MODEL ELITE WORLD JUNIOR HANDBALL GOALKEEPER WITH VISUALIZATION

Sanja Bajgorić[1], Muris Đug[2], Nina Bijedić[3]

[1]Independent researcher, Mostar
[2]Faculty of Health and Sports, University of Tuzla
[3]Faculty of Informational Technology, University ''Dzemal Bijedic'' of Mostar

Abstract

The aim of this research is to construct the model of an elite world junior handball goalkeeper, based on the information from the official statistics run by the EHF at the 2013 World Junior Championship in Bosnia and Herzegovina. In total, 42 elite world junior goalkeepers were analysed. The model of the elite world junior handball player was constructed on the basis of a set of 28 variables: The basic central and dispersion parameters, factor, discriminatory and regression analysis were calculated for all examined variables. To determine the model goalkeeper, the average values of ten goalkeepers were taken by each of the selected defence elements, which resulted in average results of the best and at the same time reduced variability was achieved. On the basis of the results, a model of the elite world junior goalkeeper was constructed, who should, on average, be 189 cm high, weigh 88.56 kg and have a BMI of 24.71. The goalkeeper, as a model, should have 48% to 52.78% of defences from the field. From the line, this number shouldbe 32.00% to 50.41%, while from the wing he should have from 28.69% to 46.18% defence. From the passage,he should have a percentage of defence from 29.87% to 48.01%, while the high-speed centre should have a percentage of defence from 34.07% to 53.20%. From the seven meterline he should have from 36.42% to 46.56% defence percentage. Total should be from 44.71% to 53.20% of defence per game.

Key words: handball, World Junior Championship, designing

INTRODUCTION

Handball is one of the most popular and most widely distributed ball games and as such, takes a significant place in our country and in the world. It is a game belonging to a group of polystructural and complex kinesiological activities in which the same movements of cyclic and acyclic character predominate, and are based mainly on natural forms of movement (Dvoršek and Mlinarić, 2012). Handball takes place in four basic stages (Vuleta, 1997) and is defined by the parameters of the player's situational efficiency: the defence phase, the counter-attack phase, the attack phase and the return phase of the defence. The defence represents the stage of the game in which the team does not own the ball and it starts from the moment of the loss of the ball. The basic goal of the defence is to prevent the opponent from achieving a goal, i.e. to cooperate with the goalkeeper in the best way to control their space in order to effectively react and prevent the opponent from reaching the goal. Goalkeeper is the player who most significantly contributes to the team's performance (Rogulj, 2000a). Unlike other players, the goalkeeper acts independently in a limited space of activity (the goal area), in a situation he directly affects the outcome of every opponent's attempts at the end of the attack, and due to the special responsibility, the goalkeeper is more important than the other handball subjects contributing to the positive or negative emotional state of the entire team Rogulj & Srhoj, 2000). By acting independently and having a special place in the team, and in a limited space, the goalkeeper is characterized by specific movements. The goalkeeper's game greatly gives confidence, morale, and motivation in the game for the whole team. The goalkeeper's self-control, his rally with the opposing team without fear of responsibility and fear of the ball are some of the basic features of a top goalkeeper. A solid, rigid stand, balanced, cold and reasonable without the presence of sentimentality, represents good characteristics of a goalkeeper (Arslanagić, 2013). During the game it is possible to analyse the technical and tactical activity of any players both in the defence and in the attack and you get objective indicators of the team's status as well as the player individually. The aim of this research was to build a model of the elite world goalkeeper in the junior category based on the analysis of data from the junior goalkeepers at the 2013 World Junior Championship.

METHODS

Participants

42 junior goalkeepers from all junior national teams, who actively participated in a minimum of 7 games of the World Cup, were analysed. The main bearers of information in this research are the goalkeepers of the junior national teams. For one goalkeeper, there was no data on height and body mass, and therefore BMI. The data required for the analysis in this study were collected on the basis of official statistics of EHF, which was run on special patterns during the World Championship.

Instruments

28 variables, which were intended to assess the situation of the goalkeeper, were used in the study. The sample of variables is represented by height, body mass, BMI, total number of field defence, total number of field shots, percentage of defence efficiency from the field, total number of line defence, total number of shots from the line, percentage of defence efficiency from the line, total defence from the wing position, total number of shots from the wing position, percentage of the defence efficiency from the wings, the total number of defence from the fast centre, the total number of shots from the fast centre, percentage of defence efficiency from the fast centre, total number of defences from the passes, total number of goal defences from the total number of free kick defence shots, total number of seven-meter shots, total number of defensive shots of seven meters, percentage of the defence efficiency of the goalkeeper from seven meters, total number of shots , total number of defensive shots, percentage of the efficiency of the defending shots, total number of assistances and total number of assists per match.

Statistical Analysis

The basic descriptive parameters were calculated, i.e. the following values: minimum, maximum, arithmetic mean and standard deviation. In order to determine the dimensionality of space and the existence of strong relationships between variables we used factor and discriminatory analysis. We used the regression analysis to determine whether there is a significant correlation between the overall efficiency and effectiveness of the elements of defence of the goalkeeper. To determine the goalkeeper model, the average ten goalkeepers scored by each of the selected defence elements were taken which resulted in averaged results of the best and at the same time reduced variability. The visualization of the elite world handball junior goalkeeper is represented by a radar diagram that visually depicts the performance of individual goalkeepers in relation to the average (ideal) expressed through the mean value (full red line) and the confidence interval (dashed red line). With a confidence interval, the inner line corresponds to the lower, and the outer upper limit.

RESULTS

Table 1 presents the results of descriptive statistics for 28 variables for evaluating the situation activity of the goalkeeper, and ultimately defining the model of the elite world junior handball goalkeeper. The average body height of the goalkeeper was 189 cm, the average body weight was 88.5 kg and the average BMI was 24.712. The average defence efficiency of the field is 40%, with a standard deviation of 10.33. (the coefficient of variation is 0.26, and the range from 6% to 71%, which means that most goalkeepers had similar efficiency, but also that there was at least one extreme with very little efficiency). The average goalkeeper efficiency in the defence of the shots from the wings is 34%, with a standard deviation of 15.38. The range from 0% to 80% with a coefficient of variation of 0.34 suggests that the effectiveness of the goalkeeper defence from the wing position varies more than the efficiency of defence from the field, and the lower mean that goalkeepers are less likely to defend shots from the wings than on the field. The weaker component of the goalkeeper'sdefence is the defence of the shot from the centre; the average value of effective defence is 18% with a standard deviation of 7.99. The average defence efficiency after shots from the pass is 16% with a standard deviation of 14.33. The coefficient of variation is 0.86, which means that the goalkeeper's efficiency in this element of defence is very different for individual goalkeepers. The effectiveness of free-kick defence is not counted because the values varied from 0 to 3, which disfigured this element of defence as being irrelevant to the junior goalkeeper model. The average defence efficiency from the seven-meter line is 21% with a standard deviation of 12.83. The range from 0% to 63% with the coefficient of variation 0.59 points to the fact that goalkeepers are very different in this element of defence. At least the total efficiency varies, with an average value of 31% and a standard deviation of 5.32 and a coefficient of variation of 0.17.

Table 1. Basic central and dispersion parameters

Variables	N Statistic	Minimum Statistic	Maximum Statistic	Mean Statistic	Std. Error	Std. Deviation Statistic
Height	41	166.0000	203.0000	189.097561	1.2696288	8.1295906
Weight	41	68.0000	118.0000	88.560976	1.6105781	10.3127319
BMI	41	21.0	30.9	24.712	.2976	1.9054
DefFrField	42	1	73	23.31	2.332	15.115
TotFrField	42	11	154	54.98	4.721	30.595
Ef%Field	42	6.2	56.2	40.179	1.5973	10.3516
DefFrLine	42	1	33	15.12	1.334	8.648
TotFrLin	42	7	102	49.90	4.072	26.389
Ef%Linee	42	6.2	71.4	30.883	1.5950	10.3368
DefWing	42	0	17	7.40	.751	4.864
TotWing	42	3	42	21.10	1.645	10.661
Ef%Wing	42	.0	80.0	34.400	2.3736	15.3824
DefFC	42	0	9	3.93	.365	2.362
TotFC	42	5	51	22.55	1.669	10.818
Ef%FC	42	.0	33.3	17.971	1.2339	7.9969
DefPass	42	0	6	1.62	.238	1.545
TotPass	42	1	25	9.10	.944	6.116
Ef%Pass	42	.0	50.0	16.431	2.2114	14.3316
DefFK	42	0	2	.52	.109	.707
TotFK	42	0	3	1.02	.150	.975
Def7	42	0	8	3.10	.334	2.162
Tot7	42	0	33	13.90	.986	6.389
Ef%7	41	.0	62.5	21.237	2.0047	12.8362
Def	42	13	123	55.00	4.292	27.817
Tot	42	28	330	172.55	11.721	75.963
Eff	42	19	46	31.48	.822	5.329

Table 2 shows the results of Factor Analysis. Factor analysis of the entire set of data-used variables was done for us to see if some of the handball elements are similar, but as the eight factors are separated, it turns out that the defence elements are relatively independent, so for this reason the model of the ideal goalkeeper, it was necessary to consider all the elements that had sufficient frequency (excluding only the element of defence of free-kick shots).

Table 2. Factors Extraction by Factor Analysis

Total Variance Explained					
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings	
	Total	% of Variance	Cumulative %	Total	% of Variance
1	9.630	34.394	34.394	9.630	34.394
2	3.210	11.465	45.859	3.210	11.465
3	2.459	8.783	54.641	2.459	8.783
4	2.112	7.541	62.183	2.112	7.541
5	1.764	6.300	68.482	1.764	6.300
6	1.576	5.628	74.111	1.576	5.628
7	1.423	5.082	79.193	1.423	5.082
8	1.309	4.677	83.869	1.309	4.677
9	.985	3.518	87.387		
10	.812	2.900	90.287		
11	.599	2.139	92.426		
12	.516	1.843	94.269		
13	.474	1.692	95.961		
14	.417	1.490	97.451		
15	.256	.916	98.367		
16	.187	.666	99.033		
17	.130	.466	99.499		
18	.049	.173	99.673		
19	.025	.088	99.760		
20	.021	.075	99.835		
21	.019	.067	99.902		
22	.014	.050	99.951		
23	.008	.030	99.981		
24	.002	.009	99.990		
25	.002	.007	99.998		
26	.001	.002	100.000		
27	.000	.000	100.000		
28	.000	.000	100.000		

Table 3 shows a discriminatory analysis where from the correlation matrix (between groups) it follows that there is a moderately strong correlation (0.554) between the total efficiency and efficiency of the defence of the shots from the field; The weak correlation exists between the overall efficiency and efficiency of the defence of the shots from the line, from the wing, from the fast centre, and with seven meters shots, as well as with BMI, while the other correlation coefficients are negligible.

Table 3. Correlation coefficient matrix, output and discriminatory analysis

Pooled Within-Groups Matrices										
Variables	BMI	Ef%Field	Ef%Linee	Ef%Wing	Ef%FC	Ef%Pass	Ef%7	Asist/Ut	Eff	Height	Weight
BMI	1.000	.245	-.252	.062	.417	.257	.070	.200	-.053	.715	.069
Ef%Field	.245	1.000	-.230	-.245	.143	.154	.254	.554	-.209	.027	-.022
Ef%Linee	-.252	-.230	1.000	-.075	-.100	-.057	.300	.244	.103	-.109	-.001
Ef%Wing	.062	-.245	-.075	1.000	.135	.020	-.084	.354	.262	.234	-.071
Ef%FC	.417	.143	-.100	.135	1.000	.012	.032	.350	-.242	.154	-.102
Ef%Pass	.069	-.022	-.001	-.071	-.102	.081	.051	-.050	-.176	-.057	1.000
Ef%7	.257	.154	-.057	.020	.012	1.000	.251	.343	-.075	.160	.081
Asist/Ut	.070	.254	.300	-.084	.032	.251	1.000	.377	-.113	-.037	.051
Eff	.200	.554	.244	.354	.350	.343	.377	1.000	.051	.187	-.050
Height	-.053	-.209	.103	.262	-.242	-.075	-.113	.051	1.000	.657	-.176
Weight	.715	.027	-.109	.234	.154	.160	-.037	.187	.657	1.000	-.057

Regression analysis (Table 4) was performed as an additional check of the dependence of total efficiency on individual elements. A value of 0.027 for R^2 together with a F value that shows that regression dependency is not significant implies that the total efficiency cannot be modelled by individual elements in this way, and the hypothesis confirmed that the model should be developed for all selected defence

elements that must be considered at the same time, and in accordance to the game strategy of each team.

Table 4. Regression analysis

Model Summary			
R	R Square	Adjusted R Square	Std. Error of the Estimate
.165	.027	.002	1.926
The independent variable is Efik.			

	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.959	1	3.959	1.067	.308
Residual	140.996	38	3.710		
Total	144.955	39			
The independent variable is Efik.					

Table 5 analyses the average efficiency of the top ten goalkeepers for each element of the defence elements. The mean values are shown with the lower and upper limits of confidence interval in the sample environment (the t value is used because it is about the top ten goalkeepers). In this table, the average values of several specific goalkeepers are added and based on it, radar diagrams are made that visually show the performance of individual goalkeepers in relation to the average (ideal) expressed through the mean (full red line) and confidence interval (dashed red line). In the confidence interval, the inner line corresponds to the lower, and the outer upper limit.

Table 5. The average efficiency of the top ten goalkeepers
for each of the elements of the defence

Defence	Ef%LBCI	Ef%Mean	Ef%UBCI
From the field	48,78	50,78	52,78
From the line	32,00	41,21	50,41
From the wing	28,69	37,43	46,18
From the passage	29,87	38,94	48,01
From the fast centre	34,07	43,64	53,20
From seven meters	36,42	41,49	46,56
Total	44,71	48,96	53,20

Table 6 shows the model of an elite world handball goalkeeper. Based on the insights in Table 6, it can be seen that the goalkeeper as a model should have 48% to 52.78% of successful defence of the shots from the field. From the line he should have a 32.00% to 50.41% successful defence, while from the wing it should be 28.69% to 46.18% of successful. From theshots after the passage he should have from 29.87% to 48.01% of the defence, while from the shots after the fast centre he should have from 34.07% to 53.20% of the defence. After the seven-meter shot, it should be from 36.42 to 46.56%. Total should be from 44.71% to 53.20% of defence per game.

Table 6 Model of elite world junior handball goalkeeper

Model of elite world junior handball goalkeeper	
From the field	Od 48,78% do 52,78%
From the line	Od 32,00% do 50,41%
From the wing	Od 28,69% do 46,18%
From the passage	Od 29,87% do 48,01%
From the fast centre	Od 34,07% do 53,20%
With seven meters	Od 36,42% do 46,56%
Total	Od 44,71% do 53,20%

Table 7 shows the results of the top ten elite goalkeepers in their overall efficiency. An insight into Table 7 shows that all goalkeepers on average had an approximate percentage of defence after shots from the field. The highest percentage of defence after the shot from the field was scored by the second goalkeeper of Sweden-SWE2, and the smallest percentage was

scored by goalkeeper of Netherlands-NED. The highest percentage of defence after a shot from the line was scored by the Tunisia-TUN goalkeeper, and the smallest percentage of the defence after the shot from the line had the second goalkeeper of Slovenia- SLO2. In the percentages of the defence after the shots from wing positions the highest percentage of the defence had the goalkeeper of the Croatian-CRO Croatia team, and very similar in this variable

were the Serbian national team goalkeepers and the first goalkeeper of Sweden-SWE1. After a shot from the pass, the highest percentage was scored by the Tunisian-TUN goalkeeper. After the execution of the fast centre, the highest percentages of defences were scored by the national team of Sweden-SWE1 and Serbia-SRB goalkeeper. The seven-meter shot was most effectively defended by the Croatian national goalkeeper.

Table 7. The top ten goalkeepers in overall efficiency

Defence	TUN	SWE 1	SRB	SLO 1	SUI	SLO 2	BRA	CRO	NED	SWE 2
From the field	54,55	48,65	50,00	51,81	47,40	51,06	49,06	34,48	46,34	56,25
From the line	71,43	36,67	30,77	38,10	36,11	26,92	30,51	31,58	32,65	30,00
From the wing	0,00	50,00	50,00	33,33	31,43	42,86	36,84	55,56	48,48	45,45
From the passage	33,33	11,76	25,00	30,77	21,05	31,25	27,78	25,00	23,81	0,00
From the fast centre	0,00	40,00	40,00	0,00	11,76	0,00	33,33	16,67	11,11	25,00
With seven meters	-	27,78	23,08	26,32	21,21	16,67	33,33	62,50	5,56	18,75
Total	46,40	40,00	39,20	38,90	37,30	37,10	36,80	36,70	36,50	36,20

VISUALIZATION OF THE ELITE WORLD GOLMAN

Chart 1 Goalkeeper of TUN

Chart 2 Goalkeeper of SWE1

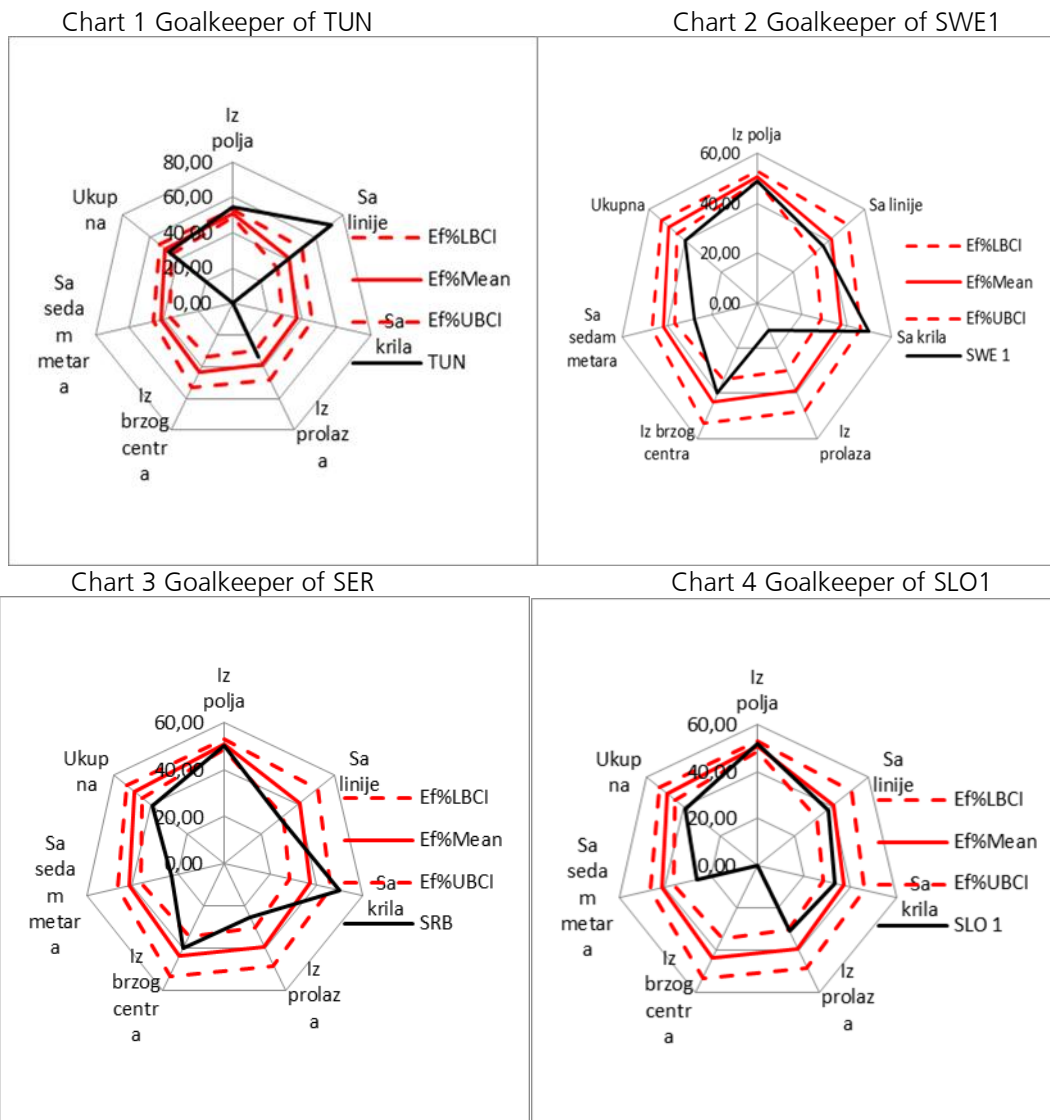Chart 3 Goalkeeper of SER

Chart 4 Goalkeeper of SLO1

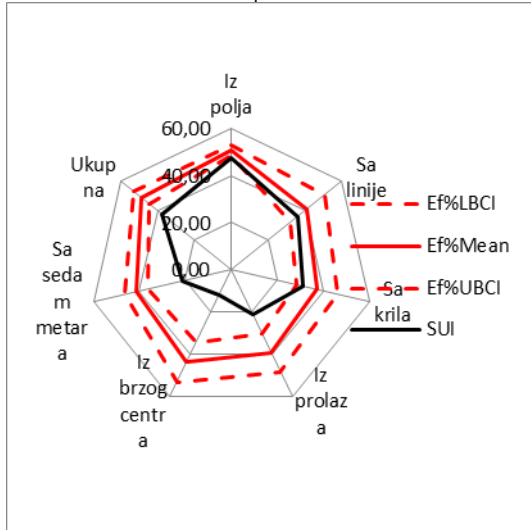## Chart 5 Goalkeeper of SUI

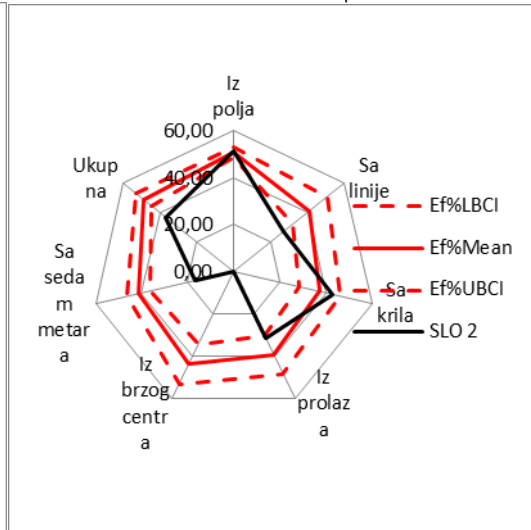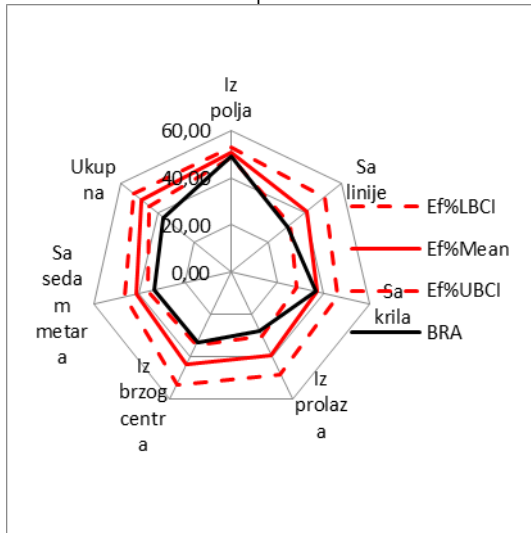## Chart 6 Goalkeeper of SLO2

Chart 7 Goalkeeper of BRA

Chart 8 Goalkeeper of CRO
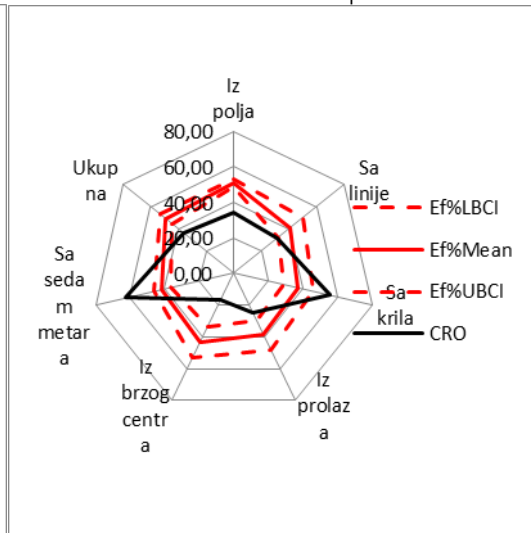
Chart 9 Goalkeeper of NED

Chart 10 Goalkeeper of SWE2

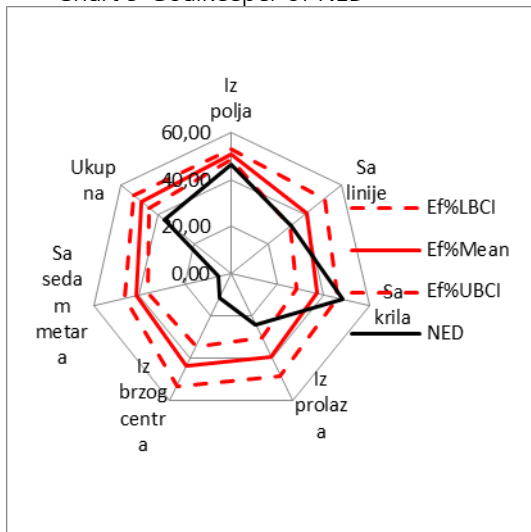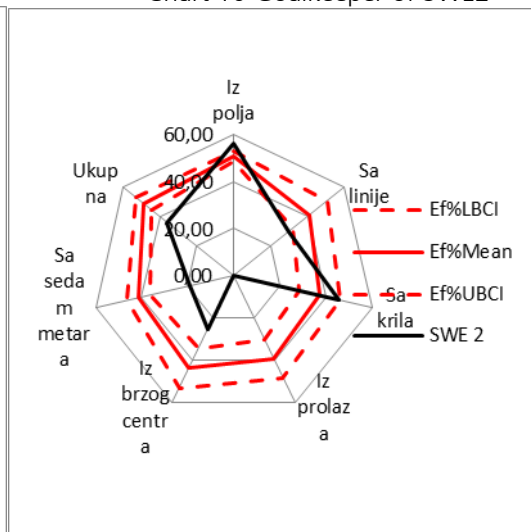Bajgorić S. at al. MODEL ELITE WORLD JUNIOR HANDBALL GOALKEEPER WITH VISUALIZATION...

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DISCUSSION

This research was conducted in order to construct the model of the elite world junior handball goalkeeper based on the variables: body height, body weight, body mass index-BMI,% defence efficiency from the field,% defence efficiency from the line,% efficiency of wing defence,% efficiency defence from a fast centre,% efficiency from passages,% defence efficiency of seven meters. The average body height of the goalkeeper was 189 cm, the average body weight was 88.56 kg, while the average Body Mass Index-BMI was 24.71%, which may be considered to be within the normal range. The maximum shots that were sent from the field were154, and out of that, 73 were defensive. 102 shots were sent from the line out of that 33 defensive ones, from the wing position 42 shots and 17 defences, from the fast centre 51 shots and 9 defences, from the passage 25 shots and 6 defences, totalled 3 shots from free kick and 2 defences, 33 shots were from the seven-meter line, and defensive were 8 shots. In total, out of all these elements, 330 shots were sent out of all these elements, of which 123 were defences. Based on the results of the percentage of efficiency, the goalkeeper as a model should have 48% to 52.78% of defence from the field. From the line he should have 32.00% to 50.41% of the defence, while from the wing he should have from 28.69% to 46.18% successful defence. After a shot from the passage, goalkeeper should have from 29.87% to 48.01% successful defence, and from the shot after the fast centre he should have from 34.07% to 53.20% successful defence. From the seven-meter line, he should have from 36.42 to 46.56% successful defence. In total, goalkeeper should have from 44.71% to 53.20% successful defence per game. The highest percentage of defence from the field was scored by the second goalkeeper of Sweden - SWE2, and the smallest- by the goalkeeper of the Netherlands - NED. The highest percentage of defence from the line was scored by the Tunisian-TUN goalkeeper, while the smallest percentage had the second goalkeeper of Slovenia-SLO2. In the percentages of defence from wing positions, the highest percentage of defences was scored by the Croatia CRO goalkeeper, and the goalkeepers of the Sweden-SWE1 and Serbia-SRB were equal. After the shots from the passage, the highest percentage of defences was scored by the Tunisian-TUN goalkeeper. In shots after fast centre, the highest percentage of defences were scored by the national team of Sweden-SWE1 and Serbia-SRB, while the most successful one in seven- meters line shoots was the Croatian national goalkeeper. It is characteristic to point out that, if we look at the placement of the first four teams, which was as follows: Sweden 1st place, Spain 2nd place, France 3rd place, Croatia 4th place, it can be seen that in the top ten goalkeepers of the championship there are no goalkeepers for the national team of Spain and France. We note that both goalkeepers of the Swedish national team entered the top ten in overall efficiency. By visualizing the charts of the top ten elite junior handball goalkeepers, it is important to emphasize that all the values that enter the confidence interval are considered optimal and represent the ideal goalkeeper for the selected elements of the defence. On the basis of a detailed analysis, significant information was obtained for constructing the model of the elite world junior handball goalkeeper. Many handball experts have written about the crucial importance and impact of the goalkeeper as well as its impact on the entire team. (Barcenas & Roman, 1991; Czerwiński, 1993; Antunez and García, 2008). An effective defence game in cooperation with the goalkeeper is of great importance for the positive result of the game. It is evident that a large number of goalkeepers had a high percentage of efficiency of defence of the field shots, which can be linked to good cooperation between the goalkeeper and defenders, a successful block or a timely outburst of defending players at the players at the stage of the shot towards the goal. The goalkeepers showed poor performance in defence shots from seven meters. The seven-meter defence does not have to offer the right picture of the quality of the goalkeeper. It is proven to be a high-tech technical tactical skill of the players, as the seven-meter requires adjustment of the strike with the technique of defending the goalkeeper which can vary during the penalty kick (Rogulj and Srhoj, 2000). However, in the end, the majority of goalkeepers had a very small percentage of efficiency of defending the shot from the line (from the passage, from seven meters, from the wings and the fast centre), which should be a good indicator on which elements of the defence should base their future training process.

Practical aspect of the paper

Based on a detailed analysis of the world elite handball junior goalkeepers, important information regarding the junior goalkeeper model was obtained. A good goalkeeper should defend equally well from all positions and from different situations during the match. An analysis of the goalkeeper, in this case, as the model of the elite world junior handball goalkeeper, should be an indicator to coaches, handball experts, in planning and programming the training process in dealing with goalkeepers, and should pay special attention to them.

Ethical approval: All methods performed in the study were inaccordance with ethical standards of the national research committee and with the 1964 Helsinki Declaration.

Conflict of interest: The authors declare that they have no conflict of interest.

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Corresponding author:
Sanja Bajgorić;
e-mail: sbajgoric@yahoo.it