INFLUENCE OF A SPECIAL PHYSICAL EDUCATION PROGRAM ON DEVELOPMENT OF DIFFERENT MUSCULAR FORCE ASPECTS

Đurica Amanović[1], Milija Ljubisavljević[2] and Milan Jovanov[3]

[1]The Academy of Criminalistic and Police Studies, Belgrade, Serbia
[2]Ministry of Interior, Belgrade, Serbia
[3]Belgrade Police Department, Belgrade, Serbia

Original scientific paper

Abstract
The aim of the research is to determine the impact of the application of the Special Physical Education program on the development of different types of muscular force in the population of the Criminal Police Academy in Belgrade. The study was conducted on a sample of 88 respondents, students in the first year of study. The first measurement was performed at the beginning and the second measurement at the end of university. A set of two morphological and six motor variables was applied. Over all variables, in both measurements partialization of raw (measured) data was performed, this way the differences among the respondents in the morphological area were neutralized and the results obtained in the applied tests were brought to the level of force. Over all data, descriptive statistical procedures and estimated significance of the differences between the average values of the first and second measurements were made. On the basis of the obtained results, it can be concluded that the applied Physical Education program of the respondents statistically significantly influenced (p <0.05) the changes in the dimensions of different forms of force (repetitive force, velocity of force).

Key words: *Special Physical Education, muscular force, partialization, management training.*

Introduction

Previous research (Amanović, Jovanović, Mudrić, 1999; Milošević, Mudrić, Amanović, 2003; Amanović, Milošević, Mudrić, 2004) that deals with the laws of changing anthropological characteristics under the influence of educational programs, suggests that the progress in these changes is different and that its flow and dynamics depend on the educational content and the population on which they are applied - the methods and means of learning, the load distribution, and the level of the motor base that the respondents have. Furthermore, in the research of the morphological, functional and motor space, the connection between the expression of muscle force and morphological characteristics, primarily by the weight (body mass) of the body, is indisputable (Gredelj 1976, Blašković 1979, Milošević 1985, Momirović, Hošek et al., 1989; Jaric, Ugarkovic, Kukolj, 2002, Amanovic, et al, 2004; Vanderburgh, Crowder, 2006; Milosevic et al., 2005; Milosevic & Milosevic, 2014a). Traditional (outdated) diagnostics, ignoring this connection, do not provide valid data required for programming training for the development of different types of forces. Namely, the variability of the achieved results in motor tests is influenced by force and morphological characteristics that behave in some cases as mufflers, and in other cases as boosters of the test result (Milošević, 1985; Milošević, Gavrilović, Ivančević, 1988; Momirović et al., 1989; Amanović, Milošević, Mudrić, Dopsaj, Perić, 2006; Milošević & Milošević, 2014a; Nemec, Milošević, Nemec, Milošević, 2016). This creates a problem in the programming of the training, because movements from different tests appear, the results of which are shown by different measuring units (Milošević et al., 1989; Amanović, Milošević, Mudrić, 2004; Zatsiorsky, Kramer, 2006; Kostovski, Zeljković, Ibri, Soklevska, Zaborski, 2012; Amanovic, Kostovski, Blazevic, Pavic, Ljubisavljevic, 2013; Milosevic & Milosevic, 2014; Milosevic, Milosevic, Nemec, Zivotic, Rađo, 2014b). Mudrić and associates (Mudrić, Božić, Baltić, Subotički, 1998) to investigate the change in the basic motor status of students of the College of Interior Affairs in the first year of study. Based on the obtained results, the authors find a significant improvement in the motor skills of students at the end of the first year of study. Positive changes can be largely attributed to the impact of the Special Physical Education Program (SFO). In the meantime, the education program has undergone some changes in structure by number of hours, so that the issues dealt with are still current. Therefore, the problem of this paper is the examination of the influence of the educational program of Special Physical Education on one segment of the motor space, on the muscular force, ie on the development of different types of muscular force (maximum force, repetitive force, speed of force) by students of the Criminal Police Academy KPA).

Methods

Sample of respondents

The sample was made of 88 students of the Criminal Police Academy in Belgrade, 19 to 21 years of age at the end of morphological and motor development. It should be noted that all respondents had previously successfully passed a medical examination and psychological tests that spoke of their ability to work and work in the Ministry of the Interior of the Republic of Serbia.

Distribution of educational treatments
The Special Physical Education program for the first year of study was realized in the duration of seven months, with two classes per week (I and II semester) ie 39 + 39 = 78 hours during the school year. At this stage of education, the relationship between information treatment and general motor treatment is 60%: 40% (Milošević & Milošević, 2014a).

Pattern of variables
In the experiment a set of two morphological variables (body height expressed in m, mass body expressed in kg) and six motor variables were used. The sample of variables observed in this study was selected to represent status in the different types of muscular force in the dynamic mode of operation (repetitive force, speed of force). We rehearsed the force of repetitive force: snaps for 10 seconds and hoisting for 30 seconds.

The speed of the demonstration of the force was measured by the tests: a long distance jump from the ground, the jump with the momentum of the hand - the Abagal test, running at 20 meters with a flying start and running at a 20 meters high start (Milošević, 1985, Amanović et al. Milosevic, 2014a). Anthropometric measurements are performed according to the method recommended by the International Biological Program (IBP).

Accordingly, in this case, morphological and motor tests are actually only individual items. Specifically, there are measured (raw) results, where the muscular force tells vertical movement or movement at an angle to the horizontal, followed by push ups, lifting the hull and running fragmentation of the relation to height and body weight. On that basis we have a corrected value of the force expressed in Newtons (N) and partialization will be performed as follows (Milošević, 1985; Milošević et al., 1988; Milošević & Milošević, 2014a):

- **Body surface area** ($P = BH^2$) where P - body surface area expressed in square meters (m^2), BH-value of body height expressed in meters (m).
- **Reduced value of body weight** ($Rt = G^{2/3}$) where Rt - relative value of body weight expressed in newtons (N), G-body weight expressed in newtons (N).
- **Force of hands and shoulder griddle implemented by push-ups in 10 seconds** ($Fkr = S2.\ G^{1/3} \cdot BH$) where Fkr - relative value of force of hands and shoulder griddle implemented by push-ups per 10 seconds expressed in newtons, S - number of push-ups per 10 seconds, G - body weight expressed in newtons, BH -body height expressed in meters.
- **Torso flexor force** ($Fkt = P^{2} \cdot G^{1/3} \cdot BH$) where Fkt- relative value of torso flexors expressed in newtons, P - number of torso flexions in 30", G - body weight expressed in newtons, BH - body height expressed in meters.
- **Leg extensor force during long jump** ($Fksd = G^{1/3} \cdot SD / BH$) where Fksd - relative value of leg extensors force expressed in long jumps expressed in newtons, G - body weight expressed in newtons, D - long jump distance expressed in meters, BH - body height expressed in meters.
- **Force implemented in the VRT + test** ($Fksv+ = G^{1/3} \cdot Abl+ / BH$) where Fksv+- relative value of leg extensors force expressed in Abl + test expressed in newtons, G - body weight expressed in newtons, Abl+ - height depth jump with arm swings expressed in meters, BH - body height expressed in meters.
- **Body and leg extensors force during 20 meters run with flying start** ($Fk20l = G^{1/3} / t^2$) where Fk20l - relative value of leg extensors force expressed during 20 meters run with flying start expressed in newtons, G - body weight expressed in newtons, t - time of 20 meters distance run with flying start expressed in meters.
- **Body and leg extensors force during 20 run with standing start** ($Fk20V = G^{1/3} / t^2$) where Fk20l - relative value of leg extensors force expressed during 20 meters run with standing start expressed in newtons, G - body weight expressed in newtons, t - time of 20 meters distance run with standing start expressed in meters.

Methods of statistical data processing
Data obtained in a single test in both measurements, using the indicated battery test and partialization of directly measured results was processed by descriptive and comparative statistics (Perić, 2006). Their mathematical processing has been carried out using Microsoft Excel and SPSS version 17.0 in Windows version 7.0. Using the method of primary data processing, necessary information was obtained on the distribution of variables within the examined space.

To test the difference in average values after the variables at initial and final measurements, Student's t-statistics for dependent samples were used, by determining the t-value and significance level ($p \square 0.05$). In order to determine the size of the effect of the educational treatment, the eta square was made (Pallant, 2009).

Results and discussion

Applying the methods of primary data processing, we processed all the variables and presented them in Table 1. When correcting the obtained values (raw variables), variability measures for all variables indicate a relatively high degree of homogeneity of the distribution.

The error of the estimation of the average value is quite small for all the observed variables in the first and second measurements, which indicates that the sample that is monitored in this paper represents a good representation of the population of students of the Criminal Police Academy.

Table 1. Values of initial and final testing of students

	N	Mean	Std. Error	Std. Deviation	cV%
TV1	88	1,81	0,01	0,06	3,21
TV2	88	1,82	0,01	0,06	3,21
TT1	88	76,84	0,89	8,32	10,83
TT2	88	79,67	1,01	9,47	11,88
sklek1kor	88	1972,13	56,24	527,59	26,75
sklek2kor	88	2652,30	78,51	736,48	27,77
trup1kor	88	18718,13	483,75	4537,99	24,24
trup2kor	88	23488,50	570,41	5350,90	22,78
dalj1kor	88	954,59	11,76	110,29	11,55
dalj2kor	88	1012,35	12,91	121,13	11,97
abalak1kor	88	194,03	3,04	28,54	14,71
abalak2kor	88	226,33	3,64	34,19	15,11
L20m1kor	88	4259,16	72,03	675,73	15,87
L20m2kor	88	4637,40	75,91	712,09	15,36
V20m1kor	88	2907,35	45,07	422,78	14,54
V20m2kor	88	3251,08	46,64	437,55	13,46
Valid N (listwise)	88				

Table 2. The difference between values of variables in the initial and final testing Paired Samples Test

		t	df	Sig. (2-tailed)	Eta Kvadrat
Pair 1	sklek1kor - sklek2kor	-9.993	87	.000	0.53
Pair 2	trup1kor - trup2kor	-9.025	87	.000	0.48
Pair 3	dalj1kor - dalj2kor	-6.065	87	.000	0.30
Pair 4	abalak1kor - abalak2kor	-9.877	87	.000	0.53
Pair 5	L20m1kor - L20m2kor	-5.168	87	.000	0.23
Pair 6	V20m1kor - V20m2kor	-8.947	87	.000	0.48

The use of the T-test of vaporized samples confirmed a significant difference in the arithmetic mean of the measured values, between the first and second measurements in the positive sense (Table 2), which is statistically confirmed on all observed variables ($p < 0.05$). Thus, an increase was achieved in all forms of muscle force (Graphs 1 and 2), and the highest increase in force production was achieved in variables characterized by the fact that the results achieved by respondents depend on the muscular force realized in the dynamic mode - repetitive force (Corrected value of the number of pins for 10 sec.) And the speed of the expression of the force (corrected value of the jump in height - Abalakov test). For the first variables, the characteristic cyclicity and the formation of different levels of force in the unit of time when shortening or elongation of the muscle, while for the second variable, include the ability to quickly involve the muscle, the ability to realize the force at high contractions of the muscles and synchronously engage and exclude antagonistic muscle groups. The values of the eta square (% explained variance) of 0.23 (for variables L20m) to 0.53 (for variables of 10 seconds and elevation jump - Abalakov test) show that the large difference between the results achieved on the first and second measurements in all variables, Which confirms that the impact of the educational program on the traces of muscular strength in our respondents is high.

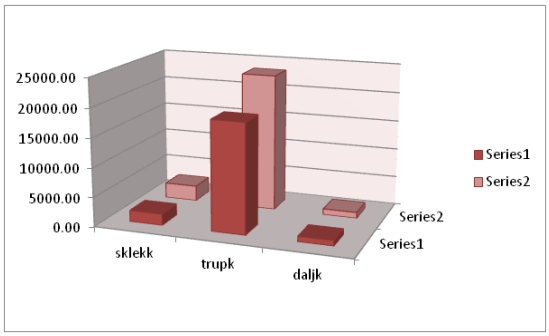

Figure 1. The difference between values of variables in the initial and final testing

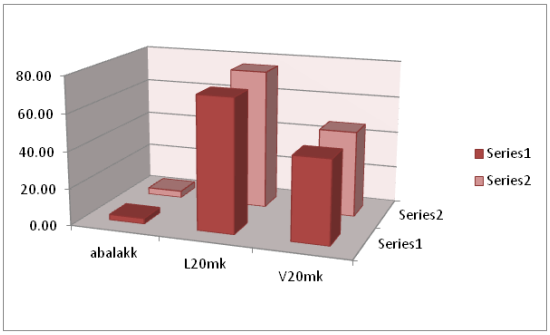

Figure 2. The difference between values of variables in the initial and final testing

Conclusion

In the examination of the influence of the educational program of Special Physical Education on the development of different types of muscular force, students of the Criminal Police Academy have applied a set of two morphological and six motor variables. All data were collected on a sample of 88 respondents, students of the first year. The first measurement was done at the beginning of the school year, and the second measurement was done in the last week of the summer semester. Over all variables, in both measurements, the partialization (correction) of the raw data was carried out, namely, the differences between the respondents in the morphological area were neutralized and the results obtained in the applied tests were brought to the level of muscular strength. Furthermore, descriptive and comparative analyzes have been made to assert that the analyzed data are reliable and can be interpreted validly. Following the experimental procedure, and based on the obtained results, we can conclude the following: That the selected sample represents a very good representation of the population of KPA students and that the obtained results on the sample can refer to the entire population; that the educational program of the SFO statistically significantly influenced the changes in different forms of force (repetitive forces and the rate of force) in students of the first year of study; in the end it can be concluded that the results that we have received in addition to theoretical have a practical significance, contributing to the problem of programming and managing the educational process in Special Physical Education and Sport.

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UTJECAJ PROGRAMA SPECIJALNOG FIZIČKOG OBRAZOVANJA NA RAZVOJ RAZLIČITIH ASPEKATA MIŠIĆNE SILE

Sažetak

Cilj istraživanja je utvrditi utjecaj primjene programa Specijalnog fizičkog obrazovanja na razvoj različitih vrsta mišićne sile u populaciji Akademije kriminalističke policije u Beogradu. Studija je provedena na uzorku od 88 ispitanika, studenata prve godine studija. Prvo mjerenje provedeno je na početku i drugo mjerenje na kraju sveučilišta. Primijenjen je niz dviju morfoloških i šest motoričkih varijabli. Na svim varijablama u objema mjerenjima provedena je parcijalizacija sirovih (mjerenih) podataka, tako da su se razlike među ispitanicima u morfološkom području neutralizirale, a dobiveni rezultati u primijenjenim testovima dovedeni su na razinu sile. Na svim podacima provedeni su deskriptivni statistički postupci i procijenjen je značaj razlika između prosječnih vrijednosti prvog i drugog mjerenja. Na temelju dobivenih rezultata može se zaključiti da je primijenjeni program fizičkog obrazovanja ispitanika statistički značajno utjecao (p<0,05) na promjene u dimenzijama različitih oblika sile (repetitivna sila, brzina sile).

Ključne riječi: Specijalno fizičko obrazovanje, mišićna sila, parcijalizacija, upravljanje treningom.

Received: April 17, 2017
Accepted: June 10, 2017
Correspondence to:
Đurica Amanović
The Academy of Criminalistic and Police Studies,
Belgrade, Serbia
Tel: +381 11 3161444
E-mail: dekanat@kpa.edu.rs