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EFFECTS OF ADDITIONAL KINESIOLOGICAL OPERATORS ON THE SPEED PROPERTIES OF ATHLETES IN SPORTS OF MONOSTRUCURAL AND POLYSTRUCTURAL TYPE

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Abstract
The research was conducted on a sample of athletes aged 13-15 from BiH, namely 60 athletes and 60 karate players. The participants were divided into groups consisting of 30 athletes and karate athletes. Experimental groups of athletes, in addition to regular training operators, had additional operators, while the control group of athletes and the control group of karate players performed the training process by practicing regular kinesiological operators. A set of nine variables was used to evaluate the speed properties of the investigated sample of athletes. The assessment of segmental velocity was carried out with three common variables, speed in athletes with three variables characteristic of speed assessment for athletes and speed in karate players with three variables specific to the assessment of speed in karate players.
Therefore, the main objective of this research is to determine the effects of the application of additional training operators on the rapid properties of athletes in sports of monostructural and polystructural type. The program of additional kinesiology operators was implemented within five training units during the weekly microcycle. The treated speed properties of athletes in a period of six months, which in addition to the basic program include the program of additional training operators, progressed significantly faster and better within the experimental treatment. Also, positive effects were achieved by applying the basic program in the control sample, but on a somewhat smaller scale. From a kinesiological-methodical point of view, the applied experimental treatment indicates the fact that it has largely contributed to positive effects in the experimental group of athletes in relation to the control group. It is also evident that in both groups of karate players there are positive changes in velocity properties. However, the experimental group sees a significantly better transformation of certain anthropological features compared to the control group. These facts suggest that the application of additional kinesiological operators in the experimental group produced greater effects on the development of rapid properties in the experimental karate team compared to the control group.
Keywords: Effects, kinesiological operators, speed properties, athletes.

INTRODUCTION

This paper sought to determine the changes in speed properties resulting from the application of additional training process operators. Defining the influence of certain anthropological characteristics for success in sport is of great importance for creating guidelines in the development of certain motor skills that ensure the achievement of top results. The ability to achieve results in athletics and karate binds to itself a number of motor skills that facilitate or complicate the path to the goal. Therefore, there is a real need to define these motor skills that greatly contribute to the fulfillment of the conditions for achieving results, as well as their development and the possibility of upgrading. Also important is the ease of application of training operators who have produced positive effects of change, essential for overcoming established.
training models applicable to sports that are monostructural and polystructural, cyclical and acyclic in character in the development of speed properties. Speed, agility and explosiveness training has become a popular way to train athletes. The common name for these three motor skills is speed-explosive properties, i.e. BEA or English SAQ (speed, agility and quickness). The basis of the methodology of training of speed-explosive properties is learning the technique of walking, running, changing the direction of movement, jumping and landing. These are the basic structures of movement that are crucial for successfully playing any sport. SAQ training can be used to increase speed or power, i.e. the ability to exert maximum force at high speed movement (Brown et al., 2003). Speed, explosive strength and agility are the abilities that form the basis in most sports, i.e. they are responsible for success (Milanović, 2007).
Research on the impact of speed, agility and explosiveness (SAQ) training programs on speed, agility and acceleration improvement was conducted by Azmi and Kusnanik (2018). The

results showed that using the SAQ program improved the results in the parameters of speed, agility and acceleration. During speed training, the so-called "speed barrier" often occurs, which is described in their work Speed Barrier by Maršić and Šentija (2010), as well as the methodology of eliminating it. Long-term application of the same training facilities, methods and loads can lead to stagnation in the development of the athlete's speed capabilities. Success in athletics, especially in sprint disciplines, depends on a number of factors. One of them is certainly the period in which the training begins (Babijak 1979). There are many methods for speed development (Bompa 2006), which can be successfully applied to both monostructural type sports (athletics) and polystructural type (karate) sports. These methods were applied through a six-month program of additional kinesiology operators on a sample of athletes and karate players aged 13 to 15 years. According to the above, the main objective of this research is to determine the effects of the application of additional training operators on the speed properties of athletes in sports of monostructural and polystructural type.

RESEARCH METHODOLOGY

Sample of respondents

The sample of respondents in this study consisted of athletes aged 13-15 years from BiH, namely: 60 athletes members of athletic clubs Doboj East and Sarajevo, (30 experimental group and 30 control groups) and 60 karate players members of karate clubs "Konjuh" Živinice and "Tuzla Sinbra" Tuzla (30 experimental group and 30 control groups). The test was tested by competitors of this age clinically healthy. Athletes whose competitive disciplines relate to medium and long distance tracks, and karatists who are not in the competition system did not take the test.

Sample variables

To estimate the speed, a set of 9 variables was applied. Speed assessment in athletes was carried out with three variables characteristic of athletes: running 20 m flying start (MB20LS), running 30 m low start (MB30NS), running 60 m low start (MB60NS). The estimate of the speed specific to the karate players was carried out with three variables: the speed of kizama tsuki stroke (MBKZTU), the speed of gjaku tsuki stroke (MBGJZU), the speed of the watchmaker ashi mawashi (MBAMWU). Three variables were used to estimate segmentary speed in athletes and karate players: hand taping (MBRTAR), taping with foot (MBRTAN), taping with a foot against the wall (MBFTAZ).

RESULTS AND DISCUSSION

In order to determine the effects of different training programs on the global development of certain anthropological dimensions in the investigated sample from the population of karate and athletes, as well as the partial participation of the analyzed variables in these effects, multivariate and univariate analysis of covariance was applied. This analysis starts from the total matrix variance-covariance of the observed groups. It is differentiated to the variance-covariance matrix between the groups and the variance-covariance matrix within each group.

The theoretical condition for the application of covariance analysis is the homogeneity of these matrices. Therefore, it is important that multivariate distributions of the results of subjects of individual groups have statistically equal density, that is, statistically equal variability. The specified matrix equality condition is tested by the Box-s M test, which is based on likelihood-ratio analysis. The statistical significance of this parameter is determined by the F approximation, which tests the probability of the Nul-hypothesis, according to which the variance-covariance matrices do not differ from each other. With regard to mathematical characteristics, this test must be profiled as statistically insignificant, in order to provide the basis for its acceptance, i.e. making decisions about the homogeneity of variance-covariance matrices between groups. Wilks' lambdom (Wilks˘ Lambda) and the corresponding Rao F approximation tested the Nul hypothesis that the centroids of the groups are statistically equal to the common centroid at the final test with the neutralization of the initial state. After it was determined that there is a generally statistically significant difference between the groups of subjects, univariate analysis of covariance determined which variables contribute to this difference. Based on the numerical characteristics of the corrected arithmetic environments of the observed groups, judgments were made on the effects of applied experimental and control treatments on the development of the investigated anthropological dimensions.

The Box M test tested the equality of covariance matrices of the investigated groups. According to

the results (Tables 1 and 2) of the speed characteristics of athletes and karate players, it is evident that the significance of the specified parameter has not been established. This indicates the fact that the covariance matrices of the observed groups do not differ statistically significantly from each other. In accordance with the results obtained by Box M tests, and bearing in mind the criterion of acceptance of the same, it can be concluded that the theoretical conditions for the application of covariance analysis have been met, and a meaningful interpretation of the obtained results.

Surface observation of relevant statistical indicators of the multivariate model can be observed that, in addition to neutralizing the differences of subjects in the initial testing, the applied training operators over a period of six months produced statistically significant differences in the development of analyzed speed properties between the experimental and control groups of athletes. From Table 1b. It is evident that the discriminative strength (Wilksˇ Lambda) is statistically significant at the level of 0.05 (Sig =.019), with the overall model explaining 26.7% of the investigated manifest space.

Results of univariate analysis of covariance for a set of applied motor tests presented in Table 1c show high significance in tests for estimating segmental taping speed (MBRTAN) and specific speed of athletes running 60m low start (MB60NS), while statistically significant difference between experimental and control groups with milder conventional level registered in test running 20 m flying start (MB20LS). Statistically significant differences in progression between the experimental and control groups were not recorded in other applied tests. Such a small number of separate variables with statistically significant effects can be justified by a large coefficient of congenitality of speed properties. Despite the high coefficient of innateness, the program of additional training operators has contributed to the effects in these tests, which is a good prerequisite for achieving better results in athletic disciplines where speed has a great contribution.

Table 1c clearly identifies the partial contribution of tests to group discrimination, but not the characteristics that indicate the qualitative structure of those differences. The answer to this question is provided by the corrected arithmetic mean of the tested groups at the final test described in Table 1d.

By inspecting all numerical and graphic indicators that are the result of partialization of the investigated anthropological characteristics of the subjects at the initial test, with special reference to the inverse measurement scale of certain measuring instruments, and bearing in mind the results of the initial state of speed properties of athletes (Table 1c.), it can be concluded that statistically significant differences in qualitative terms clearly benefit the experimental group. In addition to the above, it is important to note that in other tests there are evident differences, although not statistically significant, where the subjects of the experimental group clearly lead.

Table 1. Results of multivariate and univariate analysis of covariance of speed characteristics of athletes

a)

Box's M	24,524
F	1,038
df1	21
df2	12372,787
Sig.	,412

b)

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Group1exsp. 2contr	Wilks' Lambda	,733	2,848[a]	6,000	47,000	,019	,267

c)

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Group 1exsp. 2contr.	MBRTAR-F	,083	1	,083	,016	,900
	MBRTAN-F	67,504	1	67,504	9,566	,003
	MBFTAZ-F	33,455	1	33,455	3,018	,088
	MB20LS-F	,101	1	,101	5,922	,018
	MB30NS-F	,292	1	,292	2,914	,094
	MB60NS-F	2,162	1	2,162	7,772	,007

d)

Dependent Variable	Group 1-exsp. 2-contr.	Mean Initial	Mean Final	Mean Estimated	Mean Estimated 95% Confidence Interval	
					Lower Bound	Upper Bound
MBRTAR	1	31,467	36,50	35,354[a]	33,476	37,233
	2	32,033	34,43	35,579[a]	33,701	37,457
MBRTAN	1	42,800	47,53	49,400[a]	47,213	51,588
	2	43,467	44,87	43,000[a]	40,812	45,187
MBFTAZ	1	23,833	25,77	27,070[a]	24,328	29,811
	2	24,467	23,87	22,564[a]	19,822	25,305
MB20LS	1	2,884	2,6130	2,608[a]	2,501	2,716
	2	2,982	2,8513	2,856[a]	2,748	2,963
MB30NS	1	5,488	4,8780	4,814[a]	4,553	5,074
	2	5,491	5,1700	5,234[a]	4,974	5,495
MB60NS	1	9,557	8,5810	8,398[a]	7,964	8,832
	2	9,910	9,3607	9,543[a]	9,109	9,978

The treated speed properties of athletes in a period of six months, which in addition to the basic program include the program of additional training operators, progressed significantly faster and mawashi kick (MBAMWU), while the groups differed the least in the test for estimating the speed of gjaku tsuki stroke (MBGJZU).

Such a large number of statistically significant differences in speed properties in the final test can be explained by the specific structure of competitive karate techniques applied during the six-month basic program, while the sizes of these differences were caused as a result of the application of the program of additional training operators.

The smallest contribution to the differences can be justified by the complexity of the test for estimating the speed of gjaku tsuki stroke (MBGJZU), where in addition to moving forward-backward, the rotation of the hull along the longitudinal axis is included, which further complicates the execution of the same. According to the above data, differences between the groups in the analyzed tests have been proven. The character and scope of these differences explain the corrected arithmetic mean in Table 2d.

By analyzing the numerical values of the arithmetic mean of the final test, their distance and directionon on graphs, as well as the results of the subjects on the initial test (Table 2d), and bearing in mind the inverse metric of certain measuring instruments where a smaller value reflects a qualitatively better result, one can clearly recognize the positive effects of the applied, kinesiological treatments. Thus, the applied experimental compared to the control treatment provided far better results in all its segments.

It is evident that both groups of karate players have positive changes in velocity properties. However, the experimental group recorded a significantly better transformation of certain anthropological characteristics compared to the

control group, which indicates that the applied additional kinesiological operators within the experimental treatment had a greater influence on the development of the rapid properties of the karateist experimental group. The development of these dimensions stems from a well-programmed and well-executed six-month experimental treatment.

better within the experimental treatment. Also positive effects were achieved by applying the basic program in the control sample, but on a somewhat smaller scale.

From a kinesiological-methodical point of view, the applied experimental treatment indicates the fact that it has largely contributed to positive effects in the experimental group of athletes in relation to the control group.

By examining the sizes of parameters and their characteristics within the above analysis (Table 2b),we come to the conclusion that at the final testing there are statistically significant global differences in the rapid properties of the karatist between the experimental and control groups.

The maximum significance of Wilks' lambda (Sig =.000) was confirmed by rao's F test, where the overall model can explain 61.2% of manifest space (Partial Eta Squared). This data clearly shows that the treated manifest variables significantly contribute to discrimination against groups of respondents.

Table 2c. presents the basic statistical indicators of the univariate analysis of covariance for a set of applied motor tests with partialization of the results of the subjects of the initial test. The numerical characteristics of these parameters indicate that statistically significant differences between the experimental and control groups at the strictest level of inference were recorded in all applied tests. Judging by the values of the Fischer approximation (F), it can be noted that the greatest contribution to differences is evident in the taping test with a foot against the wall (MBFTAZ), a slightly smaller contribution, but also at the strictest level of statistical significance in variables: the speed of kizama tsuki kick (MBKZTU) and the speed of ashi

Table 2. Results of multivariate and univariate analysis of covariance of rapid properties of karate players

a)

Box's M	25,319
F	1,071
df1	21
df2	12372,787
Sig.	,318

b)

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Grop1exsp.2 contr.	Wilks' Lambda	,388	12,334[a]	6,000	47,000	,000	,612

c)

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Group 1exsp. 2contr.	MBRTAR-F	45,553	1	45,553	10,490	,002
	MBRTAN-F	101,395	1	101,395	10,983	,002
	MBFTAZ-F	89,963	1	89,963	38,123	,000
	MBKZTU-F	12,928	1	12,928	24,340	,000
	MBGJZU-F	6,275	1	6,275	9,647	,003
	MBAMWU-F	18,126	1	18,126	21,663	,000

d)

Dependent Variable	Group 1-exsp. 2-contr.	Mean Initial	Mean Final	Mean Estimated	Mean Estimated 95% Confidence Interval	
					Lower Bound	Upper Bound
MBRTAR	1	30,767	34,57	35,215[a]	34,330	36,099
	2	32,267	33,60	32,952[a]	32,067	33,837
MBRTAN	1	40,767	47,13	47,704[a]	46,414	48,994
	2	43,000	44,90	44,329[a]	43,039	45,619
MBFTAZ	1	20,700	26,27	26,723[a]	26,071	27,375
	2	22,600	24,00	23,544[a]	22,891	24,196
MBKZTU	1	8,469	6,6453	6,370[a]	6,061	6,679
	2	7,269	7,3000	7,575[a]	7,266	7,885
MBGJZU	1	9,070	7,238	6,986[a]	6,643	7,328
	2	7,373	7,573	7,825[a]	7,483	8,168
MBAMWU	1	10,270	7,9560	7,503[a]	7,115	7,891
	2	9,098	8,4770	8,930[a]	8,542	9,318

CONCLUSION

According to the intention of fulfilling the set goal on a sample of athletes aged 13-15 years from BiH, namely: 60 athletes and 60 karate players, it can be concluded that the application of the program of additional kinesiological operators contributed to positive effects on the final testing in the experimental group of subjects in relation to the control group. Statistical indicators of the multivariate model indicate the fact that, along with the neutralization of the results of the subjects at the initial test, the applied training operators over a period of six months produced statistically significant differences in the development of analyzed speed properties between the experimental and control groups of athletes.

By inspecting all numerical indicators that are the result of partialization of the investigated anthropological characteristics of the subjects at the initial test, with special reference to the inverse measurement scale of certain measuring instruments and bearing in mind the results of the initial state of speed properties of athletes, it can be concluded that statistically significant differences in qualitative terms clearly go in favor of the experimental group.

The treated speed properties of athletes in a period of six months, which in addition to the basic program include the program of additional training operators, progressed significantly faster and better within the experimental treatment. Also, positive effects were achieved by applying the basic program in the control sample, but on a somewhat smaller scale. From a kinesiological-methodical point of view, the applied experimental treatment indicates the fact that it has largely contributed to positive effects in the experimental group of athletes in relation to the control group.

It is also evident that in both groups of karate players there are positive changes in velocity properties. However, the experimental group sees a significantly better transformation of certain anthropological features compared to the control group. This suggests that the applied additional kinesiological operators within the experimental treatment had a greater influence on the development of the rapid properties of the karate players of the experimental group. The development of these dimensions stems from a well-programmed and well-executed six-month experimental treatment.

These facts suggest that the application of additional kinesiological operators in the experimental group produced greater effects on the development of rapid properties in the experimental karate team compared to the control group.

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