive areas. Therefore, a position-by-position comparison of blocking is not relevant owing to the small number of elements. When comparing between genders, we found that females were significantly more active than males when performing the close-range, lower shot blocking with a partner. At the same time, men perform significantly more blocking in the air, both individually and with a teammate. Because this activity must be performed by jumping, it places a greater physical demand on male players. This observation confirms the findings of a previous study (Leedy, et al, 1965, and Bayios, et al., 2006), which suggested that physiological demands should be taken into account when selecting an athlete for playing position.

In the case of *stealing the ball*, we found that on average, intercepting a pass accounts for a larger share of gaining possession of the ball, while knocking it away accounts for a smaller share. When intercepting a pass, the player who moves out from the defensive wall at a good pace acquires the ball by crossing its path with a one-handed catching technique. This takeover necessitates a sophisticated sense of ball handling and excellent motor skills (Laffaye & Debanne, 2011). When analysing the statistical data by gender, no significant differences are found, and the data variance does not show a significant deviation from the mean (a striking difference in the number of executions of the two genders is seen only in the middle area of the playing court). This implies that there should be no gender differentiation in the content of training and that technical–tactical exercises to develop ball handling skills should be of equal importance in the training of male and female players. Owing to the way the ball is handled, players have an almost the same chance of attempting to steal the ball at each defensive position; this explains why there is no significant difference in the number of attempts at different defensive areas. Because gaining possession of the ball requires not only explosiveness but also advanced cognitive skills, this observation confirms the results in previous studies (Hermassi, 2013, Michalsik, 2018), which showed that in addition to good physicality, adequate technical preparation is required for effective play at all positions.

When analysing the *tactical activity* by gender, a significant difference is found only in the case of forcing a technical error, in favour of male players. This activity requires a high level of anticipation, quick reaction and speed, which confirms previous results (Michalsik, et al., 2015) that male players perform more tempo changes and quick start–stop movements. For male players, the highest execution values are found in the focus of the attack, in No.2 and No.3 defensive areas. Manchado, et al., (2020) came to a similar conclusion when they studied elite male players and found that defensively, players in central defensive positions moved the most at high speed. However, no significant difference was found between the values for the sides or for specific positions; thus, the same values for both genders can be assumed when planning the work load. On the other hand, for female players, the right side shows more execution than the left side in all studied defensive positions. This occurs possibly because the left side of the teams is generally stronger (owing to the higher proportion of right-handed players), and the attack is usually initiated from this side. Therefore, the right-sided defenders are supposed to contest against more dangerous players and a more intense attacking play. However, no significant

difference in the values for the sides or for specific positions is detected, which justifies a difference in preparation. Of note, among the two analysed groups of tactical actions, the number of errors that can be considered as negative actions (i.e., individual defender's error, causing a 7-m penalty throw) is almost three times the number of positive actions (i.e., earning attacker's foul, forcing a technical error).

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