

PRAGMATICS OF EXPERT KNOWLEDGE IN RECOGNITION OF THE SIMPLE ANTHROPOMETRICAL MODELS IN WATER POLO

Pragmatika ekspertnog znanja u prepoznavanju jednostavnih antropometrijskih modela u vaterpolu

Mislav Lozovina

Faculty of Maritime Studies, Zrinsko-Frankopanska 38, Split

Vinko Lozovina

Faculty of Maritime Studies, Zrinsko-Frankopanska 38, Split

E-mail: lozovina@pfst.hr

Leo Pavičić

Faculty of Kinesiology, Horvaćanski zavoj 15, Zagreb

E-mail: leo.pavicic@kif.hr

UDK 797.2

Summary

Investigation of the expert knowledge was carried out on the sample of 10 experts in the area of water polo. The condition which they have to accomplish was that they are graduated in kinesiology, ex First division players, and actual water polo trainers with remarkable experience. The sample of variables consists of two anthropometric variables (weight (TT) and high (TV) as well as nine combinations of the same anthropometric variables in modalities: under average, average and over average. Measuring of anthropometrical variables, physical weight (TT) and physical height (TV), was implemented to the sample of 89 Croatian first division water polo players in the year 2000. Statistics of two anthropometric variables was calculated. The test for distributions normality was carried out by Kolmogorov-Smirnova (MaxD) procedure. Frequencies of expert opinion and real measuring and recorded state, was calculated. By implementation of the cluster analysis under the K-mean cluster proceeding entities are reorganized in the three prescribed groups, separately for physical height and physical weight. The frequencies of entities were established in separate groups (over average, average and under average in physical height and physical weight). In combination of the height and weight frequency of entities for each of 9 potential combinations of the chosen anthropometrical model was established. By means of χ^2 -test we analyzed: connections/differences in affiliation of defined anthropometrical model to certain player's role, connections/differences of the expert opinion about appurtenance of defined anthropometrical model to certain player's role and connections/differences of the experts' opinion about affiliation of given anthropometrical model to certain player's role and de facto belonging at that position. Hypothesis, that exists' correlation between experts opinion, anthropometrical models and players roles assigned on the base of the real measured state next to water polo players, are partially confirmed in this investigation. It is affirm that experts statistically significant differentiate five players' positions (role in the game) on the base designated anthropometric models. Considerable degrees of connection between expert's opinion and exactly measured anthropometric variables are noted for player's roles: centre forward, external attacker and guard. Positions (roles) wing and goalkeeper statistically significant differentiates from expert's opinion. Mentioned significant differences can be explained in two manners. Either experts have not adequate proficiency therefore did not estimate well two positions (wing and goalkeeper), what is slightly possible, either, in the selections process

till sports specialization, trainers in Croatia first water polo division disposed with small and inadequate sample or selection was not created as the profession requested. It seems that inadequate imputed sample and subsequently constrained selection exactly give assigned results.

Key words: water polo, nonparametric statistics, expert systems, anthropometric models

Sažetak

Istraživanje ekspertnog znanja provedeno je na uzorku od 10 kinezioloških eksperata iz područja vaterpola koji su morali zadovoljiti kriterij da su diplomirani kineziolozi s dugogodišnjim trenerskim iskustvom. Uzorak varijabla činile su dvije antropometrijske mjere: tjelesna težina (TT) i tjelesna visina (TV) i devet kombinacija istih antropometrijskih mjera s modalitetima natprosječno, prosječno i ispodprosječno. Antropometrijskih varijable mjerene su na 89 vaterpolista iz osam klubova hrvatske Prve vaterpolske lige. Izračunate su statistike za dvije mjerene antropometrijske varijable. Normalitet distribucije testiran je prema postupku Kolmogorov-Smirnova (MaxD). Izračunate su frekvencije ekspertnog mišljenja i realnoga stanja. Primjenom klusterske analize, uz model K-mean clustering, entiteti su kategorizirani u tri zadane skupine, zasebno za tjelesnu visinu i težinu. Utvrđena je frekventnost entiteta u pojedinoj skupini (ispodprosječne, prosječne i natprosječne težine i visine). Kombiniranjem visine i težine utvrđena je frekventnost entiteta u svakoj od devet mogućih kombinacija (antropometrijskih modela). S pomoću Hi – kvadrat testa analizirana je: povezanosti/razlike pripadnosti određenoga morfološkog modela pojedinoj igračkoj poziciji, povezanosti/razlike ekspertnog mišljenja o pripadnosti određenoga morfološkog modela pojedinoj igračkoj poziciji i stvarne pripadnosti pojedinoj poziciji. Hipoteza o povezanosti ekspertnog mišljenja između antropometrijskih modela i igračkih pozicija i stvarnoga mjerenjem zabilježenog stanja kod vaterpolista, djelomično je potvrđena. Ustanovljeno je da eksperti statistički značajno razlikuju pet igračkih uloga na temelju antropometrijskih modela. Statistički značajan stupanj povezanosti mišljenja eksperata i na eksperimentu dobivenih podataka ustanovljen je za pozicije centar, vanjski napadač i bek. Pozicije krilo i vratar, na osnovi egzaktno izmjerenih rezultata, statistički se značajno razlikuju od mišljenja eksperata. Te značajne razlike mogu se tumačiti dvojako. Ili eksperti nemaju dostatno znanja, pa nisu dobro procijenili te dvije pozicije, ili je u procesu selekcije do sportskog usavršavanja trenerima ekipa hrvatske Prve vaterpolske lige na dispoziciji bio malen i neadekvatan uzorak za selekciju, pa selekcija nije izvršena onako kako bi to tražila struka, a što nije tako s igračima koji igraju u ulogama centra, beka i vanjskog napadača.

Ključne riječi: vaterpolo, neparametrijska statistika, ekspertni sustavi, antropometrijski modeli.

INTRODUCTION / Uvod

Water polo, as an activity, belongs in the category of polistructural complex motions while in energetically sense property in the category mixed "anaerobic-aerobic" sports (50%-50%). Water polo plays 6 players in the field and goal-keeper. Six players in the field during the game performing various tasks in defence as well as in attack phase of the game. Any of them dominantly play assignee main role, but during the game then can be located on the positions where other roles play too. Five players role in water polo are defined as: center forward, guard, wing, external attacker and goalkeeper. Any of them in the sense of movements and efficient performing the techniques must have various and specific morphological and psycho-motor characteristics. That is the reason due to the trainers providing main roles to each of them.

PRELIMINARY INVESTIGATIONS / Preliminarna istraživanja

Center forward / Centar

On the basis of morphological characteristics, it is possible to define the center forward as a classical "athleticus" upon Kretchmer. His basic characteristic is extraordinary and proportional growth of skeletal system in length and breadth (measures of longitudinal and transversal dimensionality of skeleton). His height is over average, as well as weight. On this skeletal structure, he has excellently applied muscular apparatus, especially in the upper body zone, which is caused by an exceptionally wide biacromial span. Biiliocrystal span of the center forward is somewhat smaller in proportion with the biacromial, but muscle mass is a property expressed in all regions of the leg. Thighs of

the center forward are disproportional to both calves, which are relatively thin, and to the feet, which are long and wide. This specific structure of the guard's legs is the consequence of selection, call processing, and specific training for the play in the vertical phase of the game, where the calf and the foot directly participate in the propulsion and preservation of the vertical position in the game. The total body mass of the center forward is, to a larger degree, achieved on the basis of under skin fat tissue, which is proportionally distributed over all regions. (Lozovina 1981, 2004).

Guard / Obrana

Regarding the guard based on his morphological characteristic it is possible to define him as a classical athleticus upon Kretchmer. His basically characteristics are extraordinary and proportional growth of skeletal system in length and breadth (measures of longitudinal and transversal dimensionality of skeleton). His average height is 1,95 m. On this skeletal structure, he has excellently applied muscularly apparatus, especially in the upper body zone what is caused by exceptionally wide biacromial span. Biiliocristal span of the guard is somewhat smaller in proportion to biacromial, but muscle mass is properly expressed in all region of leg. Thighs of the guard are unproportional regarding the calf which is relatively thin, as well as the foot is long and wide. This specific structure of the guard legs are the consequence of selection, called processing, and specific training for the play in vertical phase of the game where the calf with a foot directly participate in propulsion and, preservation of the vertical position in the game. The total body mass guard, with somewhat minor part, achieved on the base of the under skin fat tissue, proportionally distributed over the all regions (Lozovina, 1981, 2004.).

External Attacker / Vanjski napadač

Regarding the external attacker based on his morphological characteristic it is possible to define him in the light of the results given in research (Lozovina, 1983). Author, describes external attackers, on taxonomic variable (D) which is defined by the measures of the circular dimensionality and under skin fat tissue, also by biacromial and biiliocristal span. Their general growth in the height is mediocre. Measures of under skin fat tissue and measures of circular dimensionality directly influenced body mass, but, it seems that biacromial and biiliocristal span directly defined predisposition zones for under skin fat tissue contestation. On the positive pole of this bipolar taxonomical variable, there are the players with a great value on the biacromial

and biiliocristal span, but whose total growth of the bones in the width are small. Those players body mass achieved on the account of under skin fat tissue. On the other extreme of this taxonomic variable players are positioned whose characteristic are universal reduction of skeletal dimensions, which body mass achieved also on account of under skin fat tissue, but totally of their soft tissue, are small. On one extreme of this bipolar taxonomic variable it is possible to recognize the type defined with general adiposity while on the other type which can be defined as pseudoathletic type. We can find both types between external attackers (Lozovina, 1981, 2004.).

Wing / Krilni napadač

In morphological sense wing can be described as leptomezomorphish type. His basic characteristics are emphatic growth of skeletal system in the length (longitudinal dimensionality) and somewhat weaker pronounced growth of skeletal system in the width (transversal dimensionality). His height is over medial. On this skeletal structure wing have excellent apply musculature, especially in upper body region, reduced under skin fat tissue, well balanced in regions what's enabled extraordinary buoyancy and good balance in the water. The total mass of the wing are less than expected according to height. Wing has pronounced length and width of the fist and foot what provides extraordinary propulsion thus major velocities' of the movements in vertical and horizontal phase as well as top-hole ball control (Lozovina 1981, 2004.).

Goalkeeper / Vrtar

Goalkeeper technically and tactically play uncommon role in water polo. He is the latest player in defence, reviser of all the errors previously generated in defence actions of his team. Except self ordinance in the game (all individual techniques, tactics and strategies) most often goal defence coordinates his nearest players in defence. After defence he becomes the first player in attack. Attack action dependent on his reactions and recognizing the situation as well as velocity and precision of the routing the action. There are about 15% goalkeepers in total population of water polo players. In so slum cluster, in morphological sense, it is possible to recognize two structures. The difference between those two structures directly determinates goalkeeper's techniques. The first structure defined under average height and weight, pronounced biacromial span as well as hands aperture, proportionally weaker pronounced biiliocristal span and great foot (length and width). On this skeletal structure muscle mass are excellently

applied over all body segments and under skin fat tissue are completely reduced. Such type of goalkeepers we call "jumper". He gets around semi ball in between goalposts one meter far away from goal line. Another type of goalkeepers' defined over average measures of longitudinal dimensionality (height), and, on such longitudinally proportionally associate measures of transversal longitudinally (brute pronounced biacromial and biiliocristal span). Next to that hands span provided as over average greatness. Their musculature is well developed and appropriate to that skeletal structure. One of characteristics of this type of goalkeepers 'is big foot (length and width). Under skin fat tissue are completely reduced as well as body mass respectively weight which is under average. Such structure directly defined techniques for this type of goalkeeper which we call "line goalkeeper". His basic characteristic is moving exclusively over the goal line, so his technique is essentially different from "jumpers". (Lozovina, 2008., 2009.).

In all articles by Lozovina at all (2008.) it is evident that the height is crucial anthropometric measure for primary selection and later for morphological optimization.

Differences in morphological structure of the players point a differentiation and selectivity of the players in respect of the specific requirements of individual player's positions. This type of investigations in water polo was made by authors (Vujović at all 1986.; Lozovina V., Lozovina M., 2008.) and in a handball by (Srhoj at all 2008.).

Investigations, based on the expert models, for the routing the sportsman's upon individual players roles in the game as well as for evaluation of realistic quality of the sportsmen, were projected in the sense of fixing the coefficients and definitions importance of criteria regarding the player's roles in basketball. This investigations were performed in basketball (Dežman at all 2001.) and in water polo (Hraste at all 2008.).

AIM AND IMPORTANCE / *Cilj i važnost*

The aim of this investigation is the opinion of expert knowledge whose combinations of chosen anthropometric characteristics determine various players' roles in water polo. The scope in this investigation was to establish if the experts differentiate various players' roles on the base of nine set up models and in what degree differentiate experts' opinions regarding the actually measured de facto situation. The results of this investigation will contribute to explanation for correct implementation of primer and secondary selection, sports routing, improving and sport specialization in water polo.

Basic Hypothesis / *Temeljna hipoteza*

It is assumed that there existed the connection between expert opinion and set up models for every player's role and actually measured results.

METHODS / *Načini*

Experiment description / *Opis eksperimenta*

Ten water polo experts fulfil the questionnaire list. After attentively reading the instructions they have independently fulfil the questionnaire. In the questionnaire we set up nine potential models (combinations) of anthropometrical measures of physical weight (TT) and physical height (TV), for five player's roles in water polo. The roles are defined as: center forward, wing, external attacker, guard and goalkeeper. In the case of accordance with a model experts signed (+) and for unaccordance signed (-), in the given column in questionnaire.

Sample of entities / *Uzorak entiteta*

Investigation of the expert's knowledge was carried out on the sample of 10 experts in the area of water polo. The condition which they have to accomplish was that they are graduated in kinesiology, ex First division players, and actual water polo trainers with remarkable experience. Measuring of anthropometrical variables, physical weight (TT) and physical height (TV) was implemented to the sample of 89 Croatian first division water polo players in the year 2000. The only inclusion criterion was participation in at least one official game as a member of the top national division in the year of measurement. All younger than 19, for whose we presume that because of age have not finished growth and development was eliminated from the sample.

Sample of variables / *Uzorak varijabli*

The sample of variables consists of two anthropometric variables: physical weight (TT) and physical height (TV) and nine combinations of the same anthropometric variables in modalities: over average, average and under average. That is:

- (1) NPTV x NPTT - over average physical height
* over average physical weight
- (2) NPTV x PTT - over average physical height
* average physical weight
- (3) NPTV x IPTT - over average physical height
* under average physical weight
- (4) PTV x NPTT - average physical height

- (5) PTV x PTT * over average physical weight
- average physical height
- (6) PTV x IPTT * average physical weight
- average physical height
- (7) IPTV x NPTT * under average physical weight
- under average physical height
- (8) IPTV x PTT * over average physical weight
- under average physical height
- (9) IPTV x IPTT * average physical weight establish
- under average physical height
* under average physical weight

groups (over average, average and under average in physical height and physical weight). In combination of the height and weight it was established frequency of entities in each of 9 potential combinations of the chosen anthropometrical model. By means we analyzed of χ^2 -test:

1. connections/differences in affiliation of defined anthropometrical model to certain player's role
2. connections/differences of the expert opinion about appurtenance of defined anthropometrical model to certain player's role
3. connections/differences of the expert opinion about affiliation of given anthropometrical model to certain player's role and de facto belonging to that position

STATISTICAL ANALYSIS / Statistička analiza

Statistics of two anthropometric variables: means, standard deviations, minimal and maximal results, skewness and kurtosis was calculated. Test for distributions normality was carried out by Kolmogorov-Smirnova (MaxD) procedure. Frequencies of expert opinion and real measuring and recorded state are calculated. By Implementation of the cluster analysis under the K-mean cluster proceeding entities are reorganized in the three prescribed groups, separately for physical height and physical weight. In this way we established frequencies of entities in separated

RESULTS AND DISCUSSION / Rezultati i rasprava

The statistics of two anthropometric variables are calculated (arithmetical mean, standard deviation, minimal and maximal results, skewness and kurtosis) (Table1.). Both variables have normal distributions and

Table 1. Descriptive statistics of anthropometric variables
Tablica 1. Deskriptivna statistika antropometrijskih varijabli

	AS	Min	Max	S.D.	Skew	Kurt	MaxD
TT	94,61	78	120	11,21	0,65	-0,27	0,11
TV	192,44	177,8	205,6	6,63	0,04	-0,58	0,05

TEST=0,14 p<0,05 0,17 p<0,01

AS – Mean, Min – Minimum, Max – Maximum, S.D. – Std. Deviation, Skew – Skewness, Kurt – Kurtosis, MaxD – greatest divergence of empiric frequency from theoretical relative cumulative frequency

Table 2. Frequencies according to cluster analysis
Tablica 2. Frekvencije prema klusterskoj analizi

ULO	1	2	3	4	5	6	7	8	9
C	9	1	0	3	0	0	0	1	0
K	0	2	0	0	5	1	0	3	11
B	4	3	0	4	4	2	0	1	0
V	0	2	0	1	8	1	1	3	5
G	0	1	0	0	4	3	0	2	4

ULO–role, C–center forward, K–wing, B–guard, V–external attacker, G–goalkeeper, NPTV x NPTT (1), NPTV x PTT (2), NPTV x IPTT (3), PTV x NPTT (4), PTV x PTT (5), PTV x IPTT (6), IPTV x NPTT (7), IPTV x PTT (8), IPTV x IPTT (9)

Table 3. Frequencies by expert
Tablica 3. Frekvencije eksperta

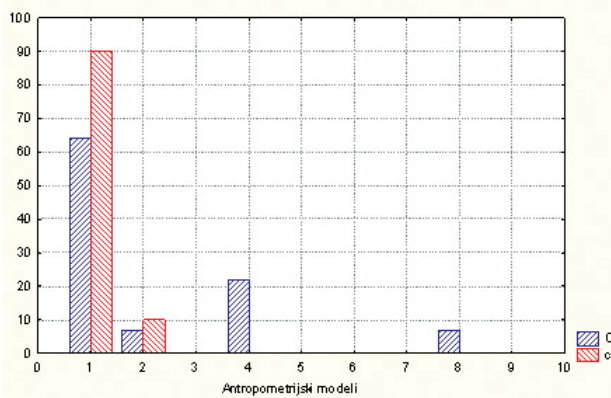
ULO	1	2	3	4	5	6	7	8	9
C	9	1	0	0	0	0	0	0	0
K	0	8	0	0	2	0	0	0	0
B	6	1	0	0	3	0	0	0	0
V	1	3	0	0	5	1	0	0	0
G	0	7	3	0	0	0	0	0	0

ULO–role, C–center forward, K–wing, B–guard, V–external attacker, G–goalkeeper, NPTV x NPTT (1), NPTV x PTT (2), NPTV x IPTT (3), PTV x NPTT (4), PTV x PTT (5), PTV x IPTT (6), IPTV x NPTT (7), IPTV x PTT (8), IPTV x IPTT (9)

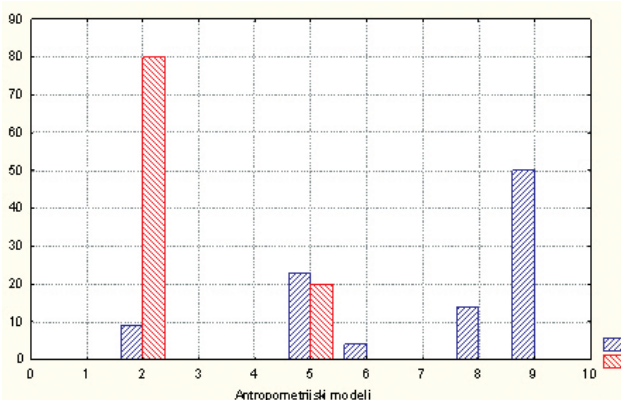
platicurtic shape.

In Table 2 calculated frequencies over the anthropometrical models for each play position (role) in the game are displayed. In Table 3 calculated frequencies of the results given by expert opinion are displayed.

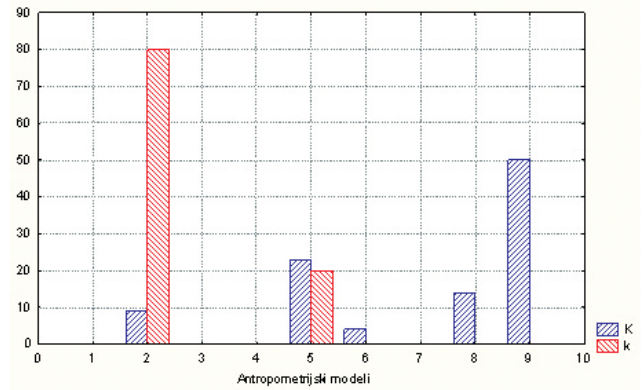
In the following five graphs relationship between expert thinking and real measured state for each of five positions (roles in the game) are displayed.



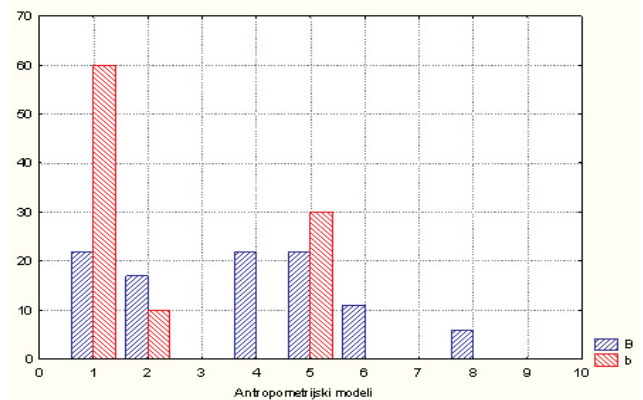
Graph 1. Relationship of expert's opinion (c) and real state (C) for center forward role
Dijagram 1. Odnos ekspertnog mišljenja i stvarnog stanja uloge centra



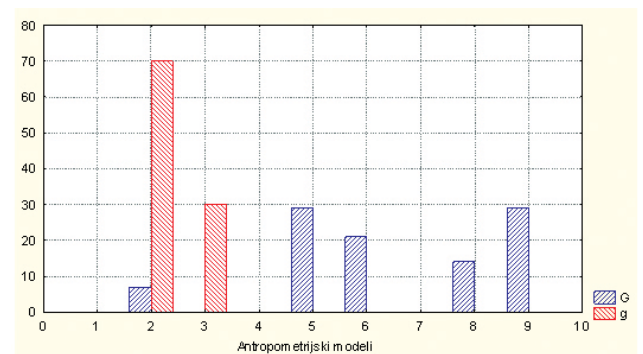
Graph 2. Relationship of expert's opinion (k) and real state (K) for wing role
Dijagram 2. Odnos ekspertnog mišljenja i pravog stanja za ulogu krilnog napadača



Graph 2. Relationship of expert's opinion (b) and real state (B) for guard role
Dijagram 3. Odnos ekspertnog mišljenja pravog stanja za ulogu obrane



Graph 4. Relationship of expert's opinion (v) and real state (V) for external attacker role
Dijagram 4. Odnos ekspertnog mišljenja i pravog stanja za ulogu vanjskog napadača



Graph 5. Relationship of expert's opinion (g) and real state (G) for goalkeeper role
Dijagram 5. Odnos ekspertnog mišljenja i pravog stanja za ulogu vratara

By inspection of five graphs it is possible to conclude that the experts recognized the roles of the center forward, external attacker and guard very well while the roles of the wing and goalkeeper are poorly recognized on the base of combined given anthropometric variables.

Table 4. χ^2 -test for expert opinion about positions (roles)

Tablica 4. χ^2 -test za ekspertno mišljenje o položajima (ulogama)

χ^2	P	DF
56,86	<0,05	32

χ^2 – Hi quadrate, P–signification level, DF– freedom degrees

Table 5. χ^2 -test for measuring real state

Tablica 5. Test za stvarno mjerenje stanja

χ^2	P	DF
73,05	<0,05	32

χ^2 – Hi quadrate, P–signification level, DF– freedom degrees

By implementation of the χ^2 -test it is appointed that the experts' opinion linked on selecting designated anthropometric models for play positions are significantly different on the significance level 0,05. Test showed their concordance in the selection of anthropometric models for different roles in the game (Table 3.). By implementation of the χ^2 -test it is appointed that on the base of anthropometric models there are significant differences in the play roles on the significance level 0,05. It is perceived that the player's roles are better differentiated in the reality than on the base of expert knowledge (Table 4.)

Table 6. Connection of expert knowledge and real state
Tablica 6. Veza ekspertnog znanja i stvarnog stanja

χ^2	P	DF
KRILO		
17,9	<0,05	8
CENTAR		
3,43	-	8
VANJSKI		
9,14	-	8
BEK		
6,8	-	8
VRATAR		
20,4	<0,05	8

χ^2 – Hi quadrate, P–signification level, DF– freedom degrees

From the Table 6 it is possible to conclude that expert knowledge and really measured state statistically significant did not differentiate roles of the center forward, external attacker and guard. Experts opinion about roles in water polo and real measured state statistically significant differentiate roles of the wing and goalkeeper on significance level 0,05. It is evident that experts excellently recognized roles of center forward, external attacker and guard, but weaker roles of the wing and goalkeeper, on the base of given anthropometric variables. Each of mentioned players roles are specialized therefore recognition probability needs to be great. Since experts did not recognized wings and goalkeepers, it is possible that confusion make two potential types of goalkeepers' (jumper and line goalkeeper). On the other side, wings, except wings role rarely plays other roles. Since the wings needs under average physical height that can be a reason which experts drag away from the right speculation? Right exact analysis and statistical data are necessary to acquire the real senses.

CONCLUSION / Zaključak

Ten water polo experts in the nine anthropometric models have explicate mutual influences between physical height and physical weight for five player's roles (center forward, wing, external attacker, guard and goalkeeper). The frequencies' table of expert opinion is carried out. In experimental procedure 89

first division water polo players was measured in two anthropometric variables (physical height and physical weight). Both variables are allocated in the three grades (over average, average and under average). Hypothesis, that exists correlation between experts opinion, anthropometrical models and players roles assigned on the base of the real measured state next to water polo players, are partially confirmed in this investigation. By implementation of χ^2 -test it is affirm probability of relationship of the expert's opinion and measured real state. It is affirm that experts statistically significant differentiate five players' positions (role in the game) on the base designated anthropometric models. Considerable degrees of connection between expert's opinion and exactly measured anthropometric variables are noted for player's roles: center forward, external attacker and guard. Positions (roles) wing and goalkeeper, on the base exactly measured variables, statistically significant differentiates from experts opinion. Mentioned significant differences can be explained in two ways. Either experts have not adequate proficiency therefore did not estimate well two positions (wing and goalkeeper), what is slightly possible, or, in the selection process till sports specialization, trainers in Croatia first water polo division disposed with small and inadequate sample or selection was not created as the profession requested. It seems that inadequate imputed sample and subsequently constrained selection exactly give assigned results. The results obtained in this investigation will contribute to explanation necessary for correct performing primary and secondary selection, sports routing and sports specialization in water polo.

REFERENCES / Literatura

- Dežman, B., Trninić, S., Dizdar, D. (2001.) Ekspert Model of Decision-Making System for Efficient Orientation of Basketball Players to Position and Roles in the Game-Empirical Verification. Coll. Antropol. 25, 1:141-152, Zagreb.
- Hraste, M., Dizdar, D., Trninić, V. (2008.) Ekspert Opinion about System of the Performance Evaluation Criteria Weighed per Positions in the Water Polo game. Coll. Antropol. 32, 3:851-861, Zagreb.
- Lozovina, V. (1981). Karakteristike vaterpolista u morfološkom prostoru. (Magistarski rad). Fakultet za fizičku kulturu Sveučilišta u Zagrebu, Zagreb.
- Lozovina, V. (1983). Utjecaj morfoloških karakteristika i motoričkih sposobnosti u plivanju na uspješnost igrača u vaterpolu. (Disertacija). Fakultet za fizičku kulturu Sveučilišta u Zagrebu, Zagreb.
- Lozovina, V., Pavičić, L. i Živičnjak, M. (1999.) Komparativna analiza latentnih morfoloških struktura mlađih natjecatelja vaterpola, Školski vjesnik 48, 2, 135-148. Split.
- Lozovina, V., Pavičić, L. (2004.) Antropometric Changes in Elite Male Water Polo Players: Survey in 1980 and 1995; CMJ, vol. 45, No.2 pg.202-205, Zagreb
- Lozovina, V., Lozovina, M. (2008.) Morphological optimisation, overlap zones and secular trend in selection pressures, Acta Kinesiologica Vol. 2, Issue 1. str. 33-41, ISSN 1840-2976, Mostar.
- Lozovina, V. (2009.) Temelji vaterpola u svjetlu teorije treninga. UDK 797.253.(075.8) ISBN 978-953-98495-1-9, Split.
- Rogulj, N., Papić, V. (2006.) Talent – ekspertni sustav za otkrivanje talenata u sportu. Zbornik radova. 15. ljetna škola kineziologa Republike Hrvatske, 484-488, Zagreb.
- Rogulj, N., Papić, V., Čavala, M. (2009.) Evaluation Models of Some Morphological Characteristics for Talent Scouting in Sport. Coll. Antropol. 33, 1:105-110, Zagreb.
- Srhoj, V., Marinović, M. i Rogulj, N. (2002.) Position Specific Morphological Characteristics of Top-Level Male Handball Players. Coll. Antropol. 26, 1: 219-227, Zagreb.
- Vujović, D., Lozovina, V., Pavičić L. (1986). Some differences in anthropometric measurements between elite athletes in water polo and rowing. Kinanthropometry III. , Edited by Thomas Reilly, James Watkins and Jan Borms, Published in the USA by E./F.N. Spon 29 West 35th Street, New York NY 10001, ISBN 0 419 13970 2.

Rukopis primljen: 1. 6. 2010.