



Current Developments in Handball Game Analysis

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ABSTRACT

The most important expectation of the trainers was the correct evaluation of the game analysis and the reflection of its effects on the trainings. Because of handball's complex nature, interpreting numerical data with objective field facts requires expertise. The aim of this study was to evaluate the numerical results under three different titles (longitudinal-success-tournament analysis) and with different research problems. As a longitudinal analysis, match parameters of the same generation (WU17-WU19 European Championships) in underage categories held two years apart were compared. As a success analysis, all the matches played by the 2020 MECh (Mens' European Championship) champion (Spain) and finalist (Croatia) in the tournament were analyzed. It has been set up which parameters determine success. As a tournament analysis, the leadership of European teams in handball was analyzed after the evaluations between the European teams and others in the 2019 WWCh (Womens' World Championship) tournament. According to the property of the research problem, t-test, Kruskal Wallis H-test, Pearson correlation and the eta square statistics were used. Research results based on numerical data has tried to be done current contributions to game analysis in handball. As a result, this study has been designed to show that the results of match analysis in handball are not just numbers. It is aimed to evaluate the results under four different titles and with different research problems and to transfer them on the practice. With these three topics; longitudinal analysis, success analysis and tournament analysis, it would also be appropriate to complement the notational analysis with different variables that are predominantly characterized by actions such as different parameters' efficiency. In order to model the game process effectively, it is necessary to obtain more data about the actions of the teams during the match and the strategies used in different competitions.

Keywords: *Game analysis, tournament analysis, finalist analysis, longitudinal analysis*

INTRODUCTION

It is not easy to define team handball performance numerically due to its complex and multifactorial nature. Different technical – tactical – physiological – psychological – sociological – anthropometric - talent level factors and of course their relationships with each other effect the whole performance. It should also be remembered that handball is a team sport that beautifies with individual differences. Besides running, jumping, pushing, change of direction, side stepping etc abilities like the other team sports, handball is strongly influenced by the specific movements to the handball performance (ball handling, passing, faking, dribbling, throwing, checking, blocking etc) parameters, however, tactical concepts, social factors as well as cognitive aspects (Bilge 2012, Wagner et al., 2014).

In recent years; trainers, analyzers and scientific researchers have worked on various parameters in handball game analysis for observing, analyzing and evaluating the performance of handball players and teams. Besides all these, the most important expectation of the trainers was the correct evaluation of the analysis and the reflection of its effects on the trainings. For this reason, significant statistical findings analyzed by data's collected from match analysis systems should be interpreted according to technical, tactical or physiological aspects of performance. This will represent a strong argument for the organization and evaluation of the training applications (Passos et al., 2017).

Game analysis in team handball is used in all dimensions in top national divisions, tournaments, Continental Championships, World Championships and the Olympics. It is an indispensable fact that game analysis results targeting individual player analysis, opponent analysis, tournament analysis, longitudinal analysis, running profile analysis, tactical analysis or different research problems, contribute to the applications in training. In addition to these, it is very important to analyze the whole season of a team and to approach the next season with the right determinations, both in terms of team setup and in terms of reflecting all the requirements of handball to the training.

Results-oriented approach based on cumulative statistic is one of the main topics of tactical analysis in handball, identifying individual or collective parameters that significantly contribute to the success of the team. Many levels of success could be distinguished with a clear hierarchical relationship between them in researches regarding tactical analysis in team handball; 1. Team's final ranking (Bilge, 2012; Gutiérrez & Ruiz, 2013); 2. Match outcome, expressed by goal difference (Lago et al., 2013; Ohnjec et al., 2008; Srhoj et al, 2001; Vuleta et al., 2007) or win and loss (Foretic' et al., 2013 ; Rogulj et al., 2004); 3. Goal scoring (Lozano & Camerino, 2012; Rogulj et al, 2004). 4. Physiological aspect (Chelly et al., 2011, Povoas et al., 2012, Souhail et al., 2010, Michalsik, 2013, Hulka et al., 2014, Del Coso et al., 2012, Barbero et al., 2017, Karaca and Ilkim , 2021,Duyan et al.,2022).

It should be kept in mind that the researches findings have revealed significant differences in the parameters determined as most relevant for team or individual performance and game outcome in team handball. Some of the determinations are quite clear and agree that goalkeeping efficiency, shot effectiveness and fast break efficiency determine the result. Therefore, in order to better understand the factors that affect team or individual performance, it is necessary to take into account differences that can typically be characterized, such as game location, quality of opponent and match importance (Passos et al., 2017).

In scientific papers on match analysis in handball, these data collected by various methods constitute the basis for the design of the researches. Only demographic or percentage analysis of the data can prevent us from reaching objective results. For this reason, it is thought that new research problems based on data will be more objective in reflecting the results into practice.

The aim of this research is to obtain feedbacks by interpreting the analysis of three different main research problems with the same data collecting method;

The main research study: The purpose of this longitudinal study is to obtain feedback by

interpreting the analysis of the teams participating in the U17 Women's European Championship held in 2017 and the matches played by the same generation in the U19 European Championship held in 2019, two years later.

The main research study: The purpose of this study is to interpret the analysis of the matches played by the finalists (Spain-Croatia) in the Men's 2020 European Championship and to obtain feedback on the parameters that bring success.

The main research study: The aim of this study is to reveal technical or tactical differences by comparing the analysis of all matches of European teams and teams from other continents in 2019 Women's Handball World Championships. Another aim is to compare the analysis of all the matches between top four teams and 5-8. place teams in the tournament and to reveal the parameters that determine the success.

METHOD

40 matches for longitudinal analysis, 18 matches for finalist analysis and 88 matches for tournament analysis totally 160 game were reported in 72 parameters by using video analysis and notational method (Bilge 2012). This research was approved by Kirikkale University Non-Interventional Research Ethics Committee on 26.11.2020 with decision number 2020.11.20

The matches played by the teams participating in both underage category European Championships were reported by video analysis method. In these tournaments the author was working as the formal European Handball Federation analyst. In U17 and U19 tournaments, Mann Whitney U-test was used for differences in anthropometric profiles, number of female coaches, attack-shot-goals efficiency, as well as turnover, foul, punishment parameters, offensive types, equal-superior-inferior attack

and passive rules. The Kruskal Wallis H-test was applied for the differences between the teams that played in the finals in both tournaments and the others. In order to find out between which groups the difference was, they were compared in pairs and the difference between the groups was given with the Mann Whitney U-test.

All matches played by the two finalist teams in the 2020 Men's European Championship were reported by video analysis. In these 18 games reanalyzed after the tournament, the differences between offense-shooting and goalkeeper efficiency, position shooting success, positive and negative attack parameters, attack options and equal-inferior-superior offense efficiency were analyzed with the Mann Whitney U-test. In addition, the eta square statistics were made for the differences between the two finalists in the first group, the qualifying group and the semi-final and final matches.

All 88 matches are reported by video analysis method in 2019 Women's Handball World Championships. In these 88 games reanalyzed after the tournament by the author, the offense-goals-total shooting efficiency, turnovers, getting fouled, position shooting efficiency and fast attack parameters of the teams were included in t-test analysis. For the difference between the relevant parameters applied by the European and other continental teams and the first 4 and the second 4 teams during the competition, the independent sample t-test was applied.

RESULTS AND DISCUSSION

Longitudinal Analysis

Analysis differences in U17 and U19 tournaments (Bilge, 2017, Bilge, 2019) were seen in equal attacks and inferior attacks ($p < 0.05$). Equal attacks and number of goals were higher in U19, while offensive efficiency was in favor of U17. The inferior attacks -goal-efficiency difference was determined in favor of U17 (Table 1).

TABLE 1: Mann Whitney U-test for the difference between parameters in matches U17 and U19 tournament

Parameters	Tournament	N	X	SD	U	P
Average of height (cm)	U 17	9	169,89	5,05	33	0,815
	U 19	8	171,32	1,51		
Average of body weight (kg)	U 17	9	65,38	2,85	32	0,743
	U 19	8	65,75	3,21		
Number of attacks	U 17	9	60,19	3,98	30	0,606
	U 19	8	60,58	2,26		
Goal throws	U 17	9	47,11	3,66	32,5	0,743
	U 19	8	47,68	4,12		
Number of goals	U 17	9	26,63	3,48	30,5	0,606
	U 19	8	25,73	4,44		
Attack efficiency %	U 17	9	44,19	4,53	30	0,606
	U 19	8	42,6	8,18		
Goal throw efficiency %	U 17	9	56,43	4,77	31	0,673
	U 19	8	53,9	7,55		
Goalkeeper saves (per game)	U 17	9	11,71	2,48	34,5	0,888
	U 19	8	11,65	1,35		
Turnover (per game)	U 17	9	15,17	1,83	29	0,541
	U 19	8	16,1	3,82		
Getting fouled (per game)	U 17	9	24,09	8,92	35	0,963
	U 19	8	24,45	3,99		
Doing foul (per game)	U 17	9	23,87	5,81	34,5	0,888
	U 19	8	24,45	8,38		
2 min (per game)	U 17	9	4,4	0,99	31	0,673
	U 19	8	4	0,98		
Number of set-play offense attempts	U 17	9	208,33	38,34	20,5	0,139
	U 19	8	228,75	27,38		
Number of set-play offense goals	U 17	9	91,44	18,26	35	0,963
	U 19	8	91,25	11,2		
Organize attack efficiency %	U 17	9	44,31	7,99	26,5	0,37
	U 19	8	40,67	8,83		
Number of basic FB attempts	U 17	9	32	30,99	21,5	0,167
	U 19	8	36,63	10,53		
Basic fast break goals	U 17	9	11,78	8,7	21,5	0,167
	U 19	8	17,5	8		
Basic FB %	U 17	9	39,61	16,08	28,5	0,481
	U 19	8	45,66	11,47		
Number of combined FB attempt	U 17	9	19,11	9,12	29	0,541
	U 19	8	25,25	14,46		
Combined FB Goals	U 17	9	10,33	6	24,5	0,277
	U 19	8	14,75	8,31		
Combined FB %	U 17	9	52,04	10,34	24	29,5
	U 19	8	58,08	8,57		
Number of fast throw-off attempts	U 17	9	10,56	9,67	29,5	0,541
	U 19	8	10,5	6,68		
Fast throw-off goals	U 17	9	4,89	4,46	30	0,606
	U 19	8	5	2,73		
Fast throw-off efficiency %	U 17	9	47,36	27,35	31	0,673
	U 19	8	52,41	16,7		
Number of offense in equality	U 17	9	211,56	41,18	14	,036*
	U 19	8	258,25	15		

Equality set-play goals	U 17	9	93,89	23,15	20,5	,049*
	U 19	8	111,25	21,42		
Equality offense efficiency %	U 17	9	44,23	5,82	27	,042*
	U 19	8	41,57	7,11		
Number of numerical superiority in attack	U 17	9	25,89	10,29	29	0,541
	U 19	8	22,38	8,4		
Numerical superiority goals	U 17	9	12,11	3,89	28,5	0,481
	U 19	8	10,88	5,72		
Numerical superiority efficiency %	U 17	9	48,39	8,35	35	0,963
	U 19	8	46,91	11,13		
Number of numerical inferiority in attack	U 17	9	25,44	14,27	20	,039*
	U 19	8	14,88	11,09		
Numerical inferiority goals	U 17	9	10,11	5,65	12,5	,021*
	U 19	8	3,63	2,33		
Numerical inferiority efficiency %	U 17	9	39,18	9,36	23	,036*
	U 19	8	36,13	28,16		
Number of passive play decisions	U 17	9	14,33	6,36	22	0,2
	U 19	8	19,25	5,12		
Number of passes during passive play warning	U 17	9	42	22,34	25	0,321
	U 19	8	52,88	17,88		
Average of passes during passive play warning	U 17	9	2,91	0,59	26,5	0,37
	U 19	8	2,72	0,33		
Ended by goal during passive play warning	U 17	9	5,22	3,31	29	0,541
	U 19	8	5,63	1,06		
Ended by turnover during passive warning	U 17	9	3	2,18	24,5	0,277
	U 19	8	4,13	2,17		
Ended by unsuccessful shot during passive play warning	U 17	9	6,11	2,89	23	0,236
	U 19	8	9,5	4,6		

*(p<0.05)

A significant difference in favor of U17 was found only in the inferior attacks between the teams that played in the finals in both tournaments (p <0.05). In terms of the differences between the teams that played in the finals of both tournaments and the others, in the parameters of shooting efficiency in favor of U17 tournament finalists, organized attack, inferior

attacks, number of goals, and in U19, in favor of tournament finalists, the number of goals, attack efficiency, shooting efficiency, turnovers, organized attack efficiency; there was a significant difference (p <0.05) (Table 2). The number of female coaches decreased from 40% to 35.5%.

TABLE 2: The Kruskal Wallis H-test for the differences between the teams that played in the finals in both tournaments and the others

Parameters		N	X	SD	Lowest	Highest	X2	p	Statistical Differences between..
Number of goal	U17 finalists	2	31,2	0,57	30,8	31,6	9,283	,026*	U-19 finalist - U17 finalist
	U17 others	7	25,33	2,67	21,8	29,4			U-19 others - U19 others
	U19 finalists	2	31,6	1,13	30,8	32,4			
	U19 others	6	23,77	2,99	19	26,8			

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	Total	17	26,21	3,86	19	32,4			
Attack efficiency %	U17 finalists	2	50,1	2,55	48,3	51,9	9,483	,024*	U17 finalist - U19 others
	U17 others	7	42,5	3,37	38,6	47,4			U19 finalist - U17 others
	U19 finalists	2	53,89	3,62	51,33	56,45			U19 finalist - U19 others
	U19 others	6	38,84	4,82	31,88	44,67			
	Total	17	43,44	6,34	31,88	56,45			
Goal throw efficiency %	U17 finalists	2	62,6	2,55	60,8	64,4	7,81	,050*	U17 finalist - U17 others
	U17 others	7	54,67	3,6	51,3	61,5			U17 finalist - U19 others
	U19 finalists	2	62,59	5,39	58,78	66,4			U19 finalist - U17 others
	U19 others	6	51	5,81	42,86	56,22			U19 finalist - U19 others
	Total	17	55,24	6,17	42,86	66,4			
Turnover (per game)	U17 finalists	2	14,35	0,07	14,3	14,4	8,088	,044*	U19 finalist - U19 others
	U17 others	7	15,4	2,04	12,8	18,6			
	U19 finalists	2	11,3	0,71	10,8	11,8			
	U19 others	6	17,7	2,84	13,4	21,2			
	Total	17	15,61	2,88	10,8	21,2			
Offense set-play efficiency %	U17 finalists	2	55,6	8,34	49,7	61,5	9,813	,020*	U17 finalist - U17 others
	U17 others	7	41,09	4,35	36,3	47,5			U17 finalist - U19 others
	U19 finalists	2	53,25	6,01	49	57,5			U19 finalist - U19 others
	U19 others	6	36,48	4,18	30,97	41,26			
	Total	17	42,6	8,34	30,97	61,5			
Number of equity goals	U17 finalists	2	112,5	20,51	98	127	7,267	,044*	U17 finalist - U19 others
	U17 others	7	88,57	22,27	63	123			
	U19 finalists	2	140	15,56	129	151			
	U19 others	6	101,67	12,37	87	119			
	Total	17	102,06	23,42	63	151			
Number of numerical inferiority attacks	U17 finalists	2	33,5	10,61	26	41	6,766	,040*	U17 finalist - U17 others
	U17 others	7	23,14	14,99	5	41			U17 finalist - U19 finalist
	U19 finalists	2	22	0	2	2			U17 finalist - U19 others
	U19 others	6	19,17	9,15	8	33			
	Total	17	20,47	13,61	2	41			
Number of numerical inferiority goals	U17 finalists	2	14	4,24	11	17	7,492	,048*	U17 finalist - U17 others
	U17 others	7	9	5,75	1	17			U17 finalist - U19 finalist
	U19 finalists	2	5,5	0,71	1	2			U17 finalist - U19 others

	U19 others	6	4,33	2,25	2	8			
	Total	17	7,06	5,43	1	17			
Numerical inferiority efficiency %	U17 finalists	2	41,9	0,57	42	42	10,27	,016*	U17 finalist - U19 finalist
	U17 others	7	38,4	10,66	20	48			U17 finalist - U19 others
	U19 finalists	2	25	35,36	50	100			
	U19 others	6	23,18	7,38	15	36			
	Total	17	37,74	19,83	15	100			
Number of passive play decisions	U17 finalists	2	6,5	0,71	6	7	8,904	,031*	U17 finalist - U19 others
	U17 others	7	16,57	5,26	7	24			
	U19 finalists	2	13	1,41	12	14			
	U19 others	6	21,33	3,93	16	27			
	Total	17	16,65	6,17	6	27			
Ended by unsuccessful shot during passive play warning	U17 finalists	2	2,5	0,71	2	3	8,146	,043*	U17 finalist - U19 others
	U17 others	7	7,14	2,34	3	9			
	U19 finalists	2	5	2,83	3	7			
	U19 others	6	11	4,15	7	17			
	Total	17	7,71	4,06	2	17			

*(p<0.05)

Success Analysis

In order to analyze and obtain feedback of the matches played by the finalists in the 2020 Men's European Championships, findings showed some parameters that bring success. In general; 6m-7m-9m shots, total shooting efficiency, assists, steals, fast break efficiency, basic fast break efficiency and 6: 6 attack efficiency there are significant differences in favor of Spain, while

Croatian success stands out in goalkeeper efficiency, block and offensive foul parameters (p <0.05). There is no statistical difference in other parameters. In the group and final matches of Spain and Croatia, a statistically significant difference is observed in the parameters of fast break and goalkeeper saves in 6m-7-9m, 9m over shooting efficiency (p <0.05) (Table 3-4-5).

TABLE 3: Mann Whitney U-test for the difference between finalists' matches goal throw parameters in 2020 Men's European Championships tournament.

Parameter	Team	X	SD	U	p
6 m shots	Spain	12,33	5,2	16,5	,034*
	Croatia	9,89	3,48		
6 m goals	Spain	9,44	3,91	19,5	,046*
	Croatia	6,11	2,47		
6 m shots efficiency	Spain	77,24	8,59	20	,015*
	Croatia	63	13,11		
7-9 m shots	Spain	14,11	4,37	17	0,414
	Croatia	15,33	5,92		
7-9 m goals	Spain	8,44	2,46	20,5	0,662
	Croatia	9,44	4,33		
7-9 m shots efficiency	Spain	61,34	13,26	22	0,852
	Croatia	60,67	13,16		

9 m shots	Spain	5,56	2,74	19,5	0,573
	Croatia	8,11	3,76		
9 m goals	Spain	2,89	2,09	17,5	0,414
	Croatia	3,11	1,83		
9 m shots efficiency	Spain	48,02	14,12	13	,028*
	Croatia	37,11	9,57		
7 m shots	Spain	2,67	1,87	16,5	0,345
	Croatia	3,78	1,56		
7 m goals	Spain	2	1,8	19,5	0,573
	Croatia	2,22	1,2		
7 m shots efficiency	Spain	73,33	36,67	18	,037*
	Croatia	61	31,05		
FB shots	Spain	10,78	4,52	21,5	,010*
	Croatia	5,89	2,26		
FB goals	Spain	8	3,84	22,5	,013*
	Croatia	4,11	1,69		
FB m shots efficiency	Spain	73,03	11,53	19,5	0,573
	Croatia	72,78	19,9		
Total shots	Spain	45,22	7,1	16,5	0,345
	Croatia	43	7,26		
Goals	Spain	30,67	5,43	15,5	,018*
	Croatia	25	3,46		
Total shot efficiency	Spain	67,8	5,57	18	,008*
	Croatia	58,89	6,83		

*(p<0.05)

TABLE 4: Mann Whitney U-test for the difference between finalists' matches parameters in 2020 Men's European Championships tournament.

Parameters	Team	X	SD	U	p
Goalkeeper	Spain	8,44	2,83	22,5	,042*
	Croatia	11,11	3,18		
Wide	Spain	1,78	0,67	15,5	0,282
	Croatia	2,22	1,3		
Post	Spain	2,56	1,42	23	0,95
	Croatia	2,44	0,73		
Block	Spain	2	0,71	19,5	0,573
	Croatia	2,11	2,2		
Wrong pass	Spain	4,33	2,12	18,5	0,491
	Croatia	3,67	1,8		
Ball loss	Spain	0,89	1,05	18,5	0,491
	Croatia	0,33	0,5		
Charging	Spain	1,78	1,39	20,5	0,662
	Croatia	2,78	2,05		
Walking	Spain	0,44	0,53	22,5	0,852
	Croatia	0,56	1,01		
Line mistake	Spain	1,56	1,13	22	,005*
	Croatia	0,22	0,44		
End-run	Spain	1,22	0,97	18,5	0,491
	Croatia	0,89	0,6		
Passive Play Decision	Spain	0	0	20	0,662
	Croatia	0,22	0,44		
Assist	Spain	11,11	4,81	20	,011*

	Croatia	5,89	2,52		
7 m awarded	Spain	2,78	2,11	16,5	0,345
	Croatia	3,78	1,64		
2 min +	Spain	3,89	1,36	16	0,345
	Croatia	4,67	1,73		
Getting Fouled	Spain	22,44	7,92	16	0,345
	Croatia	19,78	8,15		
Disqualification	Spain	0,22	0,67	20	0,662
	Croatia	0	0		
7 meters caused	Spain	3,11	1,9	17,5	0,414
	Croatia	2,67	1,41		
2 min -	Spain	2,56	1,51	18,5	0,491
	Croatia	3,22	1,2		
Position mistake	Spain	0,11	0,33	21	0,755
	Croatia	0	0		
Defense Block	Spain	1,44	1,01	20	,032*
	Croatia	2,67	1,32		
Offense Foul	Spain	1,44	0,88	14,5	,048*
	Croatia	2,78	1,79		
Steal	Spain	5,33	3,35	10,5	,041*
	Croatia	3,11	1,54		
Foul	Spain	17,78	6,08	24	1
	Croatia	18,78	6,57		

*(p<0.05)

TABLE 5: Mann Whitney U-test for the difference between finalists' matches attack option parameters in 2020 Men's European Championships tournament.

Parameters	Team	X	SD	U	p
Number of set-play offense	Spain	40,33	3,97	37,5	0,796
	Croatia	40	6,56		
set-play offense goals	Spain	23	4,82	30	0,387
	Croatia	20,56	3,24		
set-play offense efficiency %	Spain	56,67	8,58	25	0,19
	Croatia	52,02	8,09		
Number of basic FB attempt	Spain	5,56	3,84	22	0,113
	Croatia	3,11	1,62		
Basic fast break goals	Spain	4	2,92	19,5	,043*
	Croatia	1,89	0,93		
Basic FB %	Spain	73,07	18,11	32	0,489
	Croatia	67,41	26,71		
Number of combined FB attempt	Spain	5	1,8	32	0,743
	Croatia	4,75	2,25		
Combined FB Goals	Spain	3	1,41	28	0,481
	Croatia	2,5	1,41		
Combined FB %	Spain	139,81	227,26	26	0,37
	Croatia	56,43	27,61		
Number of fast throw-off attempt	Spain	2,17	1,17	8,5	0,905
	Croatia	2,33	1,53		
Fast throw-off goals	Spain	1,33	0,82	6	0,548
	Croatia	1	0		
Fast throw-off efficiency %	Spain	78,34	33,12	5	0,571
	Croatia	58,33	38,19		

Number of equality attack attempt	Spain	41,78	6,74	24	0,161
	Croatia	37,89	6,92		
Equality attack goals	Spain	24,22	6,51	18,5	,047*
	Croatia	19	3,46		
Equality attack efficiency %	Spain	57,29	8,37	19	,043*
	Croatia	50,3	4,86		
Number of numerical superiority in attack	Spain	5,44	2,96	33,5	0,546
	Croatia	5,78	2,82		
Numerical superiority goals	Spain	3,78	2,54	36,5	0,73
	Croatia	3,33	2,24		
Numerical superiority efficiency %	Spain	60,51	27,93	37,5	0,796
	Croatia	63,03	19,32		
Number of numerical inferiority in attack	Spain	3	1,41	0,5	0,1
	Croatia	1,25	0,5		
Numerical inferiority goals	Spain	0,5	0,71	3	0,8
	Croatia	0,75	0,5		
Numerical inferiority efficiency %	Spain	13,5	16,26	2	0,533
	Croatia	62,5	47,87		
Number of 7:6 attacks	Spain	2,5	2,12	4	1
	Croatia	2,5	1,29		
7:6 attack goals	Spain	1	0	4	1
	Croatia	1,25	1,26		
7:6 attack efficiency %	Spain	62,5	53,03	6,5	0,8
	Croatia	56,25	51,54		

*(p<0.05)

Tournament Analysis

13 national teams of the total 24 teams represented the European continent in 2020 Women's World Championship. According to the results of the t test conducted within the framework of this grouping, it was determined that the European teams were statistically more successful than the other teams in terms of

offensive and shooting efficiency and fast attack number-goals (p<0.05). The European team's averages in turnovers and getting fouled are significantly lower than the others (p<0.05). The only significant result in favor of other teams was shown in the goalkeeper efficiency (p <0.05). There is no statistical difference in any other parameters (Table 6).

TABLE 6: T-test results for independent samples regarding the difference between European teams and the others.

Parameters	Teams	N	X	SD	t	p
Goalkeeper efficiency	European (N=13)	106	21,17	7,54	-2,981	,003*
	Others (N=11)	70	24,85	8,67		
Attack efficiency	European	105	54,47	12,8	4,07	,000*
	Others (N=11)	69	46,17	13,72		
Goal shot efficiency	European	106	61,51	10,23	4,756	,000*
	Others (N=11)	70	53,59	11,65		
Turnover	European	105	11,33	4,18	-3,942	,000*
	Others (N=11)	70	14,4	6,12		
Getting fouled	European	106	17,25	6,89	-5,622	,000*
	Others (N=11)	69	24,52	10,24		

6 m shots	European	106	18,63	5,74	1,054	0,293
	Others (N=11)	70	17,7	5,73		
6 m goals	European	106	11,82	4,25	1,249	0,213
	Others (N=11)	70	10,99	4,47		
7-9 m shots	European	105	6,44	3,33	-1,163	0,247
	Others (N=11)	70	7,16	4,85		
7-9 m goal	European	104	3,33	1,99	0,447	0,655
	Others (N=11)	69	3,17	2,49		
9 m shots	European	104	7,61	4,97	-2,121	,035*
	Others (N=11)	69	9,32	5,54		
9 m goals	European	98	3,08	2,27	0,148	0,883
	Others (N=11)	65	3,03	1,96		
7 m shots	European	105	4,27	2,38	-0,341	0,733
	Others (N=11)	70	4,4	2,74		
7 m goals	European	103	3,51	2,04	1,214	0,226
	Others (N=11)	70	3,11	2,25		
Number of fast breaks	European	106	10,73	6,99	4,712	,000*
	Others (N=11)	67	6	5,41		
FB goals	European	105	7,9	5,68	4,878	,000*
	Others (N=11)	66	4,05	3,8		

*(p<0.05)

In the analysis comparison made between top tournament, the only difference was seen in four teams and 5-8. place teams in the offense efficiency (p <0.05) (Table 7).

TABLE 7: T-test results for independent samples regarding the difference between first four teams and second four teams (5-8).

Parameters	Teams	N	X	SD	t	p
Goalkeeper efficiency	First 4 team	37	20,47	8,31	-0,793	0,431
	5-8. teams	34	21,9	6,72		
Attack efficiency	First 4 team	36	60,18	12,36	2,161	,034*
	5-8. teams	34	54	11,52		
Goal shot efficiency	First 4 team	37	64,16	10,26	0,725	0,471
	5-8. teams	34	62,48	9,25		
Turnover	First 4 team	37	10,84	3,1	-0,676	0,501
	5-8. teams	34	11,47	4,69		
Getting fouled	First 4 team	37	15,46	6,74	-1,638	0,106
	5-8. teams	34	18,06	6,61		
6 m shots	First 4 team	37	19,14	5,3	0,988	0,327
	5-8. teams	34	17,88	5,38		
6 m goals	First 4 team	37	12,32	3,65	0,401	0,69
	5-8. teams	34	11,91	4,96		
7-9 m shots	First 4 team	36	6,72	3,22	0,134	0,894
	5-8. teams	34	6,62	3,33		
7-9 m goals	First 4 team	36	3,53	1,98	-0,24	0,811
	5-8. teams	34	3,65	2,17		
9 m shots	First 4 team	37	6,81	4,51	-0,389	0,699
	5-8. teams	34	7,24	4,69		
9 m goals	First 4 team	35	2,8	2,03	-0,013	0,99
	5-8. teams	31	2,81	1,96		
	First 4 team	37	4,59	2,63		

7 m shots	5-8. teams	33	3,85	2,35	1,246	0,217
7 m goals	First 4 team	37	3,84	2,26	1,158	0,251
	5-8. teams	32	3,22	2,17		
Number of fast breaks	First 4 team	37	12,76	6,23	0,467	0,642
	5-8. teams	34	12,03	6,9		
FB goals	First 4 team	37	9,7	5,51	1,003	0,319
	5-8. teams	34	8,41	5,32		

*($p < 0.05$)

DISCUSSION

When the findings are interpreted, it can be said that after two years in the European Championships where the same generation played two years apart, the teams made a better retreat and developed their established defensive characteristics.

In comparison of the teams that succeeded in the final in the tournaments and the others; it can be concluded that the parameters of attack efficiency, shooting efficiency, set-play offense efficiency, inferior attacks-goals, and turnovers bring success.

Handball at the highest level has evolved significantly and probably will like continue to change. The trends found over time suggest a decreasing number of attacks, shots and defensive efficacy, while offensive efficacy is increasing (Alex et al., 2023). However, Valentin (2017) examined the playing events of the teams participating in the 4 Olympic games between 2004-2016, and as a result, he could not find a statistical difference between the Olympic tournaments for the game actions analyzed in three categories (all teams, 1-4 places, 1-8 places). It was reported that the game activities of the athletes and teams participating in the Olympics were close to each other.

The scope of these studies should be expanded. In order to observe how handball develops over time, variables such as physical, technical, tactical and number of game changes gender should be taken into account (Meletakos and Bayios, 2010). In addition, team capacity, opposing team capacity, and the number of matches played according to the season or tournament should be included in the research (Gomez et al., 2014).

National teams in underage categories try to improve their game quality according to their countries' handball style year by year. The most important thing is to improve the quality of handball by reflecting the results of the match analysis to the training sessions.

Spain and Croatia had an obvious superiority against their opponents in the first group, the qualifying group and the semi-final and final matches. While it is determined that the elements that highlight Spain in their matches with each other are generally offensive parameters, some defensive parameters are in favor of Croatia; these findings revealed general team tactical strategies.

While the high shooting efficiency of Spain in the first group matches decreased in other matches except 6m shots, there was an increase in 6m shooting and goalkeeper saves in the second group matches. In the final matches, it is seen that 7-9 meters shooting and total goal scores are higher. As for Croatia, it was observed that 6m, 7-9m shooting and goalkeeper effectiveness increased in the first group matches and 7-9m, 7-9m and 9m above shooting efficiency in the second group matches. In the final matches, high values were determined in fast break and shooting efficiency compared to other matches.

The tactical preparation of elite teams is very important as they participate in the most important tournaments in the world. Of course, every team does this. But there will be only one champion. For this reason, it is very important to follow the current developments in modern handball by determining the important match analysis parameters that bring success.

With these results, we can say that Spain is the champion not only in ranking but also in analysis results.

In this study, it has been observed that the European teams leading the world handball are more successful than the other teams in the important parameters affecting the attack performance. Fast attack emphasizes fast goal scoring effectiveness (Valentin, 2017) and is also the most effective way to score goals (Calin, 2010). It has been seen that the place of fast attack in modern handball is extremely precise. Yiannakos et al., (2005) analyzed the offenses of eight teams in fifteen games at the 2003 National Men's Handball Championship and reported a significant difference between the two halves of each game regarding the effectiveness of the fast break. According to the statistics of the Beijing Olympic Women's Handball Tournaments, Ding (2011) reported that the top teams have common characteristics, including the Chinese team's effective fast attacks (70% efficiency, 7.1 points per game).

Goalkeeping activity in favor of other teams can be evaluated as individual success. The fact that there was no difference in the ranking comparison of the European teams in the top eight, except for offense efficiency, showed how close the teams were to each other.

It is a fact that European handball is the leader in the world. Too many European teams targeting success also increases the quality of competition. At this stage, it can be said that the European teams have applied all the stages of the fast break attack very well to reach the simple goal.

It takes mastery to analyze a performance. For this reason, the evaluation result will be magnificent if the correctly constructed analysis studies are supported by the statistics obtained with the correct numbers.

Every handball coach wants to be able to put her team's performance into numbers hundred percent. What will bring this assessment closer to hundred percent is the large number of studies on this subject.

CONCLUSIONS

Feedback is defined as knowing about an athlete's performance during or after a sporting performance (Schmidt 1991). There are experimental studies on the types of feedback

that coaches use and its effect on athletes' motivation. When the studies in the literature are examined, it is still not known exactly what the effects of the feedback given by the coach on the performance of the athlete. Although feedback is used and recommended by many researchers considering that it affects performance it is not specified what it should be.

Game analysis is a process that coaches, players and managers need, whether it is recorded with notational method immediately or after the game. At this point, within the scope of the research, very important differences have been found between the analysis that was followed in this study and the analysis announced on the official web pages. Undoubtedly, the analysis that has been monitored over and over and reported after the game is valid and reliable.

As a result, this study has been designed to show that the results of match analysis in handball are not just numbers. It is aimed to evaluate the results under three different titles and with different research problems and to transfer them on the practice. With this three topics; longitudinal analysis, success analysis and tournament analysis, it would also be appropriate to complement the notational analysis with different variables that are predominantly characterized by actions such as different parameters' efficiency. In order to model the game process effectively, it is necessary to obtain more data about the actions of the teams during the match and the strategies used in different competitions.

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