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RELATIONS OF BASIC AND SPECIFIC MOTOR ABILITIES IN BOXERS

(Original scientific paper)

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Abstract

Research was conducted on 102 (one hundred and two) male subjects, boxers aged 18 to 33 The aim of the research was to verify the relation between basic and specific motor abilities of the Macedonian boxers. To that purpose a predicting system of 21 motor tests for the estimation of the basic motor abilities and a criterion system of 8 motor tests for the estimation of the specific motor abilities was applied. Th impact of the predictive system on the criterion variables was determined by a regression analysis on the latent space. The regression analysis was applied in a way the criterion variables represent the latent dimension, received through a factorization of the situational tests, and the latent motor factors, received through a factorization of 21 manifested motor tests using the varimax method, made up the predicting system of variables. The results of this analysis verify the fact that the predicting, latent and motor systems of variables have a statistically significant impact on the success of the latent criterion variables. Boxers with better coordination (the ability to efficiently change the body direction, rapid alternate moves, better statistical and repetitive power) achieve better results in the latent criterion variable defined as the agility of the cranial-caudal parts of the body. Also, boxers with better explosive power (the ability to mobilize one's energy in short time) and coordination (agility- the ability to efficiently change the body direction, rapid alternate moves achieve better results in the second latent dimension defined as a power-speed factor of the upper extremities endurance. The obtained data can be significant factors in the programming of the transformation processes in boxing, more specifically, with the development of the basic motor abilities the relative specific motor dimensions of the boxers can indirectly grow.

Keywords: *Macedonian boxers, motor coordination, precision placement in boxing, repetitive forces, static force, motor balance, motor flexibility, movements of the cranial-caudal parts of the body, motor coordination, speed-endurance hand, regression analysis; factor analysis*

INTRODUCTION

Boxing as a sport belongs to the group of polystructural acyclic sports where the acyclic unpredictable movements predominate resulting in a binary variable (victory-defeat). Movements are restricted to a direct encounter with the opponent in order to avoid the punch and the destruction.

This complex activity requires the boxer to be versatile throughout the battle and his repertoire has to hold adequate fighting stances (left-sided, right-sided, and front). He also has to posses various tactics for every technique, too. The boxer always has to be ready to fight against various opponents (short, tall, with an opposite stance- "guard stance") (Ćirković, 1978; Kuznjecov, 1980; Savić, 1986; Savić, 1996; Chatzilelekas, 1999; Filimonov (Филимонов), 2000).

The results of the sport activities are also determined by the relations between the anthropological segments and the specific tasks, typical for the given sport. Thus, the chances to program sport activities more efficiently are higher, especially the rational improvement of the movements of the individuals, enabling them to succeed in their sport activities.

The need to expand the boundaries of our scientific knowledge necessitate the conduct of this research. Its aim is to verify the relations between the basic and specific motor abilities of the Macedonian boxers.

METHODS

102 research subjects, male boxers between the ages of 18 to 33 took part in this research. The research subjects are all specified as active boxers (athletes)

from all categories, including boxing contestants in the Macedonian national league championship and contestants competing in the international tournaments. All research subjects are healthy, displaying no physical disabilities or aberrant motor manifestations.

The basic criteria for all subjects to be included in the research were active engage ment in boxing for at least a year, competing and practiceing at least three times a week.

Following variables were used to determine motor abilities: T-test (MTTEST), run-step crisscross (MOSNAV), crane exercise on a balance bench with the eyes opened (MSFOCD), crane exercise on a balance bench with the eyes closed (MSGZOD) and standing leg lift exercise with the eyes opened (MSTGOS), lifting body for 30 seconds (MP30SE), side step exercise (MCEKST), sitting hamstring stretch (MDLPSE), bench forward lean (MDLPRK), arch up exercises (MZGIVI), standing long jump (MSKDAM), leg tapping (MTAPNO), arm tapping in the frontal plane (MTAPRF), arm tapping in the sagittal plane (MATPRS), shooting long arrows toward a target (MSTMDS), shooting short arrows toward a target (MSTKST), kicking a boxing pear (MSTBKR), doing back extensions (MZTHPM), batting (MISKPAL), supine chest throw with a medicine ball weighing 1 kg (MFMPGR), seated medicine ball chest pass, with a medicine ball weighing 1 kg (MFMGST).

The influence of the predicting system on the criterion variables was verified by ~~a~~ the regression analysis of the latent space. To enable the process of ~~a~~ the regression analysis of the latent space a factorization applying the Hotelling method of significant components on the manifested basic and specific motor abilities was used. The number of significant principal components was determined using the Kaiser Guttman criterion. The significant principal components are the ones whose common roots have a value equal or greater than 1.00. The significant principal components are further transformed into an orthogonal varimax position in order to receive a zero correlation of the extracted factors to neutralize the collinearity between the predictors. The normality of the distribution of the anthropological, motor, and psychological variables was tested by the Kolmogorov-Smirnov method.

RESULTS AND DISCUSSION

In the regression analyses, the criterion variable represents the latent dimension, determined with a factorization of the situational tests (Table 1.). The system of the predicting variables comprises 6 latent motor factors determined with a factorization of 21 motor tests, determined using the varimax method (Table 2.).

The process of the factorization of the specific motor abilities tests isolates two principal components (Table 2.). They describe 68.71% of the valid variance of the system of the specific motor tests. This percentage satisfyingly covers up the analyzed areas. The first principal component describes 49, 32% of the variance validity of the specific motor abilities tests. The second principal component describes 19.40% of the variance validity.

The measures of the variances of every test or the measures of the communalities (h^2) satisfy the requests of interpreting the extracted latent dimensions, since they are similar to the ones received in the motor ~~cap~~abilities researches. The results show one low communality out of the 8 tests used for this research: rope skipping, 10-second skip (SKJ10S).

The correlations in the tests of the principal components (Table 1.)~~,~~ which enable initial insight of the defining of the isolated factors, show that they are more significant in the first principal component for every test. Most of the tests show high projections in the second principal component. The only exception is the following test: a series of 100 combined punches in the coach's palms (S100RT).

Since the principal components generally (as in this case), cannot completely clarify the given factors they are rotated into a varimax position. The data displayed in Table 1. shows that the highest projections of the first latent specific-motor factor have the following tests: rope skipping, 10-second skip (SKI10S), rate of throwing 100 direct punches at a heavy bag (SP100D), rate of throwing 100 combined punches at a heavy bag (SB100K), cross armed defence from a left-right cross punch and applying 6 punches in the coach's palms (SOLDDK), a series of 100 combined punches in the coach's palms (S100TR). The highest projection, as well as diagnostic validity, has the following test: rate of throwing 100 combined punches at a heavy bag (.91). The same variable can be defined as a factor of the movements of the cranial-caudal parts of the body.

In the second varimax factor high projections have the following tests: 10-second two-leg hop and performing left-right cross punch (SSPLDD), 10-second two-leg hop and performing left-right hook punch (SSPZDK), 10-second two-leg hop and performing left-right uppercut (SSPLDA). The highest projection has the following test: 10-second two-leg hop and performing left-right hook punch (.88). The same variable can be defined as a factor of the power-speed endurance of the upper extremities.

Factorization of the basic motor capability tests isolates six principal components (Table 2.). They describe 69.82% of the valid variance of the system. This percentage satisfyingly covers up the analyzed areas.

The rotation of the initial coordinate system into a varimax position results in six latent motor variables (dimensions). In the first latent dimension the following tests have the highest saturations: standing long jump (MSKDAM), supine chest throw with a medicine ball weighing 1 kg (MFMPGR), seated medicine ball chest pass, with a medicine ball weighing 1 kg (MFMGST). High saturations with the first principal component were found as well in the following tests: arm tapping in the frontal plane (MTAPRF), arm tapping in the sagittal plane (MATPRS), batting (MISKPAL).

The second factor is defined with the following

tests: T-test (MTTEST), side step exercise (MCEKST), run-step crisscross (MOSNAV). This factor can be interpreted as coordination or, according to the functional accessibility evaluator of the motor capabilities, as mechanism structuring the moves. It is mostly defined by the tests in which the results depend on the ability of fast performance of the move with a change of direction (agility). A rather high projection of this factor has the variables: arm tapping in the frontal plane (MTAPRF) and arm tapping in the sagittal plane (MATPRS). This indicates that a successful carrying out of the tests of the research subjects is more dependent on the ability of a good cortical regulation and explosiveness, rather than the ability of a fast excitation and inhibition of the agonists and antagonists.

In the third latent variable the statistically significant tests with rather high projections are the following: shooting long arrows toward a target (MSTMDS), shooting short arrows toward a target (MSTKST) and kicking a boxing pear (MSTBKR). This factor can be defined as a punch accuracy.

The fourth factor has the highest projections in the following tests: lifting the body for 30 seconds (MP30SE), arch up exercises (MZGIVI) and doing back extensions (MZTHPM). According to the phenomenological approach, this factor is interpreted as power; while according to the functional approach it is interpreted as a mechanism that regulates the duration of the excitation.

The fifth latent variable is defined by the following tests: crane exercise on a balance bench with the eyes opened (MSGOCD), crane exercise on a balance bench with the eyes closed (MSGZOD) and standing leg lift exercise with the eyes opened (MSTGOS). This factor can be defined as the balance factor.

The sixth factor is assigned as flexibility and it is determined by two tests, both of which in the Hotelling

Table 1. Factor analysis of the situational-motor tests

Variables	H1	H2	h^2	V1	V2
SPJ10S	-,60	-,34	,48	**-,68**	,15
SB100U	,75	,37	,70	**,81**	-,23
SB100K	,75	,53	,84	**,91**	-,12
SSPLDD	-,63	,51	,66	-,13	**,80**
SSPZDK	-,71	,55	,80	-,15	**,88**
SSPLDA	-,70	,52	,76	-,17	**,86**
SOLDDK	,72	-,14	,54	**,44**	**-,59**
S100RT	,73	,41	,70	**,81**	-,19
Lambda	3,95	1,55			
%	49,32	19,40			

Table 2. Factor analysis of the basic motor abilities tests

Variables	H1	H2	H3	H4	H5	H6	h^2	V1	V2	V3	V4	V5	V6
MTTEST	-,31	,60	,29	-,08	,30	-,13	,66	,00	**,79**	,04	-,11	-,16	,06
MOSNAV	-,33	,71	,36	-,14	,01	,13	,79	,13	**,78**	-,09	-,37	,03	-,13
MCEKST	-,50	,43	,50	-,12	,21	,04	,75	-,19	**,82**	-,13	-,13	,12	-,05
MSGOCD	,48	-,11	,59	-,01	-,23	,23	,71	,30	-,02	,25	,08	**,73**	-,13
MSTGOS	,15	-,29	,62	,16	,00	,45	,71	-,01	,03	-,05	,07	**,83**	,14
MSGZOD	,21	-,51	,57	,18	-,10	-,06	,68	-,25	-,15	,32	,26	**,65**	-,01
MTAPNO	,54	-,03	-,19	-,02	,07	-,33	,44	**,31**	-,25	**,40**	,28	-,21	,05
MTAPRF	,78	,04	-,20	,08	-,21	,33	,81	**,72**	**-,48**	,13	-,07	,19	,10
MATPRS	,80	,09	-,23	,07	-,27	,28	,85	**,74**	**-,49**	,18	-,11	,14	,04
MSTMDS	,65	,28	,20	,26	-,17	-,40	,80	,37	-,04	**,81**	-,04	,06	,04
MSTKS	,55	,18	,41	,34	-,16	-,39	,80	,21	,05	**,83**	-,03	,25	,06
MSTBKR	,54	-,10	,09	,21	,04	-,24	,42	,20	-,21	**,50**	,20	,11	,17
MDLPRK	,24	-,12	,08	,54	,57	,12	,71	,01	-,02	,13	,17	,16	**,80**
MISKPAL	,45	,45	-,21	,03	-,07	-,05	,45	**,55**	-,02	,26	-,17	-,22	,05
MDLPSE	,11	,21	-,25	,70	,37	,18	,78	,09	-,06	,07	-,29	-,13	**,81**
MZTHPM	,30	-,49	,16	-,36	,20	-,23	,57	-,01	-,15	,10	**,71**	,13	-,15
MP30SE	,36	-,47	,07	-,31	,36	-,13	,60	,07	-,16	,03	**,74**	,09	,03
MZGIVI	,62	-,21	-,03	-,39	,36	,18	,74	,54	-,16	-,10	**,62**	,12	,09
MSKDAM	,74	,17	-,05	-,08	,30	,05	,68	**,68**	-,05	,23	,31	,00	,25
MFMPGR	,70	,49	,07	-,30	,16	,06	,86	**,86**	,22	,22	,18	-,02	,00
MFMGST	,76	,39	,05	-,32	-,05	,08	,85	**,86**	,05	,24	,13	,06	-,15
Lamda	5,83	2,73	2,04	1,69	1,26	1,11							
%	27,74	13,01	9,73	8,06	5,98	5,30							

Table 3. Regressive relations between the motor tests and the criterion variable FAKT1 (factor of the mobility of the cranial-caudal parts of the body)

	Variables	R	Part-R	Beta	T-test	Q
1	MOT1	-,16	-,18	-0,16	-1,64	,11
2	MOT2	,39	,42	0,39	4,09	**,00**
3	MOT3	-,14	-,17	-0,14	-1,51	,13
4	MOT4	-,21	-,24	-0,21	-2,17	**,03**
5	MOT5	-,11	-,13	-0,11	-1,15	,25
6	MOT6	-,12	-,14	-0,12	-1,31	,20
R .519			R^2 .260		Q.000	

Table 3. Regressive relations between the motor tests and the criterion variable FAKT2 (power-speed factor of the endurance of the upper extremities)

	Variables	R	Part-R	Beta	T-test	Q
1	MOT1	,31	,34	0,31	3,20	**,00**
2	MOT2	-,26	-,29	-0,26	-2,68	**,01**
3	MOT3	,17	,19	0,17	1,73	,09
4	MOT4	,17	,19	0,17	1,72	,09
5	MOT5	,09	,11	0,09	0,97	,34
6	MOT6	-,06	-,07	-0,06	-0,58	,56
R .485			R^2 .236		Q.001	

method are selected for measuring the latent variable.

The results of the regression analysis on the latent space (Table 3.) show that the predicting system has a statistically significant positive effect on the first criterion latent variable coming from the factorization of the specific manifest tests. We get the second latent dimension with a factorization of the basic motor abilities test, defined as coordination, or, according to the functional approach, as a mechanism that structures the moves. The fourth latent dimension is defined as a repetitive and static strength.

Boxers with better coordination, agility (the ability to efficiently change body direction and position), a higher speed rate of various punches, (speed rate of the moves of the upper extremities), better developed body, arm and torso musculature, achieve better results in the criterion variable defined as factor of the mobility of the cranial-caudal parts of the body.

Table 4. displays the results of the regression analysis of the second criterion latent variable, obtained by the specific motor ability tests. The predicting system shows a statistically significant positive effect on the criterion in the first motor latent dimension defined as explosive power, the second motor latent dimension defined as coordination, or, according to the functional approach, as a mechanism that structures the moves. The subjects with better explosive power (the ability to mobilize one's energy in short time) and coordination (agility- the ability to efficiently change the body direction, rapid alternate moves, better statistical and repetitive power) achieve better results in the second latent dimension obtained by the factorization of the specific motor abilities tests.

Similar results on the research of the basic and specific motor abilities the boxers can be found in the research of Blashkovic and Savic (Blašković, 1977; Savić, 1986; Savić, 1996).

The results indicate that in order to carry out the tests for specific motor abilities boxers require basic motor ability. This ability has an integral-interactive basis which confirms that one segment of the anthropological status cannot develop if the other segments are inactive for that segment's effects. The data can be significant factors in the programming of the transformation processes in boxing, more specifically, with the development of the basic motor abilities the relative specific motor dimensions of the boxers can indirectly grow.

CONCLUSION

According to the obtained results, we can conclude that:

- The predicting system of the latent motor

variables has a statistically significant effect on the success of the latent criterion variables.

- The boxers with better coordination, agility (the ability to efficiently change the body direction), higher speed rate of various punches, better static and repetitive strength achieve better results in the latent criterion variable defined as the factor of the mobility of the cranial-caudal parts of the body.
- The subjects with better explosive power (the ability to mobilize one's energy in short time) and coordination (agility- the ability to efficiently change the body direction, rapid alternate moves, achieve better results in the second latent dimension defined as a power-speed factor of the upper extremities endurance.

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