

FACTOR ANALYSIS OF MORPHOLOGICAL CHARACTERISTICS OF YOUNG ELITE SWIMMERS OF BOSNIA AND HERZEGOVINA

Damir Đedović¹, Almir Popo² and Indira Mahmutović²

¹ Sport Association, City of Mostar, Bosnia & Herzegovina

² Faculty of Education, University "Džemal Bijedić", Mostar, Bosnia & Herzegovina

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Abstract

On the sample of 10 selected swimmers, national junior champions and national junior record holders of B&H, was applied a system of 26 morphological variables. The main issue was to determine quantitative degree of correlation of hypothesis factors which are responsible for correlations between manifest variables in this research. The number of morphological variables was reduced with relatively less number of independent latent variables. Those latent morphological variables can explain mutual relations of analysed set of manifest variables in tested swimmers. Three independent morphological factors were determined: longitudinal dimension factor, factor of free fat and transversal dimension factor. Those factors were in the certain degree related. Orthoblique factors were revealed relation between longitudinal dimension and transversal dimension with high correlation 0.7609, while factor of free fat was separate factor. The most marked morphological separate variables were variables of transversal dimensionality: wrist diameter (ADRZ), knee diameter, ankle diameter, hand bandwidth (ASSA), foot bandwidth (ASST), biacromial bandwidth (ABIK). It is obvious that specially formed structures of morphological dimensions of elite level swimmers are result of genetic predisposition, selection and training process in swimming.

Key words: morphology, young elite swimmers, factor analysis

Introduction and aim

Morphological characteristics of the athletes describe the material of his body. Constitutional characteristics are particularly important factor for success in sport. Every sport places specific demands in relation to body build, and the sports complex, even for individual roles and playing positions and characteristics differ. Morphological status of athletes is an important component that affects the functional ability of the organism and causes predisposition for certain sports. Swimmers, perhaps more than other athletes, conditioned by their morphological structure and adapted to work in the medium in which the anthropometric characteristics come to the personal expression.

Many authors have studied the morphology of the swimmers and their impact on performance in swimming, so (Popo, 2009) conducted research of 10 promising swimmers representatives of BiH, and make certain conclusions about the influence of anthropometry on the results in swimming, (Leko and Grcic -Zupčević, 1990) carried out research on a sample of 77 girls with the aim of determining the predictive value of a specific set of anthropometric dimensions to the speed of learning swimming. Relations special motor in relation to the efficiency of learning are engaged in swimming (Volčanšek and Matkovic, 1990), a sample of 118 boys. Čolić and Volčanšek (1990) on the same sample is trying to provide the scientific basis of the problem parameters influence on the performance tests, anthropometry learning swimming. The most significant relationships were observed between swimming performance and biological age.

The oldest girl, according to the expectations of the author, and were most mature physically. Moreno et al. (1995) were investigated included 272 swimmers quality levels in the 100 and 200 meter events front crawl technique. The subject of this study consisted of determining anthropometric and technical scale swimmers. Stager and Babington (1995) speak about the changes that occurred in the U.S. swimmer in the last two decades, with respect to biological maturity. The population of competitors is now older and it seems that the sport is now dominated by those who would later mature and characterized by greater body height and shoulder width. As can be seen dealing with this problem and most other research consists in finding a complex morphological dimension that is most ideal for achieving top results in swimming. Accordingly, the aim of this study consisted in determining the efficiency of the transformation process of programmed swimming training on the morphological dimensions to determine the structure of the national team swimmer tested BiH.

Methods

Measurements provided in this study were conducted at the Center for diagnostic studies at the Faculty of Sport and Physical Education in Sarajevo. Testing was conducted on a sample of 10 (ten) swimmers, state representatives of BiH in swimming, the participants state championships BiH 2007th. For the final treatment results were included respondents who participated in the measurement and control in the competition and diagnostic testing after the championship.

In the selection of variables taken into account that they suit the characteristics of the respondents age, physical conditions and the available instruments, but above all to well cover most of the four-morphological space, and hypothetical factors isolated in previous relevant research. Accordingly, the choice of variables, in order to swimmers in this study can objectively describe the morphological dimensions that define them. This choice is made according to commonly accepted models of the structure of morphological space. From the analysis included it is presented factor analysis with orthoblique parallel solution (Bonacin, 2004).

Table 1. Variable of morphological space

Longitudinal dimensions	
AVIT	Body height
ADUR	Arm length
ADUN	Leg length
ADPL	Forearm length
ADPK	Tibia length
ADST	Feet length
Body weight and volume	
ATEZ	Body weight
AOGK	Mean chest circumference
AOTR	Abdominal circumference
AONL	Upper arm circumference
AOPL	Forearm circumference
AONK	Thigh circumference
AOPK	Leg circumference
Transverse dimensions	
ABAK	Biacromial range
ADIL	Diameter of the elbow
ADRZ	Diameter of the wrist
ADIK	Diameter of the knee
ADSK	Diameter hock
ASSA	Hand width
ASST	Feet width
ABIK	Bikristal range
Subcutaneous adipose tissue	
ANNL	Upper arm skinfold
ANPL	Forearm skinfold
ANTR	Abdominal skinfold
ANPK	Tibia skinfold
ANLE	Skinfold of the back

Results and discussion

Model of this study is defined in such a way as to identify a problem that should be explored, and procedures for processing are defined only after the problem thoroughly box set. Such behaviour help to avoid usage of irregular methods of treatment, because due to the complexity of a large number of well-known method simply inapplicable. This is especially true in a situation that is often encountered in sport, and these are small samples, where the rule entirely different statistical rules rather than in large samples. In fact, as you know, good research can be done if the sample only one participant, but then the problem of the framework and model of data processing must be special. Precisely such a situation, in this study.

As seen in Table 2 variable in morphological space in the clearest way to show that the morphological parameters of swimmers largely specific and as such are crucial to understanding the results of the swimming sport and develop the training process.

Table 2. Morphological oblique factors

	OBQ1	OBQ2	OBQ3
AVIT	0.91	-0.05	0.09
ADUN	0.87	-0.02	0.05
ADPL	1.04	-0.05	-0.06
ADPK	1.09	-0.10	-0.14
ADST	0.54	-0.07	0.49
ADUR	1.02	-0.01	-0.22
ABAK	1.01	-0.06	-0.15
ADIL	0.81	-0.18	0.26
ADRZ	0.34	-0.05	0.61
ADIK	-0.15	-0.07	1.00
ADSK	-0.38	-0.03	1.02
ASSA	0.24	0.22	0.71
ASST	-0.32	-0.02	1.00
ABIK	-0.40	0.88	0.34
ATEZ	0.76	0.12	0.23
AOGK	0.95	0.18	-0.08
AOTR	0.61	0.44	0.09
AONL	0.54	0.35	0.30
AOPL	0.67	0.22	0.24
AONK	0.32	0.57	0.31
AOPK	0.01	0.05	0.89
ANNL	-0.11	0.95	-0.25
ANPL	-0.17	0.93	-0.12
ANTR	0.17	0.93	-0.27
ANPK	-0.39	0.94	-0.25
ANLE	0.28	0.66	0.26

In morphological space separately obtained three factors. They were obtained in a very specific way. We will start from the third because it is particularly interesting. Transverse dimensions that define this factor were defined by four variables: knee diameter, diameter of the hand, hand breadth and width of the foot. As you can see these are all parts of the distal extremities, which means that the swimmers there is a particular characteristic, whether genetic, either by selection, either themselves training, which produces morphological structure in a way that this is not a common situation as you might in a normal population or populations of other athletes. It may happen that some other athletes have this structure, but we can not say without a deep clean operation in a number of additional research. However, it probably will not always happen to such a structure - to be the distal segments, especially the transverse, so important and highly stressed as they are here. Transversal dimensions of like biakrominal range bikristal range diameter knees are not in this factor, which means that the swimmer is no specific relationship between parts of the body which is responsible for swimming, if you are the best. That is not a world record holder does not mean anything, they were selected and genetically predisposed means and selected and trained, therefore, it is likely that such morphologically complex wishes just for swimming.

What this means in the training process, which in methodological approach, which ultimately means to achieve results is not difficult to imagine. Also there is one thing interesting, and that is that this is the factor that joined the extent of the leg, which means that the extent of the leg (obviously measure of volume) indicates that, on at least a little more belongs to these transverse dimensions. Should not imagine how this man looks like when you would not know its other dimensions. It has emphasized the value of a similar growth pattern of these four elements that we described before and the fifth this band tibia. So, when you perceive to be already formed a picture as a swimmer, a top swimmer in BiH, and we said they are nearing a top, should look like morphology. What this means for training, the methodological approach and the result, it becomes very clear. Another factor is very simple, it is fat, full fat and no other especially pronounced in size, with some highlights bikristal range. This would mean that the adipose tissue similarly growth and development in swimmers have elements bikristal range. Now back to see how these boys look like. It is not excluded that it was desirable for the development of these transverse dimensions do not follow some other parameters and perhaps it is desirable that the growth and development of adipose tissue in terms of energy followed exactly bikristal range, because it is very probable energy segment, but which affects the seaworthiness and perhaps helps propulsive, buoyancy, etc. And, of course, the first factor that brings most of the elements, the most variable takes on himself, which means that the best saturated, consists of fifteen variables, there are all dimensions longitudinal, length dimensions, height, arm length and all other than the feet and hands, the transverse dimensions and, of course, the whole volume. By all accounts training process, selection, and all other products in particular the formation of particular model because it is a kind of capacity (in principle as to the scope of larger muscles capable) of course, that does not fall within the physiological characteristics, but we are talking about mechanical. In this case, expected to be in a particular way (eg, spindle) to develop the muscles of swimmers and significantly differ from those in, for example, basketball or weightlifting. The medium here is different and therefore longitudinalnost and volume related. Accordingly, there is a special characteristic between these two subdimensions that on one dimension. So the first factor as the first dimension, we have two parts which are equally directed, meaning bone growth in length, follows the development of volume, but it goes up to certain limits.

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So, if the first factor, as it is, longitudinal the volume in Table 3 we can see that this is one very specific characteristics of swimmers that is otherwise such, if the transversality associated with distal limb segments to the third factor, and if another factor in adipose tissue, then we need to see how they relate to each other, correlation factors, say the following: first and third are associated with a 0.76, which is quite high, the relationship between the type of volume and body length, ie, long bones, bone growth in length and volume with one hand, very high correlation with that growth transverse dimension of the distal segments, and this is again a special mechanism, which is again likely to feature just swimming and not the other samples, sports, etc.

Tabela 3. korelacije ortoblique faktora

	OBQ1	OBQ2	OBQ3
OBQ1	1.00	0.35	0.76
OBQ2	0.35	1.00	0.17
OBQ3	0.76	0.17	1.00

Adipose tissue is much less connected to these two factors is of course expected. In general, among young athletes, but is not formed, we have soft and hard tissue. Under the soft tissue we include: adipose tissue and muscle tone, volume, the hard tissue growth in length, growth in width. This is not so. For example, this study shows that a morphologically complex swimmer specifically structured.

Conclusion

Based on the research results we can conclude that the morphologically complex swimmer specifically structured. If they are already largely formed swimmers, and to assume that they are, then this is the final result of the operation, selection, genetic predisposition and training. If this is indeed the best and if the measurements are correct (as are), then this is the goal of morphological dimensions, this must be structured in each individual - a swimmer. However, our results should be checked on a much larger sample of top swimmers, so that later we could make some laws that relate to a specific set of morphological elite swimmers. This study showed the direction in which it is possible to focus efforts and knowledge in order to obtain optimal morphological structure that seeks specific swimming model (Đedović, D., 2009).

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FAKTORSKA ANALIZA MORFOLOŠKIH ZNAČAJKI PLIVAČA MLADIH REPREZENTATIVACA BOSNE I HERCEGOVINE

Sažetak

Na uzorku od 10 selekcioniranih plivača, višestrukih prvaka i rekordera, državnih kadetskih i juniorskih reprezentativaca BiH, testirano je ukupno 26 varijabli morfološkog prostora sa ciljem da se precizno kvantitativno utvrdi stepen povezanosti svakog od činilaca za koji se pretpostavlja da su odgovorni za korelacije između manifestnih varijabli koje tretirane ovim istraživanjem. Dakle, u ovom istraživanju je veliki broj međusobno povezanih varijabli u morfološkom prostoru kondenziran i reduciran u manji broj međusobno relativno nezavisnih latentnih varijabli koje mogu objasniti međusobne relacije analiziranog skupa manifestnih varijabli kod testiranih plivača. U morfološkom prostoru zasebno dobijena su tri faktora longitudinalne dimenzije, masno tkivo i transverzalne dimenzije koji su u određenoj mjeri povezani. Naime korelacije ortoblique faktora kažu da je povezanost između longitudinalnih dimenzija i transverzalnih dimezija 0.7609 što je dosta visoko, dok je masno tkivo relativno zaseban faktor. Od pojedinačnih varijabli najizraženije su transverzalne dimenzije dijametar ručnog zgloba (ADRZ), dijametar koljena (ADIK), dijametar skočnog zgloba (ADSK), širina šake (ASSA) širina stopala (ASST), bikristalni raspon (ABIK). U svakom slučaju očigledno je da uvelike formirani plivači, odnosno oni plivači koji se bave vrhunskim plivanjem imaju specifično strukturane morfološke dimenzije koje su finalni rezultat rada, selekcije, genetskih predispozicija i treninga.

Ključne riječi: morfologija, mladi elitni plivači, faktorska analiza

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Correspondence to:

Almir Popo, MSc.

University "Džemal Bijedić"

Faculty of Education

88104 Mostar, Univerzitetski kampus, Bosnia & Herzegovina

Tel: 00 387 (0)62 97 06 23

E-mail: almir.popo@unmo.ba