FACTA UNIVERSITATIS
Series: **Physical Education and Sport** Vol. 13, N° 3, 2015, pp. 411 - 418

Original research article

ANTHROPOLOGICAL DIMENSIONS AS A PREDICTOR OF SPECIFIC MOTOR SKILLS OF YOUNG WATER POLO PLAYERS

UDC 797.253.012

Marko Aleksandrovic[1], Bojan Jorgić[1], Georgi Georgiev[2], Mehmet Ozsari[3], Duran Arslan

[1]Faculty of Sport and Physical Education, University of Niš, Serbia
[2]Faculty of Physical Education, University "St. Cyrilus and Methodius", Skopje, Macedonia
[3]National Sports Academy „Vassil Levski“, Sofia, Bulgaria

Abstract. *The aim of this research was to determine the common influence of anthropological dimensions (anthropometric characteristics, basic motor and functional abilities) on the specific motor skills of young water polo players. A total number of 90 water polo players were involved in the study. The investigation protocol consisted of standardized anthropometric measurements, functional and basic motor abilities and specific motor skills assessments. The general factor of specific motor skills in water polo was obtained by way of factorization and represents a criterion. The regression analysis showed that anthropological dimensions as group predictors, two variables of explosive power and one variable of repetitive torso strength as a separate variable have a significant influence on the general factor of specific motor skills. The results of the study pointed out the impact of anthropological dimensions on specific motor skills of selected young water polo players. This enables the proper selection process for young water polo players.*

Key words: *water polo, young players, effects, anthropological dimensions*

INTRODUCTION

Modern water polo is characterized by quick actions and strong counter attacks, firm contact game play, strong and precise shots at the goal, all of which requires that the players be in the possession of a high level of psychomotor abilities (Lozovina, Đurović & Katić, 2009). The Serbian water polo team is one of the most successful in the world.

Received December 16, 2015/ Accepted December 24, 2015
Corresponding author Marko Aleksandrovic
Faculty of Sport and Physical Education, University of Belgrade, St. Blagoja Parovića 156, 11000 Belgrade, Serbia Phone: +381 18 510900 • E-mail: marko.aleksandrovic@gmail.com

Their successes are the result of an appropriate selection and training process. In order for someone to be a successful water polo player, he has to be in possession of a high level of skills in an aquatic environment, which requires 4-5 years of swimming training on average (Horvath, Petrekanits, Gyore, Kneffel, Varga-Pinter, & Pavlik, 2009). According to Vičević (2003), in order for someone to achieve maximal sports results, water polo training should begin at the age 10 at the latest. This is the pre-pubescent period in which the selection of children for future water polo players should begin, as the basis for future sports specialization and for maximal results (Aleksandrović, Popovski & Madić, 2005a; Aleksandrović & Radovanović, 2005b). Knowledge of the characteristics and abilities of top water polo players can help coaches in the selection process (Tan, Polglaze, Dawson, & Cox, 2009). Falk, Lidor, Lander & Lang (2004) studied the influence of specific motor skills, basic motor abilities as well as cognitive abilities (player intelligence) on the selection process of young water polo players. Kos, Rynkiewicz, Zurek, Zabski & Rynkiewicz (2010) have determined that the local and general precise manifestation of muscle strength can be an important criterion in the selection process of water polo players. For successful selection, it is necessary to determine which of the anthropological dimensions have the greatest influence on the specific motor skills of water polo players and indirectly have an effect on the sports result. Specific motor skills develop under the influence of the training process and have a direct influence on sports performance. They are closely related to sports success (Malacko & Rađo, 2004). Up to now, only the influence of individual anthropological dimensions on the criterion (specific motor skills) has been studied in water polo, and never has more than one anthropological dimension been grouped together as a predictor (Aleksandrović, Radovanović, Okičić, Madić & Georgiev, 2011; Ferragut, Abraldes, Vila, Rodríguez, Argudo, & Fernandes, 2011; Vila, Ferragut, Argudo, Abraldes, Rodrigues & Alacid, 2009; Aleksandrović, Naumovski, Radovanović, Georgiev & Popovski, 2007a).

The aim of this research was to determine the common influence of anthropological dimensions (anthropometric characteristics, basic motor and functional abilities) on the specific motor skills of young water polo players.

METHOD

Sample of participants

The studied sample consisted of 90 young water polo players aged 12 ± 0.5 years, who play in the best Serbian water polo teams. All of the water polo players were involved in the training and competitive cycles in water polo for a minimum of 3 years. Some of the studied water polo players were members of the national water polo team of Serbia for that age group.

Sample of variables

The variables of anthropometric characteristics

In order to measure the anthropometric characteristics, we used an anthropometer and caliper (GMP, Swiss) and electronic scales (Tefal, France). The following 12 variables were measured: ABH - Body height, AAL - Arm length, AHL - Hand length, ALL - Leg

length, ASW - Shoulder width, AAC - Arm circumference, AULC - Upper leg circumference, ALLC - Lower leg circumference, ABW - Body weight, ATST - Triceps skinfold thickness, AAST - Abdominal skinfold thickness and ASST - Subscapular skinfold thickness. Anthropometric measurements were carried out in accordance with the conventional criteria, ethical restrictions and procedures (Weiner & Lourie, 1969).

The variables of basic motor skills

In order to measure the basic motor skills, standardized protocols were used for this period of development (Kurelić, Momirović, Stojanović, Šturm, Radojević & Viskić-Štalec, 1975; Adam, Klissouras, Ravazzolo, Renson & Tuxworth, 1988).

The following 12 tests were used: MAA - agility in the air, MAT - Arm tapping, MLT - Leg tapping, MDFB - Deep forward bend on the bench, MFBR - Seated forward bend with reaching, MCSB - Cross-stand on the beam, MR20 - Running 20m, MTJ - Standing triple jump, MLJ - Standing long jump, MHHB - Hanging on the high bars, MSU - Sit-ups and MPU - Push-ups.

The variables of functional abilities

By testing lung ventilation, maximal oxygen uptake and heart rate frequency, we obtained five variables: $FAVO_{2peak}$ - absolute maximal oxygen uptake, $FRVO_{2peak}$ - relative maximal oxygen uptake, FVC - forced vital capacity, FEV1.0 - forced expiratory volume in one second and FHRr - resting heart rate frequency.

In order to evaluate we used a submaximal test on a bicycle ergometer (Kettler, Germany) with telemetric monitoring of heart rate frequency by means of a pulsometer (Polar, Finland). The estimated of $FAVO_{2peak}$ was carried out on the basis of the extrapolation method (American College of Sports Medicine, 2006). $FRVO_2$ was obtained by dividing the absolute values by body weight and is manifested as ml O_2/kg/min. FVC and FEV1.0 were measured with computerized spirometer following a standardized procedure (American Thoracic Society, 1995). FHRr was measured with a pulsometer (Polar, Finland). All of the testing was carried out in accordance with the appropriate standards and laboratory measuring.

The tests for the evaluation of specific motor skills

In order to evaluate the specific motor skills of young water polo players, we used 6 tests (Volčanšek & Grčić-Zubčević, 1984; Bratuša, 2000). In order to evaluate the speed of swimming and the specific swimming abilities of young water polo players, the following tests were used: SM25 - 25 m water polo freestyle, SM50 - 50m freestyle, SM100 - 100m freestyle and SM4x5 - 4x5M freestyle-backstroke. In order to evaluate the ability of manipulation with a ball the following tests were used: SM3x5 - driving a ball 3x5m and SMTB - throwing a ball. In all of the tests the participants had the right to two trials, and the better result was noted for further analysis. The test results were read out as soon as the test was completed in order to motivate the young water polo players (Dopsaj, Madić & Okičić, 2007). Water polo coaches at the national level took part the evaluation of specific motor skills in relation to the realization of these tests.

Statistical procedure

The structure of specific motor skills was established utilizing the component factor analysis – Hotelling's method of principal components with the Guttman-Kaiser (GK) criterion (the characteristic root Lambda of ≥1.00 was considered) with six manifested variables. The total variability in the system of utilized variables (Percent) was calculated, as well as the communalities of the variables of specific motor skills (h^2) Fulgosi (1988). The number of obtained principal components when Lambda was ≥1.00 would be considered as the representative criterion of latent space of specific motor skills for linear regression analysis.

The impact of predictor anthropological dimensions (anthropometric measurements, functional and basic motor abilities) on specific motor skills was assessed utilizing a linear regression analysis.

RESULTS

The component factor analysis of the specific motor variables determined a single statistically significant component by means of the Gutman-Keizer criterion. The isolated main component is defined as the general factor of the specific motor skills (GFSM) of the tested group of water polo players. Its value is 3.95 and it explains the overall variability of the system of specific motor variables with 65.79% (Table 1.).

Table 1 Factor analysis (Principal component)

Variables	Mean±SD	Component	h^2
SM25	18.09±1.83	0.85	0.72
SM50	38.74±4.58	0.92	0.84
SM100	85.65±9.73	0.84	0.71
SM4x5	22.24±2.15	0.73	0.53
SM3x5	16.37±1.72	0.84	0.71
SMTB	14.93±2.85	-0.66	0.44
Eigen values		3.95	
% of Variance		65.79	

SM25 - 25m water polo freestyle; **SM50** - 50m freestyle; **SM100** -100m freestyle; **SM4x5** - 4x5 freestyle-backstroke; **SM3x5** - the 3x5m driving a ball; **SMTB** - throwing a water polo ball.

The results of the regression analysis which are shown in Table 2. indicate the statistically significant correlation (p=0.00) within the overall system of predictor variables: the anthropometric characteristics, functional and basic motor abilities with the criterion variable - the isolated general factor of specific motor skills (GFSM). The multiple correlation coefficient (R=0.79) and values of the determinant coefficient (R^2=0.62) indicate this. Three variables MR20 (p=0.01), MTJ (p=0.00) and MSU (p=0.00) have an individually significant impact.

Table 2 Regression analysis of influence anthropometric characteristics, functional and basic motor abilities on single general factor of specific motor skills (GFSM)

Variables	Mean ± SD	R	Part-R	BETA	t	Sig.
ABH	156.99 ± 8.36	-0.38	-0.04	-0.12	-0.32	0.75
AAL	67.55 ± 4.42	-0.40	-0.20	-0.42	-1.59	0.12
AHL	15.35 ± 1.75	-0.37	0.02	0.04	0.17	0.86
ALL	89.50 ± 5.67	-0.30	0.21	0.44	1.70	0.09
ASW	29.94 ± 5.48	-0.23	-0.16	-0.30	-1.27	0.21
AAC	24.20 ± 3.37	-0.14	-0.20	-0.42	-1.61	0.11
AULC	47.98 ± 6.70	-0.11	0.11	0.27	0.87	0.39
ALLC	32.53 ± 3.59	-0.22	0.10	0.22	0.78	0.44
ABW	50.99 ± 11.31	-0.20	-0.06	-0.19	-0.43	0.67
ATST	11.75 ± 7.03	0.09	-0.07	-0.09	-0.53	0.60
AAST	20.77 ± 14.55	0.10	0.11	0.18	0.82	0.41
ASST	14.48 ± 9.17	0.12	0.11	0.14	0.82	0.41
$FAVO_{2peak}$	2.41 ± 0.43	-0.35	-0.19	-0.26	-1.48	0.14
$FRVO_{2peak}$	48.15 ± 9.90	-0.08	0.09	0.14	0.70	0.49
FVC	3.73 ± 0.69	-0.36	-0.16	-0.21	-1.24	0.22
FEV1.0	3.16 ± 0.45	-0.37	0.08	0.12	0.60	0.55
FHRr	78.12 ± 10.52	0.10	-0.01	-0.02	-0.10	0.92
MAA	4.78 ± 1.18	0.11	-0.03	-0.03	-0.25	0.80
MAT	44.39 ± 5.82	-0.27	0.02	0.02	0.18	0.86
MLT	30.87 ± 4.25	-0.26	-0.18	-0.16	-1.43	0.16
MDFB	41.04 ± 7.22	-0.11	-0.16	-0.15	-1.24	0.22
MFBR	22.61 ± 8.76	0.15	0.01	0.01	0.06	0.95
MCSB	2.89 ± 3.82	-0.01	0.23	0.17	1.83	0.07
MR20	3.42 ± 0.36	0.30	0.31	0.37	2.52	**0.01**
MTJ	4.65 ± 0.61	-0.28	0.37	0.57	3.08	**0.00**
MLJ	1.56 ± 0.20	-0.35	-0.19	-0.21	-1.51	0.14
MHHB	18.31 ± 16.65	-0.16	-0.01	-0.01	-0.06	0.96
MSU	22.76 ± 3.88	-0.49	-0.41	-0.49	-3.46	**0.00**
MPU	16.10 ± 9.77	-0.12	-0.11	-0.10	-0.85	0.40
$R=0.79$, $R^2=0.62$, df1=29, df2=60, F=3.35, p=**0.00**						

R-multiple correlation coefficient; **R^2**-determinant coefficient; **BETA** – standardized beta coefficient; **t**-t test; **F** - F test; **df1** and **df2** - degree of freedom; **Part-R** - Partial correlations; **p**-level of significance, significant if the value was $p \leq .05$; **ABH** - Body height; **AAL** - Arm length; **AHL** - Hand length; **ALL** - Leg length; **ASW** - Shoulder width; **AAC** - Arm circumference; **AULC** - Upper leg circumference; **ALLC** - Lower leg circumference; **ABW** - Body weight; **ATST** - Triceps skinfold thickness; **AAST** - Abdominal skinfold thickness; **ASST** - Subscapular skinfold thickness; **MAA** – Agility in the air; **MAT** - Arm tapping; **MLT** - Leg tapping; **MDFB** - Deep forward bend on the bench; **MFBR** - Seated forward bend with reaching; **MCSB** - Cross-stand on the beam; **MR20** - Running 20m; **MTJ** - Standing triple jump; **MLJ** - Standing long jump; **MHHB** - hanging on the high bars; **MSU** - Sit-ups; **MPU** - Push-ups; **FAVO2peak** - absolute maximal oxygen uptake; **FRVO2peak** - relative maximal oxygen uptake; **FVC** - forced vital capacity; **FEV1;0** - forced expiratory volume in one second; **FHRr** - resting heart rate frequency

DISCUSSION

The results of this research were meant to offer information regarding the influence of the anthropological dimensions (anthropometric characteristics, basic motor and functional skills) of young water polo players on their specific motor skills.

The results shown in Table 1. indicate that the space of specific motor skills can be explained with a single general factor of specific motor skills (GFSM). The results that were obtained in the area of specific motor skills are the results of the homogenous nature of young water polo players in terms of their swimming skills and anaerobic processes involved in energy supply. This battery of tests for assessing specific motor skills was used in studies involving young water polo players (Aleksandrović et al., 2007a; Aleksandrović et al., 2011). Falk et al. (2004) also used throwing a water polo ball and the 50m freestyle tests in their research which involved young water polo players. On the basis of the results of these studies, this battery of tests can successfully be used in the evaluation of the specific motor skills of young water polo players. The results of mean and standard deviation (Mean±SD) in Table 2. confirm the results of previous studies that the water polo training and competitions in the prepubescent period lead to the superiority of young water polo players in relation to their peers who are non-athletes in regards to anthropometric characteristics, basic motor and functional abilities (Radovanović, Aleksandrović & Ranković, 2004; Hraste, Lozovina & Lozovina, 2009; Aleksandrović, Radovanović, Okičić & Madić, 2005c; Bratuša, 2000; Aleksandrović, Georgijev, Okičić, Madić & Malezanov, 2007b).

The results of the regression analysis (Table 2) indicate that the entire anthropological space, which in this case is made up of anthropometric characteristics, basic motor and functional abilities, has a significant influence on the specific motor skills of young water polo players which are represented by a single general factor of specific motor skills (GFSM). Aleksandrović et al. (2007a) determined that only the entire set of applied anthropometric variables have a significant influence on specific motor skills. In the case of basic motor abilities, Aleksandrović et al. (2007a) determined a statistically significant influence of the entire set on specific motor skills. Individual influence was determined by two tests for the evaluation of explosive leg strength and one test for the evaluation of muscle endurance. Another study has determined (Aleksandrović et al., 2011) that only the entire set of the applied tests for the evaluation of functional abilities has a significant influence on specific motor skills. Our research is as step further since it determines the common influence of anthropometric characteristics, basic motor and functional abilities (a great number of variables) on the general factor of specific motor skills (GFSM) and in that way enables better evaluation of the success in the specific motor skills of young water polo players. This is consistant with Horvath et al. (2009) who considered that water polo and other sports played with a ball demand a special combination of speed, strength, and endurance along with a high level of technical-tactical knowledge. Individually only two tests for the evaluation of explosive muscle strength (MTJ, MR20) and one test for the evaluation of muscle endurance of abdominal musculature (MSU) had a statistically significant influence on the GFSM. The results determined in such a way confirm the importance of the development of muscle strength for the maintenance of vertical positions in the water. Vertical positions, based on the volume and intensity of the load, represent the dominant elements and situations which the water polo players realize during a game (Dopsaj & Thanopulos, 2006; Dopsaj & Matković, 1994; Bratuša, Matković & Dopsaj, 2003; Platanou, 2005). In accordance with the aforementioned, Platanou (2005) considered

that the ability to perform the explosive jump in the water and the repetition of the jump are very important for the successful manifestation of water polo performance. McCluskey (2010) also determined that the speed of a ball throw in most cases depends on the muscle strength of the lower extremities. Garrido, Marinho, Barbosa, Costa, Silva, Pérez-Turpin & Marques (2010) cited that simple land tests of strength could be used to evaluate the abilities of young swimmers. In addition, we could say that land tests for the evaluation of explosive leg strength can be used for testing young water polo players in the selection process, which has been confirmed by the results of this research.

CONCLUSION

The obtained results are important for sports practice as they offer coaches information regarding the influence of anthropological dimensions on the specific motor skills of young water polo players. This enables the proper selection and training process of young water polo players, with the aim of their optimal development for the purpose of achieving top sports results in the senior category.

REFERENCES

Adam, C., Klissouras, V., Ravazzolo, M., Renson, R., & Tuxworth, W. (1988). *Eurofit: European test of physical fitness.* Rome: Council of Europe, Committee for the development of sport.

Aleksandrović, M., Radovanović, D., Okičić, T., Madić, D. & Georgiev, G. (2011). Functional abilities as a predictor of specific motor skills of young water polo players. *Journal of Human Kinetics*, 29, 123-132.

Aleksandrović, M., Naumovski, A., Radovanović, D., Georgiev,G. & Popovski D. (2007a). The influence of basic motor abilities and Anthropometric measures on the specific motor Skills of talented water polo players. *Facta Universitatis Series: Physical Education and Sport,* 5 (1), 65 - 74.

Aleksandrović, M., Georgiev, G., Okičić, T., Madić, D. & Malezanov, N. (2007b). Basic motor skills structure in 12-year-old water polo players and non - sportsmen. *Serbian Journal of Sports Sciences*, 1 (3), 79-88.

Aleksandrović, M., Popovski, D. & Madić, D. (2005a). Connection of basic-motorical and swim-situational abilities of selected water polo players. *Sport Mont*, 6-7, 313-319.

Aleksandrović, M. & Radovanović, D. (2005b). Influence of water polo training on body composition and functional abilities in prepubescent boys. In: Dikić, N.; Živanić, S.; Ostojić, S.; Tornjanski, Z. (Eds.) *10th Congress of European College of Sport Sciences*, Proceedings Book of Abstracts. Sports Medicine Association of Serbia: Belgrade, pp. 283-284.

Aleksandrović, M., Radovanović, D., Okičić, T. & Madić, D. (2005c). Morphological space structure of 12 years old water polo players and non-sportsmen. In: D. Milanović; F. Prot (Eds.). *4th International Scientific Conference on Kinesiology "Science and Profession – Challenge for the Future"*. Faculty of Kinesiology: Zagreb, pp. 710-712.

American College of Sports Medicine. (2006). *Guidelines for exercise testing and prescription. 7th ed.* Baltimore: Lippincott Williams & Wilkins.

American Thoracic Society. (1995). ATS statement -standardization of spirometry. 1994 update. *Am Rew Respir Dis*, 152 (5), 1107–1143.

Bratuša, Z., Matković, I. & Dopsaj, M. (2003). Model characteristics of water polo players' movements in the vertical position during the competition. In: J. C. Chatard, (Ed.) *Biomechanics and Medicine in Swimming IX*. Publications de l'Universite de Saint-Etienne: Saint-Etienne, pp. 481-486.

Bratuša, Z. (2000). Razvoj brzinskih sposobnosti dečaka mlađeg školskog uzrasta pod uticajem specifičnog vaterpolo treninga (Speed abilities development of young school age boys under influence of specific water polo trainings). *Unpublished master thesis*, University of Belgrade, Belgrade.

Dopsaj, M., Madić, D. & Okičić, T. (2007). The assessment of the acquisition of various crawl style modes in water polo players with respect to age and competitive levels. *Facta Universitatis Series: Physical Education and Sport*, 5 (2), 109-120.

Dopsaj, M. & Thanopoulos, V. (2006). Generalna validacija metode za procenu radne pripremljenosti vrhunskih vaterpolista u vertikalnoj plivačkoj poziciji (General validity of the method for measure vertical swimming work ability of elite water polo players). *Sportska medicina,* 6 (2), 28-40.

Dopsaj, M. & Matković, I. (1994). Motorička aktivnost vaterpolista za vreme utakmice (Motor activity of the waterpolo players during the match), *Fizička Kultura,* 48 (4), 339-346.

Falk, B., Lidor, R., Lander, Y. & Lang, B. (2004). Talent identification and early development of elite water-polo players: a 2-year follow-up study. *Journal of Sports Sciences*, 22 (4), 347-355.

Ferragut, C., Abraldes, J.A, Vila, H., Rodríguez, N., Argudo, F.M. & Fernandes, R.J. (2011). Anthropometry and Throwing Velocity in Elite Water Polo by Specific Playing Positions. *Journal of Human Kinetics*, 27, 31 – 44.

Fulgosi, A. (1988). *Faktorska analiza (Factor analysis).* Zagreb: School book.

Garrido, N., Marinho, D.A., Barbosa, T.M., Costa, A.M., Silva, A.J., Pérez-Turpin, J.A. & Marques, M.C. (2010). Relationships between dry land strength, power variables and short sprint performance in young competitive swimmers, *Journal of Human Sport and Exercise online*, 5 (2), 240-249.

Horvath, P., Petrekanits, M., Gyore, I., Kneffel, Z., Varga-Pinter, B. & Pavlik, G. (2009). Echocardiographic and spiroergometric data of elite Hungarian female water polo players. *Acta Physiologica Hungarica*, 96 (4), 449–457.

Hraste, M., Lozovina, V. & Lozovina, M. (2009). The effect of long-term training on static and dynamic lungs volumes and capacities of young water-polo players, *Naše more,* 56, (1-2), 72-76.

Kos, H., Rynkiewicz, M., Zurek, P., Zabski, S. & Rynkiewicz, T. (2010). Maximal strength and strength accuracy in water polo players from the polish junior national team. *Studies in Physical Culture and Tourism*, 17 (4), 307-313.

Kurelić, N., Momirović, K., Stojanović, M., Šturm, J., Radojević, Đ. & Viskić-Štalec, N. (1975). Struktura i razvoj morfoloških i motoričkih dimenzija omladine (Structure and development of morphological and motor dimensions at youngsters). Belgrade: Institut for scientific researhes of Faculty of Physical Education.

Lozovina, M., Đurović, N. & Katić, R. (2009). Position specific morphological characteristics of elite water polo players. *Collegium Antropologicum*, 33 (3), 781–789.

Malacko, J. & Rađo, I. (2004). *Tehnologija sporta i sportskog treniniga* (Technology of sport and sports training). Sarajevo: Fakultet sporta i tjelesnog odgoja.

McCluskey, L. (2010). Throwing velocity and jumping height in female water polo players: Performance predictor. *Journal of Science and Medicine in sport,* 13, 236-240.

Platanou,T. (2005). On-water and dryland vertical jump in water polo players. *The Journal of Sports Medicine and Physical Fitness*, 45 (1), 26-31.

Radovanović, D., Aleksandrović, M. & Ranković, G. (2004). The effects of water polo training on aerobic power and pulmonary function in 11 and 12 years old boys. *Acta facultatis medicae Naissensis,* 21 (3), 137-141.

Tan, F.H.Y., Polglaze, T., Dawson, B. & Cox, G. (2009). Anthropometric and fitness characteristics of elite australian female water polo Players. *Journal of Strength and Conditioning Research*, 23 (5), 1530–1536.

Vila, H., Ferragut, C., Argudo, F.M., Abraldes, J.A., Rodrigues, N. & Alacid, F. (2009). Relationship between anthropometric parameters and throwing velocity in water polo players. *Journal of Human Sport and Exercise online*, 4 (1), 57-68.

Vičević, S. (2001). Sistem takmičenja i njegov uticaj u radu sa mlađim kategorijama (System of competition and its influence in work with young categories). In S. Vičević (Ed.) *Jugoslovenska vaterpolo škola "Trifun-Miro Ćirković" (Yugoslav Water Polo School «Trifun-Miro Ćirković»)* Vaterpolo savez Jugoslavije: Kotor, pp.115-118.

Volčanšek, B & Grčić-Zubčević, N. (1984). Metric characteristics for estimation of speed swimming abilities with crawl technique**.** *Kineziologija*, 16 (1), 73-79.

Weiner, J. & Lourie, J. (1969). *Human biology, a guide to field methods, international biological programme.* Oxford – Edinburgh: Blackwell Scientific Publication.

ANTROPOLOŠKE DIMENZIJE KAO PREDIKOTOR SPECIFIČNIH MOTORIČKIH SPOSOBNOSTI MLADIH VATERPOLISTA

Cilj ovog istraživanja bio je da se utvrdi zajednički uticaj antropoloških dimenzija (antropometrijskih karakteristika, bazičnih motoričkih i funkcionalnih sposobnosti) na specifične motoričke sposobnosti mladih vaterpolista. Ukupan broj od 90 vaterpolista je bio uključen u studiju. Protokol se sastojao od standardizovanih antropometrijskih, funkcionalnih i bazičnih motoričkih testova i testova za procenu specifično motoričkih sposobnosti. Generalni faktor specifičnih motoričkih sposobnosti u vaterpolu je dobijen putem faktorizacije i predstavlja kriterijum. Regresiona analiza je pokazala da antropološke dimenzije posmatrano kao grupa prediktora, zatim posmatrano pojedinačno dve varijable eksplozivne snage i jedna koja predstavlja repetativnu snagu trupa, imaju značajan uticaj na opšti faktor specifičnih motoričkih sposobnosti. Rezultati istraživanja su ukazali na značajan uticaj antropoloških dimenzija na specifične motoričke sposobnosti selekcionisanih mladih vaterpolista. Ovo omogućava pravilan proces selekcije mladih vaterpolista.

Ključne reči: *vaterpolo, mladi igrači, efekti, antropološke dimenzije*