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DIAGNOSTIC VALUE OF TESTS FOR ESTIMATION AND MONITORING OF SUITABILITY OF YOUTHS FOR KARATE

DIAGNOSTIČNA VREDNOST TESTOV ZA UGOTAVLJANJE IN SPREMLJAVO USTREZNOSTI MLADIH ZA KARATE

ABSTRACT

A group of one hundred and seventy-seven youths, between the ages of ten and fourteen, was examined according to a system of 24 variables (12 morphological, 12 basic motoric variables) with the aim of establishing the diagnostic (factor) value of batteries of tests for the evaluation and monitoring of youths for the sport of karate. By applying the factor analysis (direct oblimin, Kaiser λ≥1.00) in a morphological space, two latent variables were isolated (dimensionality of skeleton and body volume and subcutaneous fatty tissue) as well as two basic motoric latent variables. The first basic motoric latent variable is defined by the variables of the mechanism for the structuralism of movement (coordination), the mechanism of the length of excitation (repetitive-static power) and the mechanism of regulation of the intensity of excitation (explosive power). The second basic motoric latent variable is defined by the variables of mechanism for the regulation of tonus (flexibility). The diagnostic value of batteries of tests for estimation and monitoring of morphological characteristic and basic motoric abilities of youths for karate was established by the factor procedure by means of a matrix of parallel projections (A-matrix); it contains five morphological (body height, shoulder width, wrist diameter, body weight, abdominal skin fold thickness) and five basic motoric variables (standing long jump, hand tapping, leg tapping, body raising for 30 seconds and baton twist).

Key words: karate, youths, morphological characteristics, motoric abilities, diagnostic value

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IZVLEČEK

V raziskavi je sodelovalo sedeminsedemdeset otrok, starih med deset in štirinajst let, ki smo jih proučili glede na 24 spremenljivk (12 morfoloških in 12 osnovnih gibalnih spremenljivk), da bi ugotovili diagnostično vrednost baterije testov za evalvacijo in spremljavo mladine za potrebe športnega karateja. Z uporabo faktorske analize (direct oblimin, Kaiser λ≥1.00) v morfološkem prostoru smo ugotovili dve latentni spremenljivki (dimenzije skeleta in telesni volumen ter podkožno maščobno tkivo), pa tudi dve osnovni gibalni latentni spremenljivki. Prvo osnovno gibalno latentno spremenljivko določajo spremenljivke mehanizma za strukturo gibanja (koordinacija), mehanizma za ohranjanje ekscitacije (repetitivna statična moč) in mehanizma za regulacijo intenzivnosti exscitacije (eksplozivna moč). Drugo osnovno gibalno latentno spremenljivko določajo spremenljivke za regulacijo tonusa (gibljivost). Diagnostična vrednost baterije testov za ugotavljanje in spremljavo morfoloških značilnosti in osnovnih gibalnih sposobnosti mladih za karate smo določili s pomočjo faktorske procedure – matrico vzporedne projekcije (A-matrica); uporabljenih je bilo pet morfoloških (telesna višina, širina ramen, obseg zapestja, telesna teža in kožna guba trebuha) ter pet osnovnih gibalnih spremenljivk (skok v daljino z mesta, dotikanje plošče z roko, dotikanje plošče z nogo, dvigovanje trupa v 30 sekundah ter zvinek s palico).

Ključne besede: karate, mladi, morfološke značilnosti, gibalne sposobnosti, diagnostična vrednost

INTRODUCTION

The growth and advance of karate demands more contemporary approaches, concepts, shapes, contents and procedures in working with young karate players. In order to achieve desirable effects in the training and competitive process of young people, it is necessary to start with a timely and valid trend as well as selection based on modelling a desirable state in advance (a model of complexity, equation of specification) in karate. Following that, appropriate diagnostics, planning, programming and control effects of implementation of the training process are performed (Kajčevski, 1976; Kuleš, 1985; Doder, 1998).

Numerous previous practical experiences and scientific research (Kurelić, Momirović, Stojanović, Radojević & Viskić-Štalec, 1975; Stojanović, Momirović, Vukosavljević & Solarić, 1975; Gredelj, Metikoš, Hošek & Momirović, 1975; Lohman, Roche & Martorell, 1988; Malacko & Popović, 2001) showed that a well-programmed training process can efficiently and successfully transform the status of children and youths.

Only with a timely and valid training process, can the structure of a personality be developed and directed in a desirable way. This depends on receiving reliable return information about the state and changes of primary anthropological characteristics, which are reflected in adequately applied training means, methods and loads. Because of this, it is very important to know the morphological status and development of basic motoric abilities on achievement in sport primarily depends. It is also necessary to constantly develop, control and correct these factors in order to achieve greater results in less time (Malacko & Radjo, 2004).

Contemporary karate appeared as a result of the transformation of the traditional karate. Its basic characteristic is a competition on the basis of application of modern referee rules, and the aim of a competitor is to win with skill. In that way, a new technique for the training process appears that (in addition to studying and practicing) also implies the application of tactical, motoric and psychological techniques. Presently, we can speak about a clearly defined new concept of karate related to the former (Jovanović, 1982; Zulić, Milošević & Božić, 1985; Doder, 2000).

Significant changes appeared when the referee rules were modified, resulting in combat being prolonged from one to three ipons,[1] which led to a new approach in the training process. In combat to two minutes, i.e. to the first point, lower, stronger postures are typical, with less mobility as well as the performance of simple techniques with great explosive strength.

In karate, combat lasts three minutes, i.e. to three points, and competitors wear protective gloves. Combat is more complex with many movements, attacks, defence, counterattacks, and meetings. Because of that, it is necessary to apply strong motoric and psychological techniques and tactics. Postures are higher and mobility is primarily expressed with the application of complex manual and foot techniques. In contrast to traditional karate, combats are done fast, with higher tempo, making combat more dynamic and attractive. It is important to note that foot techniques and cleaning, which led to higher efficiency of action, are increasingly applied.

The training process also underwent significant innovations. One traditional approach, under the influence of Japanese instructors, demanded long-term practising of basic techniques (katas and sparings); nowadays, the period of training and teaching is accelerated and competitors are included in the combat system as soon as possible (Doder, 2002).

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[1]Ipon or "one full point", it is the highest score a fighter can achieve in a Japanese martial arts *ippon-wazari* contest, usually Judo, karate or Jujutsu.

The aim of this research was to establish diagnostic (factor) values of batteries of tests for the estimation and monitoring of morphological characteristics and basic motoric variables of youths for karate. This could make it possible to form more rational procedures for optimal modelling, diagnostics, planning, programming and controlling during the continued selection and performance of a training process.

METHOD

Participants

A sample of one hundred and seventy-seven youths from the ages of ten to fourteen years, from 23 karate clubs in the area of Vojvodina (Serbia) was examined according to a system of 24 variables, 12 of which were morphological and 12 of which were basic motoric variables.

Instruments

For the estimation of morphological characteristics, the following measures in Table 1 were applied:

Table 1: Measures of morphological characteristics

Variable	**Dimension**
Longitudinal dimensionality of the skeleton	
HEIGHT	body height
LLENG	leg length
ALENG	arm length
Transversal dimension of skeleton	
BRESH	shoulder breadth
BREPEL	pelvis breadth
Body volume	
DIAWR	wrist diameter
MIDBUST	middle bust measurement
FOREARM	forearm measurement
MASSBOD	body mass
Subcutaneous fat tissue	
SUPARM	skin fold of upper arm
SABDOM	abdominal skin fold thickness
SBACK	skin fold of back

For the estimation of basic motoric abilities, the following tests in Table 2 were applied:

Table 2: Motor tests

Variable	**Dimension**
Mechanism for the construction of moving	
AIRAG	agility in the air
ARMTAP	arm tapping
LEGTAP	leg tapping

Variable	Dimension
Mechanism for the regulation of tonus and synergy impact	
FORB	forward bend on a bench
LEGST	one-leg standing along the balance beam
STEPFB	step forward with baton
Mechanism for the regulation of duration of excitation	
TORLIF	torso lifting in 30 seconds
PSHUPS	push-ups on parallel bars
HSQEND	endurance in half-squat with weight
Mechanism for regulation of intensity of excitation	
LOJP	standing long jump
TRIJP	standing triple jump
RUN20m	20-m run from a standing start

Procedure

For every applied variable, the following central and dispersion parameters were estimated: arithmetic mean (M), standard deviation, (S), standard mistake of arithmetic mean (Se), minimal value (min) and maximal value (max). The normality of variable distribution was tested by skew (Sk) and kurtosis (Ku). Relations between applied manifested variables for both spaces (morphological and basic motoric) were shown by a matrix of correlation between the manifested variables.

The estimation of the structure of morphological characteristics and basic motoric abilities was accomplished by a factor analysis (direct oblimin); and for the extraction of a number characteristic roots a criterion $\lambda \geq 1.00$ (Kaiser) was applied. Communalities (h^2) were extracted for all applied variables because of obtaining their basic information values.

The structure of latent variables was calculated with the compound of a matrix (A-matrix) that contains parallel projections (coordinates) of variables on factors, followed by the structure of a matrix (F-matrix) containing orthogonal projections of variables on factors, i.e. correlations of variables and factors, as well as factor correlation matrix (M-matrix). The data were processed by the statistical package SPSS 10.0 for Windows.

RESULTS

In Tables 3 and 4, the results of central and dispersion statistic parameters of morphological and basic motoric variables, as well as their discrimination are shown. With the analysing of skew (Sk), variables that have normal (symmetrical) distribution (meaning that the results varies from 0-1.00 of a standard deviation) are marked in bold.

Table 3: Central and dispersion parameters of morphologic variables

Variable	M	S	Se	min	max	Sk	Ku
HEIGHT	148.71	11.13	.83	120.90	182.40	**.41***	.08
LLENG	85.54	7.03	.52	60.30	104.30	**-.04***	.19
ALENG	62.65	5.33	.40	49.60	79.10	**.41***	.17
BRESH	31.71	2.72	.20	25.70	41.50	**.47***	.38
BREPEL	22.72	2.19	.16	18.70	33.40	**.92***	2.37
DIAWR	4.75	.42	.03	3.90	6.00	**.33***	-.25
MIDBUST	69.80	7.06	.53	56.00	91.50	**.64***	.25
FOREARM	20.96	2.20	.16	16.50	32.40	1.37	4.57
MASSBOD	38.65	9.69	.72	22.00	68.00	**.75***	.23
SUPARM	11.43	5.09	.38	4.80	34.00	1.45	2.41
SABDOM	10.95	9.27	.69	3.00	40.00	1.76	2.42
SBACK	9.53	5.98	.44	4.00	34.00	2.16	4.53

Legend: M=arithmetic mean, S=standard deviation, Se=standard mistake of arithmetic, mean, min, max = minimal and maximal result, Sk = skew , Ku = kurtosis

Table 4: Central and dispersion parameters of basic motoric variables

Variables	M	S	Se	min	max	Sk	Ku
AIRAG	155.81	18.36	1.38	118.00	218.00	**.79***	.74
ARMTAP	41.20	6.27	.47	23.00	58.00	**.10***	.06
LEGTAP	53.41	4.96	.37	42.00	68.00	**-.08***	.20
FORB	42.81	6.28	.47	23.00	60.00	**-.12***	.75
LEGST	15.97	9.73	.73	4.00	60.00	2.22	6.78
STEPFB	60.79	10.86	.81	23.00	90.00	**-.51***	1.12
TORLIF	22.10	3.15	.23	14.00	30.00	**-.07***	-.14
PSHUPS	1.49	2.28	.17	0.00	15.00	2.42	7.79
HSQEND	44.05	20.86	1.56	4.00	144.00	**.99***	2.62
LOJP	156.8	25.01	1.87	105.00	240.00	**.41***	.07
TRIJP	486.3	61.31	4.60	260.00	660.00	**.03***	1.47
RUN20M	3.91	.37	.02	3.10	5.30	**.35***	.26

Legend: M – arithmetic mean, S – standard deviation, Se – standard error of arithmetic mean, min, max – minimal and maximal result, Sk – skewness, Ku – kurtosis

Variables: AIRAG – agility in the air, ARMTAP – arm tapping, LEGTAP – leg tapping, FORB – forward bend on a bench, LEGST – one-leg standing along the balance beam, STEPFB – step forward with baton, TORLIF – torso lifting for 30 seconds, PSHUPS – push-ups on parallel bars, HSQEND – endurance in half-squat with weight, LOJP – standing long jump, TRIJP – standing triple jump, RUN20M – 20-m run from the standing start.

By analysing Table 5, it is clear that most of applied morphologic variables do not deviate considerably from the normal distribution (HEIGHT, LLENG, ALENG, BRESH, BREPEL, DIAWR, MIDBUST, MASSBOD) because they do not pass values higher that 1.00 of a standard deviation, whereas the remaining variables (FOREARM, SUPARM, SABDOM, SBACK) are distributed abnormally and their asymmetry is expressed in a positive way, meaning that a number of respondents had greatly decreased values. Furthermore, from Table 4 it is clear that the majority of basic motoric variables, except for two (LEGST and PSHUPS), also do not deviate from normal distribution.

Table 5: Correlation of morphological variables

Variables	1	2	3	4	5	6	7	8	9	10	11
1. HEIGHT											
2. LLENG	.84**										
3. ALENG	.88**	.82**									
4. BRESH	.85**	.74**	.80**								
5. BREPEL	.75**	.62**	.68**	.74**							
6. DIAWR	.81**	.66**	.72**	.73**	.66**						
7. MIDBUST	.76**	.63**	.67**	.75**	.74**	.71**					
8. FOREARM	.66**	.54**	.56**	.67**	.67**	.72**	.75**				
9. MASSBOD	.85**	.71**	.76**	.80**	.80**	.78**	.89**	.79**			
10. SUPARM	.10	.07	.06	.06	.27**	.11	.42**	.35**	.38**		
11. SABDOM	.27**	.14*	.21**	.27**	.46**	.26**	.59**	.53**	.57**	.79**	
12. SBACK	.22**	.13	.16*	.18*	.39**	.20**	.55**	.41**	.50**	.79**	.89**

* $p_{.05} = .138$

** $p_{.01} = .181$

Table 6: Correlation of basic motoric variables

Variables	1	2	3	4	5	6	7	8	9	10	11
1. AIRAG											
2. ARMTAP	.37**										
3. LEGTAP	.42**	.56**									
4. FORB	.24**	.19**	.33**								
5. LEGST	.19**	.27**	.17*	.11							
6. STEPFB	.01	.14*	-.01	.26**	.19**						
7. TORLIF	.35**	.42**	.42**	.27**	.20**	.06					
8. PSHUPS	.33**	.29**	.39**	.30**	.21**	.04	.32**				
9. HSQEND	.24**	.18*	.34**	.34**	.26**	-.17*	.31**	.36**			
10. LOJP	.41**	.49**	.44**	.32**	.18*	.01	.54**	.51**	.27**		
11. TRIJP	.39**	.48**	.43**	.34**	.19**	.09	.50**	.43**	.24**	.68**	
12. RUN20M	.31**	.41**	-.48**	.29**	.17*	.09	.47**	.36**	.26**	.61**	.51**

* $p_{.05} = .138$

** $p_{.01} = .181$

In Tables 5 and 6, in which correlations between single morphologic and basic motoric variables are shown, it can be clearly seen that in a morphological space there are high and statistically important correlations between all applied variables, except for the variable skin fold of upper arm (SUPARM) and basic motoric variable step forward with baton (STEPFB).

With the factorization of matrix of correlation of variables and the application of Kaiser criterion ($\lambda \geq 1.00$), two characteristic roots were obtained, which, in a morphological space, explain the 82.4% mutual variation (CUM %). Moreover, a single contribution explains the first latent variable of 61.8%, and for the second 20.6%, while in a basic motoric space it explains 50.4% of mutual variation, from that for the first latent variable 38.4% and for the second 11.9%.

The interpretation of structure of morphological and basic motoric latent variables was done by the compound of a matrix (A-matrix), which contains parallel projections, i.e. the length of vector coordinates in a coordinate system.

The first latent variable (Lv-1) in a morphological space (Table 7) can be interpreted as a dimensionality of a skeleton and a voluminous body, and the second (Lv-2) as the subcutaneous fatty tissue, in view of defining of all applied variables of skin folds. The values of communalities of single morphological variables (h^2) have high values and vary from .72-.91, indicating that the explained parts of vectors variables are satisfactory, i.e. that manifested variables were measured without significant mistakes. From the matrix correlation it could be seen that there is a statistically significant correlation between isolated morphological latent variables at the level of .28 (R Lv-1 Lv-2).

Table 7: The structure of morphological latent variables

Variables	Lv-1	Lv-2	h^2
HEIGHT	**.97***	-.09	.91
LLENG	**.90***	-.17	.75
ALENG	**.93***	-.15	.81
BRESH	**.93***	-.09	.83
BREPEL	**.77***	.19	.72
DIAWR	**.87***	-.04	.75
MIDBUST	**.74***	.36	.84
FOREARM	**.69***	.30	.69
MASSBOD	**.83***	.28	.91
SUPARM	.02	**.92***	.82
SABDOM	-.09	**.92***	.91
SBACK	.09	**.93***	.88

$R_{Lv\text{-}1\ Lv\text{-}2} = .28$

Legend:

Lv-1 = first latent variable

Lv-2 = second latent variable

h^2 = commonalities of variables

The first basic motoric latent variable (Table 8) is defined by variables of the mechanism for the structuring of movement (coordination), the mechanism of the regulation of the duration of excitation (repetitive and static power) and the mechanism of the regulation of the intensity of excitation (explosive power).

Table 8: The structure of basic motoric variables

Variables	Lv-1	Lv-2	h^2
AIRAG	**-.56***	-.10	.35
ARMTAP	**.75***	-.15	.53
LEGTAP	**.68***	.10	.51
FORB	.25	**.56***	.46
LEGST	.15	**.44***	.26
STEPFB	.37	**-.83***	.66
TORLIF	**.70***	.01	.50

Variables	Lv-1	Lv-2	h^2
PSHUPS	**.52***	.26	.42
HSQEND	.24	**.57***	.47
LOJP	**.81***	.02	.67
TRIJP	**.79***	-.03	.61
RUN20M	**-.75***	-.03	.54

$R_{Lv\text{-}1\ Lv\text{-}2}$=.27

Legend:

Lv-1 = first latent variable

Lv-2 = second latent variable

h^2 = commonalities of variables

The second basic motoric latent variable is defined by the variables of the mechanism for the regulation of tonus, so it can be identified as flexibility, while the variables of static power and balance were only added to the structure of this latent dimension, because they were represented by only one variable, which was insufficient to form special latent variables. Communalities of all applied basic motoric manifested variables are to a large extent low, especially the variable of standing on a beam and agility in the air. From the matrix of correlation, it is noticeable that there is a statistically important correlation between isolated basic motoric latent variables at the level of .27 ($R_{Lv\text{-}1\ Lv\text{-}2}$).

DISCUSSION

Although there is a great interest among school-aged children in karate in recent years, the methodology of teaching of structured movement is still done by the traditional approach. Programmes for belts, competitions and the structure of training are not, to an adequate measure, in compliance with modern trends, which is reflected in the significant drop out of young karate players between the ages of 12 and 14. These factors have a significant influence on the selection of young athletes and achieving top-class results; for these reasons it is necessary to follow and monitor their anthropological status more often.

The main characteristic of karate is mobility of a great intensity and duration, with maximum speed of movement. Speed is a dominant factor in the solving of the technical-tactical tasks of combat, with the application of explosive power and great body flexibility. Karate is performed in aerobic-anaerobic levels of sub-maximum intensity.

The conducted research has shown that among the morphological variables only forearm measurement (FOREARM) and measurements of the subcutaneous fatty tissue deviate significantly from a normal distribution, whose positive measurements of distribution asymmetry show that young karate players have a small amount of fatty tissue, which is of significant importance for that age and sex.

With basic motoric variables, there is a significant deviation from the normal distribution of a variable of standing on a beam and push-ups on parallel bars, in which the distribution of results is negatively asymmetrical, which indicates that respondents had weaker results, i.e. for this age the tasks are too difficult or have a great variability of results (standing on a beam). Practically, that means that the variables of push-ups on parallel bars results are on a relatively low level, which indicates that the training process has not worked enough on the development of basic strength of the arms and shoulder region.

Based on the matrix of variable correlation in the space of morphological characteristics of young karate players, a very high and positive correlation in the segment of longitudinal skeleton dimensionality is noticeable, which varies from .82 to .88. Furthermore, it is observed that the variables for the estimation of longitudinal skeleton dimensionality have a high connection with variables of transversal skeleton dimensionality and a voluminous body.

With the analysis of matrix of correlation of basic motoric variables, it can be observed that variables of explosive strength of legs make one very high homogenous segment. The variable of agility in the air has the greatest connection with the frequency of leg movement and standing long jump, while the variables the frequency of arm and leg movement have the greatest connection with the variable of torso lifting for 30 seconds and the variables of explosive strength.

In conclusion, it is important to emphasize that the examined young karate players of this age are described according to their build, in which a mutual factor of growth and development is dominant, while the individual values of the subcutaneous fatty tissue are not increased, and that there is a statistically important correlation between morphological and basic motoric latent variables.

The diagnostic (factor) value of a battery of tests for the estimation and monitoring of morphological characteristics and basic motoric abilities of youths for karate was established by the factor procedure by means of matrix of parallel projections (A-matrix). It contains five morphological variables (body height, shoulder width, wrist diameter, body weight, abdominal skin fold thickness) and five basic motoric variables (standing long jump, hand tapping, leg tapping, body raising for 30 seconds and baton twist).

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