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COMPARATIVE ANALYSIS OF MOTOR SKILLS FOR BOXERS WITH DIFFERENT COMPETITIVE LEVEL OF THE COMPETITION SUCCESS IN THE REPUBLIC OF NORTH MACEDONIA

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Abstract: *This research was conducted on a selected sample of 87 male respondents, boxers at the age of 18 to 33 years with the aim to determine if there are some differences in motor skills between boxers with different levels of competitive success. The sample is divided into three sub-samples according to the competitive success as follows: I category of 20 boxers who achieved the best sport results in the boxing from the Republic of North Macedonia, participating in the World, European and other international tournaments, II category of 25 of boxers who participated in international tournaments, domestic tournaments, Republican league and state championships and III category of 42 boxers who participated in international tournaments, domestic tournaments, Republican league and state championships but had not achieved significant sport results. For assessment of the motor skills a system of 21 motor tests was applied. The differences in the general motor tests between the boxers with different levels of competitive success are determined by the covariance analysis with the partition of weight and height. Based on the results it can be concluded that the significant basic motor skills which differentiate the boxers with different levels of competitive success is the coordination – agility, the strength of the muscles of the arms and the shoulder area, the speed of the frequency of upper extremities, the explosive strength of upper and lower extremities and the placement precision. The results from this research can help the coaches to properly plan and program the work with the boxers during the training process.*

Key words: *motor tests; boxers; weight categories; analysis of covariance.*

INTRODUCTION

Boxing belongs to acyclic type of sport and motions in the sport are performed and developed with varying intensity and carry the speed – strength character. It belongs to the group unpredictable – non-standard movements that are tied to immediate response to changing the external conditions. The characteristic of the boxing is to be performed in direct relation of fighting with an opponent. During the fight, the boxer finds an opponent of whom resistance must be overcome, to predict his intentions which should be perceived and to achieve the desired goal that is often inflicting more powerful hits to the head and body while simultaneously achieving the timely defense of the vital points.

The technique in boxing has a complex structure. In the derivation of the movements the muscles in various topological regions participate with the activity of all joints. The different mechanisms of different levels inhibit time synchronously or successively, individual muscles or muscle group, more or less successfully to perform the technique, depending on the comprehension of the basic techniques (Ćirković 1978; Savić 1986ab; Savić 1996; Chatzilelekas 1999; Filimonov 2000).

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The process of the selecting, orientating and following the field of the boxing (sport), can not be imagined without knowledge of the motor characteristics of the boxers. In general, looking the motor skills undeniably affects the results of sport achievement. The individual contribution of different motor dimensions is remarkably different and unequal in each sport activity. This fact corresponds to a better discrimination between sporting disciplines, but, also, in the area of motor skills, and this will be reflected in the efficiency of the process of orientation.

Motor skills denote those skills of boxers participating in solving motor tasks and conditional successful movements gained by training.

Therefore, the main goal of this research is to determine whether there are differences in some common motor skills among boxers with different levels of competitive success in the Republic of North Macedonia.

METHODS OF WORK

Sample of respondents

The research is realized on a selective sample of 87 male respondents, boxers at the age ranging from 18 to 33 years. The population from which the sample is derived is defined as a population of active sportsman of all categories, participants, competitors in the league system, the state championship of the Republic of North Macedonia.

The sample is divided into three sub-samples according to the competitive success as follows: 20 of I – category sportsman (boxers) who achieved the best results in boxing from the Republic of North Macedonia participating in World, European and other international tournaments, 25 of II – category sportsman (boxers) who participated in international, domestic competitions, Republican league, state championships and 42 of III – category sportsman (boxers) who participated in domestic competitions, Republican league, state championships and had not noticed significant sports results.

Assessment of the Motor Skills

For assessment of the motor skills the following variables, i.e. motor tests are applied: T-test (MTTEST); eights by bowing (MOSNAV); steps on side (MCEKST); standing on one leg on the balance beam at length with open eyes (MSGOCD); standing on one leg on the balance beam at width with open eyes (MSTGOS); standing on one leg on the balance beam at length with closed eyes (MSGZOD); tapping with foot (MTAPNO); tapping with hand in frontal plane (MATPRS); shooting at target with a long stick (MSTMDS); shooting at target with a short stick (MSTKST); shooting at a boxing bulb by hand (MSTBKR); deep forward bend on bench (MDLPRK); Shoulder Rotation Test (MISPAL); deep forward bend by sitting (MDLPSE); keeping the trunk in horizontal position facing down (MZTHPM); raising the trunk for 30 seconds (MP30SE); pull-ups in the air shaft (MZGIV); long jump from place (MSKDAM); throwing a medicinal ball of 1kg from a position lying on back (MFMPGR); throwing medicinal ball of 1kg from sitting in chair (MFMGST).

The planned basic motor tests were measured by the method recommended by D. Metikos and the associates (1989), in the proposed model for estimation of the basic motor dimensions of the boxers.

Statistical analysis

The differences in motor skills for boxers with different level of competitive success were compared by one way analysis of covariance (ANCOVA). Multiple comparisons between pairs of groups were carried out according to the LSD- test. In this analysis, weight and height were controlled as covariates. Statistical analysis was performed using the SPSS 22.0 for Windows (Statistical Package for the Social Sciences, version 22.0, SSPS Inc, Chicago, IL, USA).

RESULTS

For all applied variables in the research the basic descriptive statistical parameters are calculated such as: arithmetic means (Mean), standard deviation (Std. Dev.), the lower and upper limit of the range in which the results move (Min and Max), skewness-symmetry (Skewness), Kurtosis – elongation or flattening of the distribution (Kurtosis), and Kolmogorov-Smirnov test (K–S) by which are tested the normality and the distribution. The results of these analyzes are shown in the Tables 1.

From the review of Table 1, it can be seen that the values of the skewness in motor test is within the recommended values from -1 to +1 indicating that the distribution of the results is approximately symmetrical. Negative asymmetry (hypo-kurtosis) is seen only in motor skills tests – Shoulder Rotation Test. Positive asymmetric – epi-kurtosis (the majority of the results are in the area of better), can be seen only in test shooting at target with long stick. From the kurtosis of the values (Table 1) show flattening (plateau-kurtosis distribution).

Table 1. *Basic descriptive statistical parameters and the normality of the distribution of motor test*

	Mean	Min	Max	Std.Dev.	Skewness	Kurtosis	K-S
MTTEST	112,71	96,00	128,00	7,70	0,13	-0,63	p > .20
MOSNAV	202,00	165,00	230,00	13,90	-0,03	-0,56	p > .20
MCEKST	102,29	80,00	128,00	9,84	-0,02	0,13	p > .20
MSGOCD	53,41	20,00	120,00	18,94	1,00	1,56	p < ,05
MSTGOS	33,56	12,00	70,00	12,34	0,79	0,49	p > .20
MSGZOD	26,80	16,00	50,00	6,22	0,77	1,24	p > .20
MTAPNO	26,46	23,00	33,00	1,73	0,52	1,34	p < ,20
MTAPRF	35,52	27,00	44,00	3,27	0,15	0,74	p > .20
MATPRS	35,03	27,00	47,00	3,56	0,35	1,44	p < ,20
MSTMDS	80,16	69,00	91,00	4,37	-0,19	-0,08	p > .20
MSTKST	82,83	69,00	92,00	4,69	-0,32	-0,10	p > .20
MSTBKR	9,71	9,00	10,00	0,46	-0,96	-1,11	p < ,01
MDLPRK	37,86	24,00	52,00	4,52	-0,22	2,17	p > .20
MISPAL	101,10	77,00	127,00	10,60	-0,25	-0,01	p < ,10
MDLPSE	59,62	21,00	78,00	12,10	-1,50	1,90	p < ,05
MZTHPM	72,44	20,00	120,00	23,28	0,18	-0,44	p > .20
MP30SE	31,59	20,00	41,00	3,66	-0,29	0,84	p > .20
MZGIVI	13,76	3,00	26,00	5,40	0,22	-0,38	p > .20
MSKDAM	211,11	170,00	250,00	17,80	0,11	0,13	p > .20
MFMPGR	1294,08	700,00	1800,00	201,78	-0,26	0,42	p > .20
MFMGST	839,53	480,00	1200,00	129,95	0,43	0,59	p > .20

The results from Kolmogorov-Smirnov procedure showed that most motor tests are normally distributed. Derogation from the normal distribution is observed in motor skills test MSTBKR on level .01.

Based on these results, especially because in most variables there is normal distribution of their results, it can be concluded that the degree of normality distribution of the applied manifest variables, meets the necessary methodological and statistical criteria for the application of fair and justified multivariate and univariate statistical procedures for further processing of the obtained data.

Table 2. *Univariate analysis of covariance between group differences in motor tests between boxers with different levels of competitive success.*

Varible	I group		II group		III group		F	Sig.	η^2	Pairwise comparisons
	Mean	SD	Mean	SD	Mean	SD				
MTTEST	108,32	6,84	111,30	6,63	115,01	7,63	5,77	,005	,12	1 & 3; 2& 3
MOSNAV	189,55	8,90	200,76	15,33	207,01	11,73	11,92	,000	,23	1 & 2; 1 & 3
MCEKST	96,28	8,96	99,47	9,93	105,91	8,68	7,93	,001	,16	1 & 3; 2& 3
MSGOCD	55,08	26,33	56,00	18,51	51,43	16,29	,53	,593	,01	ns
MSTGOS	35,87	16,01	33,76	8,02	32,66	12,96	,39	,680	,01	ns
MSGZOD	29,09	6,66	26,68	6,27	26,08	5,96	1,39	,255	,03	ns
MTAPNO	27,07	2,16	26,74	1,78	26,10	1,51	2,70	,073	,06	ns
MTAPRF	37,60	4,04	35,71	3,31	34,69	2,62	6,13	,003	,13	1 & 2; 1 & 3
MATPRS	36,80	4,43	35,25	3,34	34,30	3,13	3,86	,025	,09	1 & 3
MSTMDS	80,98	5,48	80,61	4,23	79,64	4,03	,93	,400	,02	ns
MSTKST	82,40	6,27	84,04	4,06	82,32	4,47	1,23	,299	,03	ns
MSTBKR	9,86	0,34	9,83	0,44	9,60	0,49	3,12	,050	,07	1 & 3; 2& 3
MDLPRK	38,93	5,65	39,07	5,25	36,83	3,50	2,50	,088	,06	ns
MISPAL	99,44	10,17	100,86	10,09	101,82	10,78	,44	,646	,01	ns
MDLPSE	60,36	14,65	59,12	13,72	59,64	10,30	,05	,948	,00	ns
MZTHPM	83,12	29,38	74,24	23,27	67,74	19,64	2,81	,066	,06	ns
MP30SE	33,51	4,76	31,78	3,61	30,81	3,06	3,41	,038	,08	1 & 3;
MZGIVI	18,15	6,02	13,29	5,36	12,49	4,43	7,69	,001	,16	1 &2; 1 & 3
MSKDAM	219,32	21,69	213,45	21,96	206,99	12,16	6,13	,003	,13	1 & 3

MFMPGR	1333,49	236,33	1266,10	204,30	1295,58	165,88	1,58	,212	,04	ns
MFMGST	886,28	150,96	834,72	111,46	825,88	121,58	3,10	,050	,07	1 & 3

Different letters represent the statistically significant differences between the group means according to ANCOVA (For all Leven's F statistics p>0.05)

Table 2 shows the results of applied univariate analysis of covariance by which are determined differences between groups in motor tests in boxers with different levels of competitive success.

Statistically significant univariant intergroup differences when height and weight of the body is controlled as covariance among boxers with different levels of competitive success is determined in motor tests: MTTEST (F=5,77; p=,005), MOSNAV(F=11,92; p=,000),MCEKST (F=7,93; p=,001), MTAPRF (F=6,13; p=,003), MATPRS (F=3,86; p=,025), MSTBKR (F=3,12; p=,050), MP30SE (F=3,41;p=,038), MZGIVI (F=7,69; p=,001), MSKDAM (F=6,13; p=,003) and MFMGST (F=3,10; p =,050).

From the values of the corrected arithmetic means and the level of the statistical significance of Post hoc-tests, it can be noted that the I category of the boxers statistically significantly differ in the motor tests: "T-tests" (MTTEST): eights with bowing (MOSNAV); steps on side (MCEKST); tapping with hand in frontal plane (MATPRS); shooting at boxing bulb with hand (MSTBKR); raising the trunk for 30 seconds (MP30SE); pull-ups in the air shaft (MZGIVI); long jump from place (MSKDAM) and throwing medicinal ball of 1kg from sitting in chair (MFMGST) when compared to those of III category of boxers. Among the respondents of I category of boxers and II category of boxers statistically significant differences are determined in the motor tests: eights with bowing (MOSNAV); tapping with hand in frontal plane (MATPRS) and pull-ups in the air shaft (MZGIVI). Among the respondents of II category of boxers and III category of boxers statistically significant differences are determined in the: "T-tests" (MTTEST); steps on side (MCEKST) and shooting at boxing bulb with hand (MSTBKR).

DISCUSSION

While boxing sport in Europe and in the world is experiencing an upward trend, in our country, recent years (despite modest results), this sport has stagnated and is not progressing as it is expected. What is the reason for boxing as a sport that does not show results which should objectively be expected given the desire and showing greater interest in the boxing sport. This paperwork will try to answer the question in which general motor abilities differentiate the boxers with different level of competitive success.

The results of our research indicate that good coordination, agility (the ability to quickly perform movement by changing the direction and performance of the complex and intricate movement) are important for achieving top results in boxing. The performance of complex exercises (has a complex coordination structure) the greater is the difference between the best and the weakest boxers. The differences are particularly manifested in the variable eights by bowing where I category of boxers stands in relation to the boxers of II and III category. The differences can be explained by the fact that I category of boxers are more involved in the training process, have more matches (experience) and thus a better coordination (they perform faster and easier the complex movements) which is revealed the outcome and success of the games.

In the tests for assessing the repetitive force (raising the trunk for 30 seconds and pull-ups in the air shaft) the I category of boxers also achieve best results. The strength (especially the repetitive) enables the boxer repeatedly to repeat the hit in the series, stand the fight, which is characterized by continuous movements, defense and counter hits. The fight in boxing is characterized by the participation of the entire musculature, which clearly shows the great importance of the strength for success in the sport.

The speed or more precisely, all kinds of speed (speed of reaction, speed of individual movements, segmental speed and frequency speed) allow the boxer timely to quick perform of individual hits, perform a greater number of hits per unit time, fast movement in the ring, effectively using the techniques of attack and counter-attack. Also, the speed allows the boxer timely to response from the opponent attacks, effective application of the defense equipment.

The precision placement (ability of the boxers to perform precision hits with his hand) is the ability on which the success in the boxing directly dependent. Shooting the target whose surface is very small in the box, and that are the vital points of the opponent (the tip of the chin, temporal part of the head, heart, plexus solaris, etra and so on) it is the quality that should possess the boxers. Especially, the precision during the fight which is necessary for boxers with their fists is important, hands to retain the hits that would neutralize the

impact forces, to reject hits as what is required to be able to put the counter attack, to be able to perform precise movements with the head required in the technical and tactical part.

The explosive strength of the lower extremities are abilities in which boxers from the I category vary in relation to the weaker category of boxers. The level of the explosive strength, especially of the hands and shoulder belt, can inflict to the opponent heavy and dangerous hits, but with a single hit the boxers can also solve the fight in his favor. The explosive strength of the legs is also important in boxing, because it allows the boxer to perform quick movements to or from the opponent.

The obtained results in the variables covering the space of balance and flexibility showed no statistically significant differences between boxers with different level of competitive success.

Based on the obtained results it can be concluded that the significant basic motor skills in which differ boxers with different levels of competitive success is coordination, agility, strength of the abdominal (stomach) muscles, arms and muscles of the shoulder belt, speed of the frequency of the upper and lower extremities and the precision placement of the hits.

Modern boxing requires form the contestants the maximum physical, technical-tactical and psychological preparedness at the highest level, and comprehensive in its repertoire of performance of the hits or series, they should have particular specificity for different tactical maintenance of the fight.

The results of this research can help coaches properly to plan and program the work with the boxers with different morphological structure, and even greater extent on the development of those motor skills that mostly depends on success in this sport, better development of other positive anthropological dimensions, i.e. reduction of negative anthropological dimensions which can be a significant connection with motor skills and direct or indirect with the characteristics that are specific to different types of morphological structure.

CONCLUSION

On the basis of the obtained results it can be concluded that the I category of boxers achieve better results in the motor tests: "T-tests" (MTTEST): eights with bowing (MOSNAV); steps on side (MCEKST); tapping with hand in frontal plane (MATPRS); shooting at boxing bulb with hand (MSTBKR); raising the trunk for 30 seconds (MP30SE); pull-ups in the air shaft (MZGIVI); long jump from place (MSKDAM) and throwing medicinal of 1kg from sitting in chair (MFMGST) when compared to those of III category of boxers. Among the respondents of I category of boxers and II category of boxers statistically significant differences are determined in the motor tests: eights with bowing (MOSNAV); tapping with hand in frontal plane (MATPRS) and pull-ups in the air shaft (MZGIVI). Among the respondents of II category of II category of boxers and III category of boxers statistically significant differences are determined in the: "T-tests" (MTTEST); steps on side (MCEKST) and shooting at boxing bulb with hand (MSTBKR).

The morphological structure of the body and the possibility of the impact of the different external stimuli finds a great use in the practice of kinesiology. The resulting structure in the motor space, can correct the significant training procedure and to improve and develop in the direction in a more optimal anthropological structure of boxers.

The results of this research can help coaches to properly plan and program the work with boxers in the training process. All this contributes to the training process even more to individualize and realize the programing content to estimate the results in the fight.

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