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Scientific article

COMPARATIVE MULTI-FACTOR TA-TE ELEMENTS OF WOMEN'S HANDBALL TEAMS OF SERBIA AND BRAZIL AT THE 21st WORLD CHAMPIONSHIP IN 2013

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Abstract: The aim of this scientific work is in the primacy of determining the numeric complaint – what is the type and range, in modern European and world handball, of manifesting differences between successful and unsuccessful defenses, as well as a number of other supporting factors which are generally presented through systems of zones, complex combinations, having more or less players, i.e. a goalkeeper defense, organizing counter attacks and half-counter attacks, shots from 7 meters, etc. The analysis included five key matches in the fight for medals at the 21st World Handball Championship for Women, which was held in 2013 in Serbia. Examined were three matches of the teams of Serbia and Brazil played in the first stage of the competition, quarter-final schedule and the final show. By the conducted analysis of the tactical and technical elements, the following results have been obtained: the largest representation in both teams was found in the variable of successful defensive formations 6:0 (SDF 6:0) of value 20.33 of Serbia and 12.66 of Brazil, and then for the successful defense formations 5:1 (SDF 5:1) of value 9.33 of Serbia and 12.33 of Brazil, while the unsuccessful defense formations were the most in variable (NDF 6:0) of value 9.66 of Serbia and 6.33 of Brazil. Therefore, the analyzed teams to a large extent successfully used the 'deep zone systems' in defense of their goal, with a significant number of errors of the same. In other important factors for successful results, differences in the variables of successful and unsuccessful defense of the goalkeeper were found, and in Serbia (SGD) it is expressed as the value of 22.66, and in Brazil by 18.66, while in (NGD) the value was equal and amounted to 23. The differences of arithmetic means of observed variables are displayed by the t-test at a significance level of $p<0.05$, and significant

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difference indicators of the total successful-unsuccessful defense combined 5+1 (TSUDC 5+1) were 0.04, while in other variables the compared differences of arithmetic means did not significantly differ statistically. In the variable of total successful-unsuccessful defensive formations 6:0 (TSUDF 6:0), the t-test had a value of 0.10, total successful-unsuccessful organizing of counterattacks and half counter attacks (TSUOC-HC) 0.80 and total successful-unsuccessful defenses with a man more or less (TSUMM-ML) 0.84. All of the above parameters and the results show full convenience, because by their observation and differentiation, with utmost certainty, the winning national team is separated from the defeated ones in the competition.

Key words: *handball game, zone defense systems, combined defenses, man more and man less in defense, other technical parameters, competition evaluation system*

INTRODUCTION

Handball as an excellent sports game takes on the features of a comprehensive integrated composition, and thus to define the system in addition to its structural aspects, it is necessary to apply its functional aspect as well, which defines the process flow in the said system and the importance of the individual parts of the system (Zaciorski, 1975).

The sport belongs to the group of semi-structural sports, and therefore, to a greater or lesser extent, represents a satisfactory factor of all aspects of human motivation, both biological and sociological (Kovač, Mandić & Lolić, 2009).

In order to achieve the set requirements, morphological constitutional traits that give appropriate priority in the game to a player with regard to the requirements of modern handball games and positions in the team, are necessary (Pokrajac, 1983).

The key problem of almost all team sports is to increase the efficiency of the individual techniques of each player in specific competitive situations and improve the quality of implementation of individual and team tactical ideas in competitive conditions (Dopsaj, 1994).

Modern handball is characterized, therefore, by a large number of accelerations, sprints, jumps and rapid changes of direction and contact between players. Lately, female handball has taken on a more intense character which inevitably leads to increased fatigue, which in turn hinders more a pronounced ***tactical-technical*** manifestation of players (Ronglan et al., 2006).

The part of the game tactics in defense, also the most studied, practiced and used is the *system of different zones*. There is no team in the world today that does not build a basis for the defensive play on one of the zones. The main feature of the game in zonal formation is that the defender guards the space and

the attackers in it and is not in charge (as in an individual defense) of only one man-attacker, but there is almost a pattern of movement. In addition, handball also has a defense in which some of the players play the zone system, and some of them an individual defense, which is why we call it a *combined defense*. It is very often the case in defense game tactics, and at least one of the variants is used by almost all the world's teams.

In the principle one *man more* generally the coach reaches for a combined defense, while playing with a man less in defense for some of the zone systems. After the steal, the same team can organize a quick counter-attack, which is the basis of a modern attack in handball. Such a counter-attack which involves two or more players is called *counter*, and the slower variant is a *half-counter* (Tomljanović & Malić, 1982).

A good goalie in handball represents half the victory, and therefore the most appropriate division is Pavlin's (1981) into three types of goalkeepers: classic, contemporary and combined using all the available handball techniques of their positions, and applying them in different ways and modes of application.

The aim of this study was to determine the differences in the implementation *of tactical and technical elements*, two quite opposing handball 'climates,' which would have a statistically significant overall contribution to the realization of positive results in the competition, in order to get with their help practically the most applicable conclusions in the future shaping of the training process. By the appointed hypothesis we assume that there are no statistically significant differences of means in *tactical and technical* variables of the Brazilian national team and the national team of Serbia, regardless of the fact that Serbia suffered two defeats by minimum result from the aforementioned opponents

METHOD

The sample

The sample of this study consists of two of the most successful women's handball teams at the 21st World Championship, which was held in 2013 in Serbia, these being the national team of Serbia (Serbia) and the team of Brazil (Brazil). A total of five games in the World Championship were analyzed, being the three most important games played by these teams. The first games were selected based on the model of the strongest and toughest opponent of the first phase of the competition and the other matches were quarterfinals, which were also the most difficult while fighting for medals, and finally the 'final gold match, where these two teams met. The teams in the competition observed had the role of host and guest, depending on the will of the draw.

The sample of variables

Table 1 presents the monitored variables. They relate to the established types of successful and unsuccessful defenses in handball (zone systems, combined defense, as well as ways to defend with more or less one or two players) and also the undeniable and very significant technical factors of the results in handball (success or failure of balls defended by the goalkeeper, successfully or unsuccessfully organized counter attacks and half-counter attacks, successful or unsuccessful shots from 7 meters and exclusions of players for 2 minutes).

All of these formed defenses and related important factors were analyzed from the moment of their installation, or the beginning, with all the reported specificities. Data was collected by observing the video recordings of matches for which purpose a special observation list was created

Table 1. *Monitored variables in relation to the technically and tactically formed types of handball defenses and other related factors in achieving a successful outcome of the match*

Variables	**Successfully defended formation**	**Unsuccessfully defended formation**
Formation zone system 6:0	SDF 6:0	UDF 6:0
Formation zone system 5:1	SDF 5:1	UDF 5:1
Formation zone system 4:2	SDF 4:2	UDF 4:2
Formation zone system 3:2:1	SDF 3:2:1	UDF 3:2:1
Formation zone system 3:3	SDF 3:3	UDF 3:3
Formation system of combined defense 5+1	SDF 5+1	UDF 5+1
Formation system of combined defense 5+Indian	SDF 5+ind.	UDF 5+ind.
Formation system of combined defense 4+2	SDF 4+2	UDF 4+2
Defense in formaion with a player extra	SDFMM	UDFMM
Defense in formation with a man less	SDFML	UDFML
Defense in formation with two men extra	SDF2MM	UDF2MM
Defense in formation with two men less	SDF2ML	UDF2ML
Defense in formation man-man less	SDFMML	UDFMML
Varijables	**Successfully TE-TA characteristics**	**Unsuccessfully TE-TA characteristics**
Goalkeeper defenses	SGD	UDG
Counter attack organization	SCO	UCO

Half-counter attack organization	SHCO	UHCO
Shot from 7 m line	SS7M	US7M
A total of players excluded for 2 min	TE2M	

Statistical data processing procedure

The data was analyzed by descriptive statistics, with the determination of the distribution frequency of each variable shown in the form of a nominal statistical scale. The arithmetic mean (AM) as a measure of central tendencies and standard deviation (SD), coefficient of variation (cV) and the minimum and maximum values of observed parameters (MIN, MAX) as measures of dispersion were calculated.

In the field of comparative statistics, the parametric and nonparametric discriminant procedure was used. Once a hypothesis that the observed values of the parameters are not significantly different in both teams is set, the significant differences of their arithmetic means were tested, where each team is seen through the prism of three games. In determining the differences of arithmetic means the t-test was used, at the level of significance of $p<0.05$.

RESULTS

The results obtained by descriptive statistics are presented in Tables 2, 3, 4, 5, 6, 7.

Table 2. *Formed types of successful and unsuccessful handball defenses against the attacks of opponents and other TE-TA factors of the first stage of the competition at the World Championship in the match Serbia - Denmark 23:22 (12:12), which was played at the Sports Centre Cair in Niš, 11/12/2013*

Variables	Serbia		Denmark		Σ
	Number	%	Number	%	
SDF 6:0	12	46	14	54	26
UDF 6:0	10	67	5	33	15
SDF 5:1	10	42	14	58	24
UDF 5:1	3	43	4	57	7
SDF 4:2	2	20	8	80	10
UDF 4:2	0	0	3	100	3
SDF 3:2:1	0	0	3	100	3
UDF 3:2:1	0	0	0	0	0
SDF 3:3	2	33	4	67	6
UDF 3:3	0	0	0	0	0

SDF 5+1	2	29	5	71	7
UDF 5+1	1	25	3	75	4
SDF 5+ind.	0	0	0	0	0
UDF 5+ind.	0	0	0	0	0
SDF 4+2	0	0	0	0	0
UDF 4+2	0	0	0	0	0
SDFMM	10	62	6	38	16
UDFMM	4	80	1	20	5
SDFML	4	50	4	50	8
UDFML	4	40	6	60	10
SDF2MM	0	0	0	0	0
UDF2MM	0	0	0	0	0
SDF2ML	0	0	0	0	0
UDF2ML	0	0	0	0	0
SDFMML	0	0	1	100	1
UDFMML	0	0	1	100	1
Variables	**Serbia**		**Denmark**		**Σ**
	Number	**%**	**Number**	**%**	
SGD	18	49	19	51	37
UGD	22	49	23	51	45
SCO	1	20	4	80	5
UCO	5	29	12	71	17
SHCO	2	100	0	0	2
UHCO	3	75	1	25	4
SS7M	5	62	3	38	8
US7M	2	67	1	33	3
TE2M	4	40	6	60	10

In the analyzed variables (Table 2), the highest values of formed defenses of Serbia were at SFD 6:0 - 12 same or (46%), UFD 6:0 - 10 or (67%), SDF 5:1 - 10 i.e. (42%) and 10 also SFDMM i.e. (62%), while the highest values of the variables of Denmark were SFD 6:0 with 14 same or (54%), SFD 5:1 same 14, or (58%), SFD 4:2 - 8, i.e. (80%) and SFDMM and UFDML - 6 or 38 (60%).

In other variables, the important factors of success in the handball game, significant values of SGD were found, of which 18 (49%) were in Serbia, compared to 19 of SFD (51%) in Denmark, as well as in variable UGD, which is also almost evenly distributed with 22 (49%) and 23 (51%). Significant differences were observed with the variable of unsuccessfully organized counterattacks, where Denmark had even 12 (71%), compared to 5 or (29%) of Serbia, while the difference between the successfully executed penalty shots is noticeable in proportion 5 vs. 3 (62 vs. 38%), of Serbia and Denmark.

Denmark had two suspensions more than Serbia, which are stated in values 6 (60%) versus 4 (40%)

Table 3. *Formed types of successful and unsuccessful handball defenses in relation to the attacks of opponents and other factors TE-TA in the World Championship quarter final match Serbia - Norway 28:25 (15:16), which was played in the Belgrade Arena in Belgrade on 18/12/2013*

Variables	Serbia		Norway		Σ
	Number	%	Number	%	
SDF 6:0	26	70	11	30	37
UDF 6:0	7	44	9	56	16
SDF 5:1	7	32	15	68	22
UDF 5:1	6	46	7	54	13
SDF 4:2	2	33	4	67	6
UDF 4:2	3	38	5	62	8
SDF 3:2:1	1	100	0	0	1
UDF 3:2:1	1	100	0	0	0
SDF 3:3	0	0	2	100	2
UDF 3:3	0	0	0	0	0
SDF 5+1	1	11	8	89	9
UDF 5+1	1	17	5	83	6
SDF 5+ind.	0	0	0	0	0
UDF 5+ind.	0	0	0	0	0
SDF 4+2	1	100	0	0	1
UDF 4+2	0	0	0	0	0
SDFMM	0	0	3	100	3
UDFMM	0	0	1	100	1
SDFML	1	100	0	0	1
UDFML	2	100	0	0	2
SDF2MM	0	0	0	0	0
UDF2MM	0	0	0	0	0
SDF2ML	0	0	0	0	0
UDF2ML	0	0	0	0	0
SDFMML	0	0	0	0	0
UDFMML	0	0	0	0	0
Variables	**Serbia**		**Norway**		**Σ**
	Number	**%**	**Number**	**%**	
SGD	22	49	23	51	45
UGD	25	47	28	53	53
SCO	4	44	5	56	9
UCO	1	25	3	75	4
SHCO	4	80	1	20	5

UHCO	6	60	4	40	10
SS7M	4	67	2	33	6
US7M	3	60	2	40	5
TE2M	2	100	0	0	2

Table 3 shows that the highest values of the formed defenses occurred in Serbia and in the variable SDF 6:0, which had as many as 26 of the same (70%) compared with 11 by Norway (30%), that is, with an equally large value in comparison with other variables, but not the highest.

With Norway, an extremely large number of formed zone systems was found, 5:1 in value 15 (68%) versus 7 in Serbia (32%). Also, distinct differences in successful and unsuccessful combined defenses were established - 5+1 and in particular in favor of Norway of the diameter of SDF 5+1 - 8 (89%) versus 1 (11%) of Serbia and UDF 5+1 – 5 (83%) versus 1 (17%).

Other significantly found factors of success were in variables SGD of value 22 (49%) of Serbia versus 23 (51%) of Norway as well as UGD of proportion 25 (47%) versus 28 (53%) of these two teams. Important parameters were set with values 4 or SOHC (80%) versus 1 (20%) of Serbia and Norway as well as with SS7M of diameter 4 of the same (67%) versus 2 (33%) between these two teams. Exclusions of players occurred only in the Serbian team - 2 times.

Table 4. *Formed types of successful and unsuccessful handball defenses in relation to the attacks of opponents and other factors TE-TA of the first stage of the competition at the World Championship in the match Brazil - Serbia 25:23 (14:11), which was played at the Sports Centre Cair in Niš, on 10/12/2013*

Variables	**Brazil**		**Serbia**		**Σ**
	Number	**%**	**Number**	**%**	
SDF 6:0	7	33	14	67	21
UDF 6:0	7	58	5	42	12
SDF 5:1	17	63	10	37	27
UDF 5:1	2	20	8	80	10
SDF 4:2	2	40	3	60	5
UDF 4:2	3	75	1	25	4
SDF 3:2:1	1	100	0	0	1
UDF 3:2:1	0	0	0	0	0
SDF 3:3	0	0	0	0	0
UDF 3:3	0	0	0	0	0
SDF 5+1	8	67	4	33	12
UDF 5+1	3	50	3	50	6
SDF 5+ind.	0	0	0	0	0
UDF 5+ind.	0	0	0	0	0

SDF 4+2	0	0	0	0	0
UDF 4+2	1	100	0	0	1
SDFMM	3	21	11	79	14
UDFMM	1	33	2	67	3
SDFML	10	91	1	9	11
UDFML	2	50	2	50	4
SDF2MM	0	0	0	0	0
UDF2MM	0	0	0	0	0
SDF2ML	2	100	0	0	2
UDF2ML	0	0	0	0	0
SDFMML	0	0	5	100	5
UDFMML	2	67	1	33	3
Variables	**Brazil**		**Serbia**		**Σ**
	Number	**%**	**Number**	**%**	
SGD	12	60	8	40	20
UGD	23	48	25	52	48
SCO	5	56	4	44	9
UCO	1	17	5	83	6
SHCO	1	33	2	67	3
UHCO	2	29	5	71	7
SS7M	4	67	2	33	6
US7M	1	33	2	67	3
TE2M	7	70	3	30	10

At the analyzed match of the World Handball Championship for women (Table 4), Brazil was determined as having the highest number of successfully established zone systems 5:1 in value 17 (63%) versus 10 of SDF 5:1 (37%) of Serbia, which represents one of the major parameters in relation to the other variables. In Brazil, a significant amount was found in the variables SDF 5+1 value 8 (67%), as well as SDFNL - 10 (91%), compared to Serbia where significant values were reported in variables SDF 6:0 with 14 of the same (67%), UDF 5:1 - 8 (80%) and SDFMM - 11 (79%).

Significant factors in the performance of handball teams have also been established in variables SGD where Brazil had a value of 12 (60%) and Serbia 8 (40%) and UGD of the presented proportion 23 (48%) of Brazil and 25 (52%) of Serbia. Significant differences were established in the failure of organized counter attacks and half-counter attacks which were significantly higher in Serbia with 5 UOC (83%) to 1 UOC (17%) and 5 UOHC (71%) versus 2 UOHC (29%) of Brazil. Also, significant differences were shown in the total exclusion of the players for 2 minutes, of volume 7 TE2M (70%) vs. 3 TE2M (30%) in favor of Brazil.

Table 5. *Formed types of successful and unsuccessful handball defenses in relation to the attacks of opponents and other TE-TA factors in the quarter final match of the World Championship Brazil - Hungary 33:31 after two overtimes played. The regular match part was finished with the result 26:26 (12:11) after the first overtime 29:29 and after the second already stated value. The match was played in the Kombank Arena in Belgrade, on 18/12/2013*

Variables	Brazil		Hungary		Σ
	Number	%	Number	%	
SDF 6:0	22, 15	42, 42	31, 21	58, 58	53, 36
UDF 6:0	8, 7	40, 39	12, 11	60, 61	20, 18
SDF 5:1	10, 8	43, 40	13, 12	57, 60	23, 20
UDF 5:1	4, 3	50, 50	4, 3	50, 50	8, 6
SDF 4:2	12, 10	86, 83	2, 2	14, 17	14, 12
UDF 4:2	2, 2	100, 100	0, 0	0, 0	2, 2
SDF 3:2:1	1, 1	100, 100	0, 0	0, 0	1, 1
UDF 3:2:1	1, 0	100, 0	0, 0	0, 0	1, 0
SDF 3:3	2, 1	100, 100	0, 0	0, 0	2, 1
UDF 3:3	1, 1	100, 100	0, 0	0, 0	1, 1
SDF 5+1	14, 11	74, 79	5, 3	26, 21	19, 14
UDF 5+1	5, 5	62, 71	3, 2	38, 29	8, 7
SDF 5+ind.	0, 0	0, 0	0, 0	0, 0	0, 0
UDF 5+ind.	0, 0	0, 0	0, 0	0, 0	0, 0
SDF 4+2	7, 4	100, 100	0, 0	0, 0	7, 4
UDF 4+2	1, 1	100, 100	0, 0	0, 0	1, 1
SDFMM	12, 4	48, 31	13, 9	52, 69	25, 13
UDFMM	0, 0	0, 0	4, 3	100, 100	4, 3
SDFML	4, 0	67, 0	2, 1	33, 100	6, 1
UDFML	6, 6	86, 100	1, 0	14, 0	7, 6
SDF2MM	0, 0	0, 0	1, 1	100, 100	1, 1
UDF2MM	0, 0	0, 0	1, 1	100, 100	1, 1
SDF2ML	1, 1	100, 100	0, 0	0, 0	1, 1
UDF2ML	3, 2	100, 100	0, 0	0, 0	3, 2
SDFMML	0, 0	0, 0	0, 0	0, 0	0, 0
UDFMML	0, 0	0, 0	0, 0	0, 0	0, 0
Variables	**Brazil**		**Hungary**		**Σ**
	Number	**%**	**Number**	**%**	
SGD	33, 25	61, 62	21, 15	39, 38	54, 40
UGD	31, 26	48, 50	33, 26	52, 50	64, 52
SCO	6, 5	75, 83	2, 1	25, 17	8, 6
UCO	5, 4	56, 57	4, 3	44, 43	9, 7
SHCO	1, 0	100, 0	0, 0	0, 0	1, 0

UHCO	2, 2	33, 40	4, 3	67, 60	6, 5
SS7M	5, 4	62, 67	3, 2	38, 33	8, 6
US7M	1, 1	50, 50	1, 1	50, 50	2, 2
TE2M	9, 6	82, 86	2, 1	18, 14	11, 7

* (The first column indicates the overall indicators after two played overtimes, while the values in the second column are presented after the end of the regular game.)

By a thorough analysis of Table 5, the maximum value established of the formed defenses of the match in both observed national teams was in variable SDF 6:0, whereupon with Brazil the values 22 of the established zone systems (42%) were found compared to an even 31 of Hungary (58%). Significant values in Brazil were found also in SDF 5:1 - 10 (43%), SDF 4:2 and SDFMM of the same values 12 (86 and 48%) and in variable SDF 5+1 - 14 (74%), while in Hungary the significant values were found in in UDF 6:0 - 12 (60%), SDF 5:1 and SDFMM of the same values of 13 (57 and 52%), as well as with SDF 5+1 - 5 (26%).

In the result-significant-successful factors, what was also found were the differences in the values of variables: SGD at Brazil - 33 (61%) versus 21 (39%) in Hungary, UGD with 31 (48%) versus 33 or (52%) in favor of Hungary, the proportion of SOC 6 (75%) of Brazil versus 2 of SOC (25%) of Hungary, as well as SS7M of the proportion 5 (62%) of Brazil vs. 3 (38%) of Hungary. A significant difference was also found in variable TE2M where Brazil had as many as 9 exclusions (82%) versus 2 (18%) of Hungary.

Table 6. *Formed types of successful and unsuccessful handball defenses in relation to the attacks of opponents and other factors TE-TA in the final game of the World Championship Brazil - Serbia 22:20 (13:11), which was played in the Kombank Arena in Belgrade on 22/12/201*

Variables	Brazil		Serbia		Σ
	Number	%	Number	%	
SDF 6:0	16	41	23	59	39
UDF 6:0	5	29	12	71	17
SDF 5:1	12	52	11	48	23
UDF 5:1	3	100	0	0	3
SDF 4:2	4	80	1	20	5
UDF 4:2	1	100	0	0	1
SDF 3:2:1	2	100	0	0	2
UDF 3:2:1	0	0	0	0	0
SDF 3:3	1	100	0	0	1
UDF 3:3	1	100	0	0	1

SDF 5+1	9	82	2	18	11
UDF 5+1	0	0	1	100	1
SDF 5+ind.	0	0	0	0	0
UDF 5+ind.	1	100	0	0	1
SDF 4+2	6	75	2	25	8
UDF 4+2	1	100	0	0	1
SDFMM	3	38	5	62	8
UDFMM	2	33	4	67	6
SDFML	8	62	5	38	13
UDFML	4	100	0	0	4
SDF2MM	2	100	0	0	2
UDF2MM	1	100	0	0	1
SDF2ML	0	0	0	0	0
UDF2ML	0	0	2	100	2
SDFMML	0	0	0	0	0
UDFMML	0	0	0	0	0
Variable	**Brazil**		**Serbia**		**Σ**
	Number	**%**	**Number**	**%**	
SGD	19	40	28	60	47
UGD	20	48	22	52	42
SCO	5	83	1	17	6
UCO	2	29	5	71	7
SHCO	1	100	0	0	1
UHCO	3	75	1	25	4
SS7M	3	50	3	50	6
US7M	2	100	0	0	2
TE2M	5	56	4	44	9

The highest recorded value of the observed variables in Table 6, in terms of the defense formed by both national teams is found in SDF 6:0 of proportion of 16 (41%) of Brazil versus 23 (59%) of Serbia. Significant values in Brazil are defined also in variables SDF 5:1 with 12 of the same (52%), then SDF 5+1 - 9 (82%) and in SDFML - 8 (62%), while in Serbia UDF was 6:0 - 12 (71%), SDF 5:1 - 11 (48%), as well as the same values in variables SDFMM and SDFML - 5 (62 and 38%).

The significance of the differences of other factors of success in handball was found in variables: SGD of value 19 (40%) of Brazil versus 28 (60%) of Serbia, UGD of diameter 20 (48%) of Brazil versus 22 of UGD (52%) of Serbia and with SOC, UOK and US7M presented with 5 (83%), 2 (29%) and 2 (100%) in Brazil versus 1 (17%) and 5 (71%) and without unsuccessfully carried out penalty shots from 7 meters in Serbia. Parameters of the exclusion

of players for 2 minutes were almost evenly distributed in volume - 5 (56%) versus 4 (44%) in favor of Brazil.

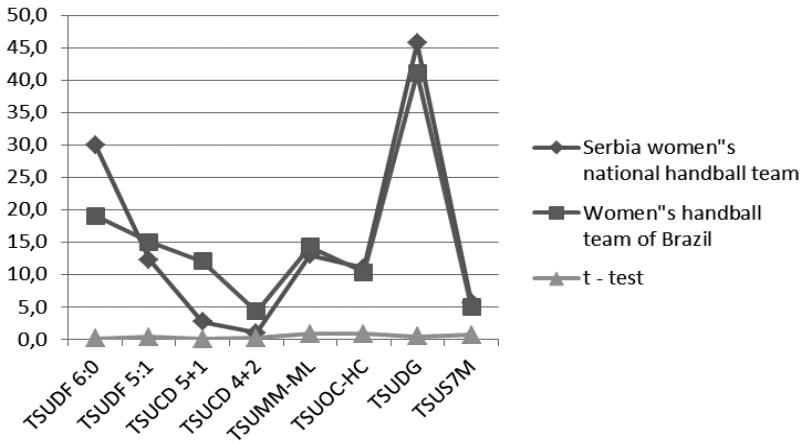
Table 7. *Descriptive indicators of the stated variables (i.e. tactical-technical elements) that are sorted and distributed in relation to the two presented teams and three games (two quarter-finals and the final match)*

Varijable	Serbia-Norway 28:25					Brazil-Hungary 26:26					Brazil-Serbia 22:20				
	Σ	AS	SD	cV	Mn Mx	Σ	AS	SD	cV	Mn Mx	Σ	AS	SD	cV	Mn Mx
TSFZS	65	32.5	3.5	0.1	2 26	90	45.0	1.4	0.0	2 31	67	33.5	2.1	0.1	1 23
TUFZS	37	18.5	3.5	0.2	3 9	30	15.0	1.4	0.1	0 12	21	10.5	2.1	0.2	0 12
TTFCD	10	5.0	4.2	0.8	0 8	26	13.0	11.3	0.9	0 14	19	9.5	7.8	0.8	2 9
TUFCD	6	3.0	2.8	0.9	0 5	9	4.5	2.1	0.5	0 5	2	1.0	0.0	0.0	0 1
TSMM-ML	4	2.0	1.4	0.7	0 3	31	15.5	0.7	0.0	2 13	21	10.5	0.7	0.1	3 8
TUMM-ML	3	1.5	0.7	0.5	0 2	11	5.5	0.7	0.1	0 6	10	5.0	1.4	0.3	0 4
TSPC-HC	14	7.0	1.4	0.2	1 5	9	4.5	3.5	0.8	0 6	7	3.5	3.5	1.0	0 5
TUPC-HC	14	7.0	0.0	0.0	1 6	15	7.5	0.7	0.1	2 5	11	5.5	0.7	0.1	1 5

*TSFZS - total successfully formed zone systems (zones taken into consideration 6:0, 5:1 and 4:2); TUFZS - total unsuccessfully formed zone systems; TTFCD – total successfully formed combined defenses (defenses taken into account 5+1 and 4+2); TUFCD – total unsuccessfully formed combined defenses; TSMM-ML – total successfully conducted defenses with a man more or less; TUMM-ML – total unsuccessfully conducted defenses with a man extra or less; TSPC-HC - total successfully played counterattacks or half-counter attacks; TUPC-HC - total unsuccessfully played counter attacks or half-counter attacks.
(** The match Brazil-Hungary in this table is considered in the 'regular part' of its duration, i.e. without the extra time played so that all observed parameters can be correctly and equally distributed).

Chart 1 shows that the highest values of arithmetic means were found in the variables TSUDG - 45.7 of Serbia versus 41.0 of Brazil, TSUDF 6:0 - 30.0 of Serbia and19.0 of Brazil, while the lowest values were recorded in TSUCD 4+2 - 1.0 of Serbia and 4.3 of Brazil and in variable TSUS7M - 5.7 of Serbia and 5.0 of Brazil. The greatest value of the differences of the mentioned arithmetic means of the two teams, which are reported by a student t-test, were found in the variables TSUMM-ML - 0.84 and TSUOC-CK - 0.80, and the lowest for TSUCD 5+1 – 0.04 and in variable TSUDF 6:0 – 0.10.

Chart 1. *Shows the difference in the arithmetic means of the observed variables and their tested statistical significance stated by a t-test between women's handball teams of Serbia and Brazil in the 21st World Championship*



* TSUDF 6:0 - total successful-unsuccessful defensive formations 6:0; TSUDF 5:1 - total successful-unsuccessful defensive formations 5:1; TSUCD 5+1 - the total successful-unsuccessful defense combined 5+1; TSUCD 4+2 - total successful-unsuccessful combined defenses 4+2; TSUMM-ML - total successful-unsuccessful defenses with a man more or less in them; TSUOC-HC - total successfully-unsuccessfully organized counter attacks and half-counter attacks; TSUDG - total successful-unsuccessful defense of goalkeeper; TSUS7M - total successful-unsuccessful shots with 7 meters at the observed matches.
(* The match Brazil-Hungary on this chart is considered in it 'regular part,' i.e. without the extra time played so that all the observed parameters can be presented and distributed evaluatively.)

DISCUSSION

Based on the results in Table 2, the two observed national teams in the set defenses had the overall highest number of set zone systems of 6:0, both successful and unsuccessful (12 SDF 6:0 and 10 UDF 6:0 of Serbia and 14 SDF 6:0 and 5 UDF 6:0 of Denmark). The found indicators suggest that expert committees opted, in the preparation of the match, largely for cleanly blocked characters of defense, with a small number of predictions of exits to outer shooters, which in totality would have the effect of a small number of scored goals. The distance of the thus set defenders was quite moderate and narrow (about 1.5 meters) with good lateral mobility in the blockades, although a loss of concentration caused mistakes.

Also, important indicators were determined with the defense 5:1 and 4:2 (Serbia had 10 SDF 5:1 and 3 UDF 5:1 and 2 SDF 4:2, while Denmark

had 14 SDF 5:1 and 4 UDF 5:1 and 8 SDF 4:2 and 3 UDF 4:2), which can be explained by the almost uniformly distributed 'shallow' zonal formations of both teams with a 'forward' quick-turn movement and prevention of a shot from secondary positions, while a significantly higher number of defense with Denmark with two protruding defensive players was established in order to solve the long shots. In this setting by Denmark, the emphasis was on a greater aggressiveness in defense tasks, which is considered partly justified, looking at the end result.

Although there were a total of ten exclusions in two minutes, significantly more successful and unsuccessful defenses with an extra player was found in Serbia (10 versus 6 SDFMM and 4 versus 1 UDFMM), which indicates that in compact and numerically stronger defenses defending the Serbian was quite effective and important in the victory, primarily due to the imposed confidence of the players. The indicators of goalkeeper defenses had nearly equal values (18 vs. 19 SGD and 22 vs. 23 UGD of Serbia and Denmark) but with a marked contrast of unsuccessfully organized counterattacks by Denmark (even in the value of 12 versus 5), which can be explained by a marked decrease in concentration created by the nature of the game itself and the added pressure of the audience in the stands. The final comment is such that both teams in the future should show a significantly higher level of organization and the use of variable zones in the defense in order to confuse the opponent and make him lose his ball more easily.

The results presented in Table 3 show that Serbia, in relation to Norway during the formation of defensive lines had the highest representation of variable SDF 6:0 (26 vs. 11), while in the reverse case Norway expressed the highest value in the SDF 5:1 (15 to 7). There were unsuccessfully set stated systems by Serbia and Norway in proportions 7 versus 9 of UDF 6:0 and 6 versus 7 of UDF 5:1.

These results support the fact that the Serbian team played quite a deep zone, properly covering the axis of its goal with a fair number of blockages, while Norway had the primary commitment, along with having five players on the goalkeeper space line, to also have a "projecting" one in the relatively vulnerable position of the goal center. However, despite such successfully set systems, there have been mistakes of a nearly equal volume, most likely caused by a loss of concentration, irregular space closure and subsequent exhaustion.

When forming a combined defense, we found a marked difference in the formation of 5+1 in favor of Norway (SDF 5+1 values of 8 to 1, and UDF 5+1 values 5 to 1), which is explained by the fact that the coaching staff of the Scandinavians had in mind an exclusion from the game of the best opponent player and organizer of the attacks (Andrea Lekić), but the end result shows that they failed in the tactical totality, primarily due to the skills of the other team members of Serbia and the great support of the audience in the stands.

Other recognizable parameters can be discussed, perhaps the most important variables in the handball game – the goalkeeper defense expressed in proportions (22 SGD of Serbia versus 23 of Norway and 24 UGD vs. 29), which speaks of the equal success of both goalkeepers, and therefore it did not play a key role in the victory, as did the game in the field and the organization of quick half-attacks presented by proportions of values (4 Serbia and only 1 Denmark).

From all the stated and observed, it is concluded that this was a very attractive game, in all its parameters, and only now can it be seen what kind of success the Serbian national team had at home, because in 2015 Norway became the new world champion in women's handball.

At the women's World Handball Championship match (Table 4), Brazil had the greatest value of defensive variable SDF 5:1 - 17, and Serbia 6:0 - 14, which is explained by the prevailing setting of both coaches with deep zones in the defense, with the difference of a 'projecting' Serbian player. Movable zones and good blocks tried to "narrow down" the space to the opponent's attack, which due to a low 'flow' of the ball ensued in a greater number of unsuccessful shots from a distance.

The significant value of 'defensive variables' with Brazil was also in SDF 5+1 – 8, in SDFML - 10, and in Serbia SDFMM - 11, which speaks of a quite a number of distractions and exclusions from the game of the best player of Serbia, as well as of a skilful defending and setting up of defensive formations with a player less, while Serbia has shown significant success with an extra player. The numerical difference of exclusion of players was in favor of Brazil (7 versus 3).

A ratio was found with the unsuccessful and most applied defensive formations in both teams: UDF 6:0 Brazil and Serbia - 7 versus 5, UDF 5:1 - 2 versus 8 and UDF 4:2 – 3 versus 1, which can be explained by the same number of errors in the two teams that have formed defense systems, made primarily due to less successful individual techniques, special physical training (usually very important for these zones), as well as somewhat shorter work on mastering the laws of motion and a high degree of practice of the team as factors of cohesion development, as studied by (Carron, 1982), and which must include different sources of influence - from the most general and less relevant to specific direct and very important factors.

The successful defenses of goalkeepers were in the approximate value of (12 Brazil, 8 Serbia), while there were significantly more unsuccessful defenses, indicated by the given results. This figure represents a considerable loss of concentration in both teams' goalkeepers (especially Maise Pessoa of Brazil and Katarina Tomašević of Serbia), imposed by the character of the match and the high expectations of the players and the coach, while in the field of technical components there was a greater number of unsuccessfully

organized counterattacks and half-attacks by Serbia, in the values of (5 versus 1 and 5 versus 2). The end result of the mentioned must be in the essential inclusion of a somewhat better psychological preparation of both the national team's goalkeepers, who, despite the importance of the match must show their full potential.

The results in Table 5 showed generally larger differences of all variables, due to the two played overtimes in the game. Both Brazil and Hungary had the highest number of defensive formations SDF 6:0 - 22 and 31, as well as many other successful formations stated by parameters (SDF 5:1 - 10 versus 13, SDF 4:2 - 12 versus 2, SDF 5+1 - 14 versus 5, SDF 4+2 - 7 versus 0 and SDFMM - 12 versus 13). All of the above indicators show a real 'trench' fight and battle in the quarterfinals of the World Cup which eventually resulted in a possible division of the medals in the competition.

The preponderance of match results, according to the indicators, was brought by the variables SDF 4:2 and SDF 5+1 and 4+2, which shows that in the use of the model for resorting to the 'most dangerous' shooter players and organizers of the attacks of Hungary, the team of Brazil 'dulled' their attack with the ultimate goal of victory. The failure of forming defensive formations was shown in the variables (UDF 6:0 8 versus 12, UDFMM 0 versus 4, UDFML 6 versus 1 and UDF2ML 3 versus 0). The exposed parameters indicate that, compared with the mentioned Hungarian 'minuses,' their 'pluses' in coping and ultimately ending with an extra player in the field were presented here, as it was Brazil that received a large number of goals with one and two players less in defense.

Successful goalkeeper defenses occurred significantly more in Brazil (33 vs. 21) which ultimately took precedence in the match, with the conclusion that a goalkeeper in handball is crucial for the outcome, while the unsuccessful defenses occurred (31 vs. 33), which is testified by the end result. The difference in successfully organized counterattacks stated by the value of 6 vs. 2 in favor of Brazil, which once again proved the team's tactical readiness for rapid transformations from the field of defense into the field of attack.

The comment of the observed World Cup match was such that it showed the full diversity and necessary content and cost-effectiveness in the game of defense and the game of attack.

The parameters of situational efficiency in handball have become the subject of interest only in the last two decades, although the sport was conceived in the 19th century (Czerwinski, 2000), and a substantial progress in the research of technical and tactical elements is primarily due to technological advances, particularly in the field of computer and video technology (Bon, 2001).

The results obtained are, in a way, the synchronization of previous researches which stress the primary importance of adequate training technology

and team skills in a technical and tactical plan in order to express a wide range of different actions (in both the defense and the attack phases). The attempt at a thorough research of the parameters of situational efficiency and a precise link gives the team a chance to fight for a high placement. Due to all the mentioned, top coaches have shown interest for a scientific approach to the study of the performative abilities of male and female handball players i.e. their technical and tactical skills, which have occurred rarely thus far (Costantini et al., 2008).

In the final World Cup match (Table 6), both teams had the greatest value of a defensive variable SDF 6:0 reported by values (Brazil 16, Serbia 23), while the more significant values of success were in variables (SDF 5+1 - 9 versus 2, SDF 4+2 – 6 versus 2 and SDFML – 8 versus 5), which indicates that the stated parameters are key in achieving the final victory and the end success of Brazil in the championship.

Namely, Brazil used a more established formula in this championship to exclude from the game one or two key Serbian players in the organization of attacks and shoots at the goal, which would bring the final predominance in the game. Also, the team used a good setting and covering the defense area with a lot of ferocity, fighting and concentration in the key moments with a player less.

The results show that Brazil succeeded in this, but nonetheless, in the defense there was a series of mistakes incurred by both teams found in variables UDF 6:0 (5 Brazil vs. 12 Serbia), UDF 5:1 (3 vs. 0), UDFML (4 vs. 0) and UDF2ML (0 vs. 2 in favor of Serbia).

All of these values can be explained by the fact that with key set zones with six players on the line of the goalkeeper area, there were significantly more mistakes made by the team of Serbia, which must have had the ultimate effect of defeat. With other important factors, inconsistencies were found in the variables SGD (19 Brazil and 28 Serbia), as well as in UGD (20 vs. 22), which confirms the fact that the goalkeepers of both teams had remarkable results, particularly Serbia, but poor play in the field leveled that and eventually led to defeat.

The difference was noted in the organization of counter attacks and half-counter attacks, so with Brazil it was 5 SOC and 2 UOK, and in Serbia 1 SOK and 5 UOK, which shows that Brazil, by a rapid transformation of the game, confused the opponents and achieved a significant number of goals, while in Serbia the number of mistakes in the rapid transformation of the game from the defense phase to the phase of attack was manifested primarily by the loss of concentration in the players.

The lesson of the game is to reduce the number of mistakes in forming the system of zones 6:0 for the national team of Serbia, primarily using situational trainings and better defensive player interaction (as such, a formed system was one of the most applied defense systems of Serbia in the

championship), and reducing the number of mistakes in organizing a counter-attack with a significantly greater accuracy thereof.

Table 7 presents the expected scale of, above all, the successful and unsuccessful zone systems, combined defenses, coping with a player extra or less in the formation and also, quick organizing of counterattacks and half-attacks at the three most important observed Championship matches. Almost all the mentioned indicators had the highest values in the observed match Brazil-Hungary, which due to its dynamism deserves to hold the title of the best representation of women's handball at the World Championship in Serbia.

Chart 1 shows a t-test at a significance level of $p<0.05$, with the following data: the arithmetic mean found in the variable of total successful-unsuccessful defensive formations 6:0 for Serbia was 30.0, and 19.0 for Brazil, while the value of the t-test for differences of the mentioned (AM) was 0.10, suggesting that the hypothesis is accepted, that is, that the values are not significantly different.

With the set variable TSUDF 5:1, Serbia had the arithmetic mean value at the three observed matches of 12.3, while Brazil had the value of 15.0, and thus their difference in the procedure of the t-test was at a 0.37 value, which can be interpreted by the acceptance of the hypothesis, i.e. that the arithmetic means compared statistically do not differ significantly.

In the variable of successful-unsuccessful combined defenses 5+1, it was noted that Serbia in the observed matches performed the same at an average of 2.7, unlike Brazil, which had a value of 12.0 of such established defenses. The value of t-test for the means difference of this variable is 0.04 suggesting that the hypothesis is not accepted i.e. that these values show significant differences.

The totality of successful and unsuccessful combined defenses (TSUCD 4+2) with Serbia had the arithmetic mean value of 1.0, unlike Brazil, which had a value of 4.3. The value of the t-test for the means difference of this variable is 0.19, which speaks in favor of the hypothesis being accepted, that is, that the values do not show significant differences.

The arithmetic mean of the variable TSUMM-ML with Serbia had a value of 13.0, and with Brazil 14.3, so their difference is represented by the t-test in the value of 0.84, which may be discussed by the fact that hypothesis is also accepted, or that the compared arithmetic means were not statistically significantly different.

The total successful-unsuccessful organized half-attacks and counterattacks at the three observed matches with Serbia are presented by the value (AM) - 11.0, and with Brazil 10.3. The value of the t-test for the means differences of this variable is 0.80, which confirms the acceptance of the proposed hypothesis whereupon values show no significant differences.

A very significant variable in the handball game TSUGD found the value of the arithmetic mean with Serbia - 45.7, and with Brazil 41.0, while the value of the t-test was 0.42, which is interpreted as accepting the proposed hypothesis, i.e. claiming that the compared arithmetic means were statistically indistinguishable.

Also, one of the major factors in handball was introduced by the TSUS7M variable, where the value (AS) in Serbia was -5.7, and in Brazil 5.0. The presented parameters were also covered by their differences i.e., the t-test which had the value of 0.67, which is explained by the fact that the hypothesis is accepted, i.e. that the values show no significant differences.

All the described and clarified team results in the fight for medals are in line with some previous studies (Gardašević, & Terzić, 2011; Gardašević, 1999), where the shown values of the effectiveness of the shots, that is, the realized assistances and situational efficiency show no significant differences, while in comparison with the finally placed teams this difference is extremely large and significant. Such a correlation between successful and unsuccessful teams is expected, which can ultimately be attributed to a comprehensive conducting of training of the best ranked players and a considerably better preparation of the workforce.

CONCLUSION

The study analyzed the total representation of successful-unsuccessful tactical and technical repercussions of the two best women's handball teams at the 21st World Championship held in Serbia. Based on the results, it can be concluded that there was a very small difference in the observed matches regarding the number of goals scored and goals received by the two teams; namely, Serbia in the three observed matches achieved (71 goals, an average of 23.66) and Brazil (73 or 80 if the two extensions are analyzed, or an average of 24.33-or 26.66). The goals received by Serbia were 69 (23 in average) and with Brazil (the same 69 or 74, or an average of 23 or 24.66).

The most important parameters at handball matches speak in favor of the fact that there were no major discrepancies in the defense and attack in both teams, and that by such an open and solid game the teams managed to reach the battle for the gold medal, as in the games there were no significant differences in the results (the biggest goal difference being three goals).

Everything said in this paper points to certain regularities that can and should be used in future analyses of the very structure of the game of handball and can be quite important, as the results obtained have direct practical implications, both in the training technology and in the direct preparation for competing.

The final conclusion is that in the future, a large number of teams among which is also Serbia, handball experts and educators should be guided to observe the countries which have founded the modern handball game (Denmark and Norway), which did not achieve remarkable results at this competition, but not give up their distinctive style. In fact, they have a very organized and tough defense with 'atomic' fast counter attacks and half-counter attacks, with which they crush their opponents and also optimize the beauty of the game, with the great support of their fans – this relates to both the national team and the clubs.

This statement is corroborated by the results of the last World Cup held in Denmark and completed a few days ago, at which Norway became the world champion by defeating the Netherlands in the finals.

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