

Differences between specific motor skills of water polo players classified by different positions in the game

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Abstract

The goal of the research was to establish hierarchy of water polo players classified by their position who are Adriatic league juniors of which many participate in senior games. This league is one of the strongest in the world. This paper could be used to prove some rules important for modeling, selection and therefore using top notch water polo training for this population (possibly reducing number of injuries during more adequate and useful training sessions) This can be done by revealing hierarchy of water polo players motor skills and getting those facts partly responsible for success, together with coordinated work of relevant individuals (all water polo coaches, fitness coaches, scientists in the field etc). Testing was done on Adriatic league junior water polo players. 15 players per club from seven clubs were tested, all together 104 water polo players. Testing was carried out in pools and gyms in Dubrovnik (W.C "Jug"), Split (W.C. "Mornar"), Rijeka (W.C. "Primorje"), Šibenik (W.C. "Šibenik"), Zagreb (W.C. "Medvescak" and "Mladost"), Herceg Novi (W.C "Jadran"). The above mentioned players are registered in their home clubs and therefore eligible to compete in the league. Of all the tested players only the result of those players that are healthy with no morphological, psychological or other aberrations were taken into the account. Results clearly indicate differences between different positions (outside wingers, centers, defense and goalies) established after testing candidates with 10 motor skills variables specific for water polo players.

Keywords: **water polo players, specific motor skills, differences, positions in the game**

Introduction

Water polo, being exceptionally dynamic and fast group sport belongs to poly structural group of sports. High level of competitiveness in water polo is based on good knowledge of elements based on specific morphological, motor skills and other characteristics. Good knowledge of hierarchical structure of the factors influencing results in a modern water polo game is a basic criteria for selection water polo talents and efficient planning and program making of daily training sessions. The issue of finding effective means and methods in training of young water polo players is an important topic in the world. Top results in water polo can only be achieved by programmed training session but also by serious, high quality selection process which can be achieved by molding of players. From these reasons stems that it is necessary to take care of extensiveness, intensity and quality of work in modern training, this specially refers to work with youth. It is therefore necessary to establish those factors which more or less lead to success in water polo through systematic training. It is known that specific motor skills are important in water polo, specially leg work. This has been confirmed by many writers: Feltner and Taylor (1997), Ball (2005), McCluskey, L. i sar. (2009), Lozovina

Sažetak

Cilj istraživanja je bio da se utvrdi hijerarhijski model vaterpolista, razvrstanih po pozicijama u igri, juniora Jadranske lige, od kojih su mnogi uključeni u igre seniora, u ligi koja je jedna od najjačih na svijetu. Otkrivanjem hijerarhijske strukture specifično motoričkih sposobnosti vaterpolista, i dobivanjem onih faktora koji su dijelom odgovorni za uspjeh u vaterpolu, uz koordinativno djelovanje mnogih relevantnih faktora (svih trenera vaterpolista, kao i kondicijskih trenera, naučnika iz ove oblasti i dr.), ovaj rad bi mogao poslužiti za dokazivanje nekih zakonitosti, koji su od važnosti za modeliranje, selekcioniranje, a samim tim i određivanje vrhunskih treninga u vaterpolu na ovoj populaciji (vjerojatno i smanjenje broja povređivanja uslijed adekvatnijih i svrsishodnijih trenažnih procesa). Ispitivanje se izvršilo na juniorima, vaterpolo igračima učesnicima Jadranske lige. Testirali su se igrači sedam klubova, njih 15 po svakom klubu, što u konačnici iznosi 104 vaterpolista. Ispitivanje se realizovalo u bazenima i dvoranama, u Dubrovniku („V.K.Jug“), Splitu („V.K.Mornar“), Rijeci („V.K.Primorje“), Šibeniku („V.K.Šibenik“), Zagrebu („V.K.Medveščak“ i „V.K.Mladost“), Herceg Novom („V.K.Jadran“). Navedeni ispitanici su uredno registrovani u svojim matičnim klubovima te su stekli pravo nastupa u ligaškom takmičenju Jadranske lige za navedeni uzrast. U konačnu obradu su se uzeli samo rezultati ispitanika koji su zdravi, na kojima nisu zapažene morfološke, psihološke i druge aberacije i koji su pristupili testiranju. Rezultati jasno pokazuju razlike između pozicija u igri (vanjski-krila, centri, bekovi i golmani) koje su nastale nakon testiranja ispitanika sa 10 postavljenih specifično motoričkih varijabli za vaterpoliste.

Ključne riječi: **vaterpolisti, specifično motoričke sposobnosti, razlike, pozicije u igri**

(1983), Gladden and Colacino, 1978; Šimenc, 1989; Sanders, 1999; Dopsaj, 1999, Kontić 2007, Smith 1998, Sanders, 2005, 2008.). Unfortunately there is still not enough relevant scientific data that would enable greater effects with the goal of achieving top results in the sport, therefore this research is a contribution. The aim of this research is to show clear motor skill differences among players according to their position in the game. Subjects were Adriatic league junior water polo players.

Methods

This research is a transversal study aiming to establish motor skills dimensional differences of Adriatic league junior water polo players according to their position in the game. Total sample of respondents (104) was made up of members of seven clubs within Adriatic water polo league at the same level of competition in Croatia and Monte Negro. Research included 10 variables of specific motor area that clearly showed water polo players condition depending on their position

in the team. Positions were split on offense (wingers and outside players), centers, defense and finally goal keepers. Tests were given with explicitly clear measurements in pools and gyms of 7 participating clubs, with the goal of monitoring players for whom specific motor area skills are very important and they show true fitness levels.

Variables for assessment of specific motor skills in the water

Foot Crawl	.	.	.	SMNOKR
Leg scissors	.	.	.	SMNOŠK
Legs bicycle	.	.	.	SMNOBI
Endurance with 10 kg bar	.	.	.	SMIZŠI
Lateral jump	.	.	.	SMISBO
Vertical jump	.	.	.	SMISKO
Shoot speed 7 m	.	.	.	SMBRŠ7
Dynamometric force pulling bicycle foot	.	.	.	SMFVNB
Dynamometric force pulling scissor foot	.	.	.	SMFVNŠ
Dynamometric force pulling hand stroke	.	.	.	SMFVRZ

Statistic programs Spss 15,0 and Statistical 8,0 were used to analyze the data. Determining measures of central and dispersion parameters were carried out with sub program Descriptive Statistics-Spss 15,0. Global differences were checked by using multivariate discriminant analysis (Discriminant Analysis - SPSS 15,0) attempting to establish importance of treated specific motor skills of water polo players classified by their position in the team. At invariant level analysis of variance was applied as well as LSD test. (Analysis of Variance; LSD test - SPSS 15,0).

Results and Discussion

Analysis of variance (ANOVA) is procedure of differentiating already defined entity groups described by a variable. Variables that are singled out in our case belong to the area of specific motor skills and they are: SMIZŠI, SMISKO, SMBRŠ7 and SMFVRZ.

Table 1. Anova

Meas.	Sum of Sq.	Df	Mean Sq.	F	Sig.
SMNOKR	35,755	3	11,918	2,124	,102
SMNOŠK	12,672	3	4,224	2,154	,098
SMNOBI	19,869	3	6,623	2,326	,079
SMIZŠI	464,811	3	154,937	3,838	,012
SMISBO	3,521	3	1,174	,254	,858
SMISKO	612,194	3	204,065	5,012	,003
SMBRŠ7	2873,800	3	957,933	29,032	,000
SMFVNB	176,009	3	58,670	1,270	,289
SMFVNŠ	189,032	3	63,011	2,375	,075
SMFVRZ	487,869	3	162,623	2,650	,053

Review of the results of LST test, measure SMNOKR statistically significantly distinguishes group of players in offence positions from goal keeper group at the statistical importance level (table2). Measure SMNOSK significantly distinguishes group of players at central positions and goalkeepers. Further analyses of LSD test show that SMNOBI measurement clearly discriminates offense positions and goal keepers as well as defense and goal keepers. For measure SMIZSI statistically significant differences are being noticed for offence players and goal keepers. For measure SMISKO statistically important differences are shown of three positions with goal keeper position which is logical considering their role in

the game. Further analysis of LSD test showed statistical importance of differences for variable SMBRŠ7 for position of offence, center and quarterback with goal keeper position where significantly lower values for shot speed are noticed. Measure SMFVNS distinguishes offence from mid field. The last measurement in this chapter of specific motor skills in water polo players referring to LSD test results is inspection of measure SMFVRZ where statistical importance of difference between offence vs center, centers vs defense as well as centers vs goalkeepers. It can be stated that indicators of specific motor skills in Adriatic league junior water polo players mostly give information on statistically important differences between positions in water polo game for almost all positions. Details an analyses were mentioned earlier in the paper.

Table 2. LSD test

G(I)	G(J)	Differences between the groups	Sig.
Measurement SMNOKR			
1	4	-1,62699(*)	,013
Measurement SMNOŠK			
2	4	1,13117(*)	,016
Measurement SMNOBI			
1	4	1,06463(*)	,023
3	4	1,27551(*)	,019
Measurement SMIZŠI			
1	4	-5,57842(*)	,002
Measurement SMISKO			
1	4	-6,16934(*)	,001
2	4	-6,64035(*)	,002
3	4	-6,14035(*)	,003
Measurement SMBRŠ7			
1	4	13,45080(*)	,000
2	4	12,61988(*)	,000
3	4	14,46115(*)	,000
Measurement SMFVNŠ			
1	2	-3,51932(*)	,016
Measurement SMFVRZ			
1	2	-5,95169(*)	,007
2	3	5,30159(*)	,038
2	4	5,44620(*)	,037

Table three shows results of discriminant analysis in area of specific motor skills. Result was significant discriminative functions that have statistically medium important at the level (Sig + ,02, (Canonical Correlation = 80 and 46 while the third singled out function has statistically low value at the level (Sig.= ,41) (Canonical Correlation= 28). Value of Wilkes lambda used as a criteria for discriminative strenght of used variable system (table 4) is showin low value for the first and medium for second (first function, 25; second 72) and very high value (92) for third isolated function wich shows high and medium high as well as low discrimination between groups specially for the third isolated function. First isolated function explains 83,5% of total variance, second isolated function 12,5% of total variance and third isolated function explains 4% of total variance.

Table 3. Discriminative analyses

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1,850(a)	83,5	83,5	,806
2	,276(a)	12,5	96,0	,465
3	,090(a)	4,0	100,0	,287

Table 4. Wilks Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	Df	Sig.
1 through 3	,252	132,202	30	,000
2 through 3	,719	31,643	18	,024
3	,918	8,244	8	,410

From structure of discriminative function (table 5) it is obvious that variable SMBRS7 contributed to greatest global differences between the players playing different positions. It represents the shot speed from 7 meters. Other variables which contribute to statistically important differences are SMISKO, SMNOBI and SMNOKR and they represent vertical jump, foot crawl and leg bicycle. Regarding other function, greatest statistical differences between different team positions were variables SMFVRZ, SMNOŠK i SMFVNŠ which represent dynamometric force of hand stroke, speed of leg scissors and dynamometric force of leg scissors. It is easily noticeable from the above mentioned that two statistically important functions were isolated where shot speed variable dominates which is indicating importance of this segment for top notch junior water polo players. Quarterbacks were singled out, they have fastest shots because they sent the biggest number of devastating shots at the goal, specially in the part of the game when offence is finishing up. Other two positions (wing and center) have pretty high values for this measurement while goal keeper's values are below average which is not surprising because they do not participate in the offense at least not in the segment where speed of shot at the goal is dominant.

Table 5. Structure of discriminative functions

	Function		
	1	2	3
SMBRŠ7	-,676(*)	,277	,240
SMISKO	,272(*)	-,218	,023
SMNOBI	-,188(*)	,079	,164
SMNOKR	,181(*)	,021	,181
SMFVRZ	,013	,535(*)	-,015
SMNOŠK	-,073	,437(*)	-,146
SMFVNŠ	,114	,401(*)	,181
SMIZŠI	,221	,217	,355(*)
SMFVNB	-,070	,269	-,320(*)
SMISBO	-,055	,016	,148(*)

Position of group centroid clearly shows differences in measurements of morphological characteristics between groups of players classified according to the position in the pool, confirmed by discriminative analyses. Centroids of the group offense (.81) and goal keepers (2,75) are furthest apart which states that they differ the most as for specific motor skills of junior water polo players in Atlantic league and that they are different from other groups. Other group centroids, centers and defense players are the least different.

Table 6. Function of group centroids

Groups	Function		
	1	2	3
1,00	-,814	-,285	-,224
2,00	,025	1,117	-,081
3,00	-,725	-,110	,558
4,00	2,748	-,246	,003

Because variable SMBRS7 was showed as most responsible in this analysis it is good to emphasize some research in this context. There are two types of shots at the goal. The most widely used is upper technique where the ball is being dropped from a high spot above the head using medial shoulder rotation for speed and sweep in which the ball is moving horizontally over the surface of the water (Feltner i Taylor, 1997.). Technique described here is upper technique and is usually used. Authors are suggesting that the muscle strength main factor responsible for 5 meter shots in water polo. It has been established that stronger respondents better used upper technique of shooting at the goal in water polo (Feltner i Taylor, 1997.). Ball (2005.) is saying that the speed of a ball in water polo can develop up to 22 m/s which is close to 80 km/h. It is important to emphasize SMISKO variable because is showed statistical importance regarding different position in the game. Performance of vertical jump is basic technical skill in many team sports including water polo where the player very often must raise the body vertically above the water in order to shoot at the goal or to prevent the opposing player to pass the ball (Gladden and Colacino, 1978; Šimenc, 1989; Sanders, 1999; Dopsaj, 1999.). According to research (Lozovina 1983.) partial conclusions can be made that leg strength is dominantly important for successful task solving in water polo. Footwork is responsible for speed of swimming, different type of water polo walking, endurance during the game, jumping out and starting, and mainly for all the elements enabling to come into an optimal position for shooting and ultimately scoring. Adding to this of high level of distance swimming (100 and 400 m) which indirectly indicates functioning at the high level of stress as well as sprint swimming at 25 m and water polo crawl at 15 m the logical conclusion can be made that the water polo player who can function well at high level of stress and who uses footwork for speed development while swimming, good jumping out, start and different endurance tests has good predispositions to be successful water polo player. Based on many analyses and results and also research of this paper it is good to mention the importance of footwork during water polo players training. (Kontic 2007.).

Discriminative analyses in area of specific motor skills shows that there is a statistically important difference between groups of respondents representing different positions in the team at the same level of competitiveness. Differences are surely made by selection of children, different approach and training methods. It is assumed that training method alone is responsible for all mentioned factors as well as education and expertise of coaches working with this age group.

Conclusion

With junior water polo players methods of determining their hierarchical model were conducted, specifically motor skills, divided by positions in the game consisting of offense, center, defense and goal players. Sample players were junior water polo players active in Adriatic league, currently registered with their clubs. There were 104 respondents from 7 clubs in Croatia and Monte Negro. It can be concluded that water polo players have different specific motor skills according to their positions on the team. Differences are surely made by selection of children and demands in the game. It is assumed that training method alone is responsible for all mentioned factors as well as education and expertise of coaches working with this age group. Specific motor

skills in water polo players, as a segment of anthropological area is very important for success in this sport, specially bicycle foot work so the coaches are advised to pay attention to its development.

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