The effectiveness of physical education of the Military Academy cadets during a 4-year study

Efikasnost fizičkog vasпитanja kadeta Vojne akademije tokom četvorogodišnjih studija

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Abstract

Background/Aim. The main role of physical education is health and educational practices of cadets and all-round personality development. Instruction executing is successful only when the set requirements are realized. The aim of this study was to evaluate the effectiveness of physical education in order to rise physical capabilities of the Military Academy cadets during a 4-year education. Methods. The study was conducted in the Military Academy, Belgrade. A total of 120 cadets who at the beginning of the study were 19 years ± 6 months and at the end 23 years ± 6 months were included in this study. The study used the following tests for verification and assessment of physical fitness: pull-ups, lifting the trunk from the ground, standing long jump seats, running at 1,600 m and overcoming the infantry obstacles. The data were analyzed using statistical programs to calculate the central and dispersion parameters. The difference in the achieved results in the individual variables were evaluated by the univariate analysis of variance (ANOVA), while the differences in the system variables by region were identified by the multivariate analysis of variance (MANOVA) and discriminant analysis. The group membership was determined using profile analysis. Results. There were statistically significant differences in all the tests to evaluate the effectiveness of physical education during a 4-year study, except in the standing long jump test. The best average results in motor capabilities tests, were achieved after two years of study, while in the endurance tests showed the best results achieved at the end of a 4-years studying. Conclusion. The results of overcoming specific tests for the physical abilities of the Military Academy cadets show that the physical education curriculum only slightly improves the development of physical skills of cadets during a 4-year study. The existing program shows the best results in the pull-ups test of the ground troops, and the worst in the multiple motor control tests (endurance, strength and speed).

Key words: military personnel; education; physical education and training; program evaluation.

Apstrakt

Uvod/Cilj. Osnovna uloga fizičkog vasпитanja je ostvarivanje zdravstvenog i vasпитnog delovanja na kadete i formiranje svestrane ličnosti. Realizacije nastave je uspešna samo kada su ostvareni postavljeni zahtevi. Cilj ovog rada bio je procena efikasnosti nastavnog programa fizičkog vasпитanja u postizanju povećanja fizičke sposobnosti kadeta Vojne akademije u toku četvorogodišnjeg školovanja. Metode. Istraživanje je sprovedeno u Vojnoj akademiji u Beogradu i obuhvatilo je 120 kadeta koji su na početku školovanja imali 19 godina ± 6 meseci, a na kraju školovanja 23 godine ± 6 meseci. Testovi za proveru i ocenjivanje fizičke pripremljenosti bili su: zgibovi na vratilu, dizanje trupa sa tla, skok u dalj iz mesta, trčanje na 1 600 m i savladavanje pešadijskih prepreka. Podaci su obrađeni primenom statističkih programa za izračunavanje centralnih i dispersijonih parametara. Za utvrđivanje razlika između postignutih rezultata tokom školovanja korišćena je univarijantna analiza varijanse (ANOVA), a razlike u sistemu varijabli po prostorima utvrđene su multivarijantnom analizom (MANOVA) i diskriminativnom analizom. Prispodobnost grupi određena je analizom profila. Rezultati. Uočene su statistički značajne razlike u svim testovima za procenu efikasnosti nastave fizičkog vasпитanja tokom četvorogodišnjeg školovanja, osim u testu skok udalj iz mesta. Najbolji prošetni rezultati u testovima za procenu motoričkih sposobnosti postignut je posle drugih godina stu-

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Introduction

Human factor and physical fitness of the members of armed forces have always been and will remain one of the most important goals and qualities of the national defense in the armed forces worldwide, regardless high performance and development of weapons technology. Previous experience in our history suggests that physical training was of great importance, through training of both soldiers and officers for successful command and control \(^1\)\(^-\)\(^2\). This confirms that physical education now plays an important role in the education of Military Academy cadets, under the specific conditions of life and work in a military school. The curricula and other normative acts regulate the implementation of training and education, by setting goals and tasks of the subjects, contents, number of classes for each thematic area and the guidelines for implementation.

The main role of physical education is health and educational influence on the cadets and versatile personality development trained for combat operations. In the “Guidelines for physical training in the military”, specific goals have been set: to achieve and maintain a high level of physical fitness, to overcome in time from 80 sec to 175 sec \(^3\). Physical education is reflected in military exercises and the like, but without finding a casual link of such a situation \(^4\). Physical education is reflected in the specific physical exercises, depending on the profession or workplace. Professional working ability is defined as the ability to perform different activities, determined by the requirements of a workplace. Each profession requires some knowledge and skills, and in some cases, predispositions \(^5\). The aim of this study was to evaluate the effectiveness of physical education in order to increase physical capabilities of the Military Academy cadets during a 4-year education.

Methods

In this longitudinal study the examinees were compared and monitored in terms of motor military skills during their 4-year training. When recruiting candidates to the Military Academy, all the examinees passed the appropriate medical and psychological examinations. Medical examinations and physical fitness tests were carried out each within the study. The research was conducted in the Military Academy, Belgrade. A total of 120 cadets, aged 19 years \(\pm\) 6 months at the beginning of training, were included and monitored throughout their studies up to the age of 23 years \(\pm\) 6 months upon graduation. The effectiveness of teaching was evaluated by the level of achievement in doing specific tests arising from the content of the curriculum for physical education in the Military Academy. During the school year, physical education is taught by two regular physical education classes and 2 h in sports day. During a 4-year study, at the end of each school year, checking the physical fitness of students is done, based on five motor tests, to assess situational motor skills including: pull-ups, performed for 60 sec with a range from a minimum of 3 to a maximum of 15 repetitions sit-ups, for 60 sec a range of recurrence from 25 to 50 standing long jump, in three attempts to perform a jump in the range from 183 cm to 287 cm a 1,600-meter-run (1,600) need to run out in time of 320 sec to 450 sec and obstacle course (OC) to be overcome in time from 80 sec to 175 sec \(^3\).

The obtained data were analyzed using statistical programs to calculate the central and dispersion parameters: arithmetic mean (X), standard deviation (SD), variance (Sig), minimum score (Min), maximum score (Max), standard error (SE), coefficient of variation (CV\%). The differences between individual years of training during the four years in some variables were determined by the use of univariate analysis of variance (ANOVA) and differences in the system of variables by regions were determined by the multivariate analysis of variance (MANOVA) and discriminant analysis. The group membership was estimated by profile analysis \(^6\).

Results

The specific motor competence of the group of examinees after the first year of training is fairly homogeneous (Table 1), except for the obstacle course test. The scores tests ranged from a minimum of 89 sec to a maximum of 441 sec, which affected the normal distribution of values (CV 26.82\%). The minimum and maximum scores in the events standing long jump (from 170 cm to 265 cm) and a 1,600-meter-run (from 332 sec to 490 sec) also indicated some differences, but they did not affect the normal distribution (CV\%). Based on the observed individual differences, a statistically significant difference was found only in the variable obstacle course \((p = 0.000)\).

Analyzing the results of the examinees by the use of mean values after the second year, there is a significant inch,
except for the variable standing long jump, where the minimum and maximum values are identical to those achieved after the first year of training. The coefficient of variation indicates no significant deviation from the arithmetic mean in the variables standing long jump (7.79%) and a 1,600-meter-run (9.82%). A slightly higher coefficient of variation in the obstacle course test indicates some differences in individual values, but they did not affect the normal distribution. Group heterogeneity in obstacle course is slightly lower than values after the first year of training (89–441 sec) and ranges from a minimum of 93 sec to a maximum of 320 sec.

Analyzing the results of the examinees by the use of mean values after the third year of training, shows a significant decrease in values as compared to the second year of training. Based on the coefficient of variation, heterogeneity of the group of examinees is slightly higher than in the previous two years in the obstacle course test (16.90%). But individual differences in the obstacle course do not affect the normal distribution of values after the third year of training, as well. The values range from a minimum of 95 sec to a maximum of 270 sec. Comparing these to the values after the second year of training, the maximum values are lower by 50 sec. The values of specific motor skills range within the limits of normal distribution in all of the three tests. The observed individual differences among examinees did not affect the normal distribution.

In terms of mean values after the fourth year of training a slight increase in all the three variables compared to the third year values is noticed. The homogeneity of the examinees was observed in all the three tests, and based on the coefficient of variation. Individual differences in the test obstacle course do not affect the normal distribution of values, ranging from a minimum of 91 sec to a maximum of 235 sec. Comparing these to the values after the first year of training, the maximum values are lower by about 200 sec. Minimum values in the standing long jump (183.0 cm) have higher values than in the previous three years. Physical competence during the 4-year training in the variables pull-ups and sit-ups was determined by measuring the number of repetitions achieved for one minute.

Table 2 shows the number and percentage of the examinees per year of training in relation to the pull-ups test. The largest number of the examinees in the first year of training, 45 (37.5%) of 120, were classified into the group with the number of repetitions from 4 to 6 pull-ups. However, after the third year of training, most examinees, 29 (24.2%) out of 120, were classified in the group with repetitions from 4 to 6 pull-ups. It is noticeable that 24 (20.0%) examinees were classified into the group with the number of repetitions over 14 pull-ups, which was higher than the values of the first and second year. In the fourth year of training, most of the examinees, 29 (24.2%) of them, were classified in the group with the number of repetitions over 14 pull-ups. By analyzing the number and the percentage of the examinees, an increase in dynamic strength of arms and shoulders after each year of training was observed.

In the sit-ups test within the time limit of 60 sec, the largest number of the examinees in the first year of training, 44 (36.7%) of 120, was classified into the group with the number of repetitions up to 49. In the fourth years of training, the majority of the examinees was in the group with 50 repetitions.

Analysis of the central and dispersion parameters of the examinees shows numerical differences in the average values in some variables for the assessment of motor competence during training. Multivariate analysis of variance showed a statistically significant difference among the examinees during training in relation to motor variables criterion (p = 0.000).

Analysis of individual values (Table 1), by the univariate analysis of variance shows a statistically significant difference among the examinees during training in the obstacle course variables (p = 0.007) and a 1,600-meter-run (p = 0.000). The results indicate that the examinees were at different levels of preparation in these two criterion variables that can be influenced by exercise. A statistically significant difference was not found in the test standing long jump during training.

Assessment of motor competence during training with no parametric values (Table 2), but with categorical data, in this part of the study shows numerical differences in average values per years, and were processed using the Roy’s F test. The multivariate analysis of variance showed a statistically significant difference among the examinees during training (p = 0.000), in the pull-ups and sit-ups within the time limit of 60 sec. The estimating individual values by the univariate

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**Table 1**

Central and dispersion parameters per year of training in the tests obstacle course (OC), standing long jump (SLJ) and 1,600-meter-run (1,600)

<table>
<thead>
<tr>
<th>Years of training</th>
<th>OC (sec) $\bar{x} \pm SD$ (min–max)</th>
<th>CV%</th>
<th>SLJ (cm) $\bar{x} \pm SD$ (min–max)</th>
<th>CV%</th>
<th>1,600 m (sec) $\bar{x} \pm SD$ (min–max)</th>
<th>CV%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>139.7 ± 37.5 (89.0–441.0)</td>
<td>26.82</td>
<td>224.1 ± 17.9 (170.0–265.0)</td>
<td>8.00</td>
<td>405.7±30.4 (332.0–490.0)</td>
<td>7.49</td>
</tr>
<tr>
<td>2nd</td>
<td>131.2 ± 26.9* (93.0–320.0)</td>
<td>20.53</td>
<td>227.3 ± 17.7 (170.0–265.0)</td>
<td>7.79</td>
<td>385.0±37.8† (305.0–550.0)</td>
<td>9.82</td>
</tr>
<tr>
<td>3rd</td>
<td>143.7 ± 24.3 (95.0–270.0)</td>
<td>16.90</td>
<td>222.7 ± 17.4 (180.0–265.0)</td>
<td>7.81</td>
<td>410.1±31.4 (336.0–530.0)</td>
<td>7.65</td>
</tr>
<tr>
<td>4th</td>
<td>140.2 ± 23.6 (91.0–235.0)</td>
<td>16.87</td>
<td>227.0 ± 18.3 (183.0–265.0)</td>
<td>8.09</td>
<td>407.3±31.3 (322.0–450.0)</td>
<td>7.70</td>
</tr>
</tbody>
</table>

Set norms: OC to 176 sec; SLJ 183–287 cm; 1,600 320–450 sec; CV% – coefficient of variation

* p < 0.007; † p < 0.000 (ANOVA)
tests analysis of variance showed a statistically significant difference among the examinees in the pull-ups tests ($p = 0.003$) and sit-ups within the time limit of 60 seconds ($p = 0.000$). The results indicate that the examinees were at different levels of preparation and ability assessed by these tests, but this can be influenced by exercise. The homogeneity of the group of examinees was the largest and identical after finishing the first and fourth year of training, 89 examinees out of 120 had the characteristics of their group (74.17%). The lowest homogeneity was observed after the third year of training, 56 examinees out of 120 had the characteristics of their group (46.67%).

**Discussion**

The effectiveness of physical education of the Military Academy cadets was evaluated on the basis of their attainment of specific motor skills during a 4-year study, based on physical education curriculum, which develops explosiveness, strength and endurance. The effectiveness of this program is estimated at the end of each year during the training of cadets through the five tests, pull-ups, sit-ups, standing long jump, 1,600-meter-run and obstacle course. These tests assess motor abilities (strength, speed, explosiveness, endurance, agility and coordination).

Unlike our program physical abilities checks of the cadets in the Military Academy, the U.S. military use tests – APFT: push-ups with the time limit of 2 min (35–100), sit-ups with the time limit of 2 min (47–97) and a timed two-mile run (16:30) and IOCT test (indoor obstacle course test including 10 obstacles) 7. This program is made in the Department of Physical Education in the United States Military Academy and is aimed at developing and maintaining a high standard of physical strength, agility and endurance of the cadets, necessary to meet the needs they faced in the military service.

Individual differences among the examinees in the values of specific motor skills obtained in our study, especially in the variable obstacle course, may be due to insufficient training to perform this complex test, and the lack of individual preparation of cadets over the previous period of training 8. The cadets’ results after the second year of training in the motor skills stated above indicate their better preparation and training 9. The cause of small individual differences in the tests may be due to better attainment of motor skills which require a high level of ability. Poorer values achieved after the third year, compared to these of the second year, may be due to the development of motor skills that have certain regularities, such as heterochrony, stageness, phaseness and transfer in developing ability 10. It is known that oriented development of motor skills with a relatively prolonged constant load leads to the reduced effects of actions. Analyzing the results of specific motor abilities of cadets after the fourth year of training, higher values compared to the previous year were observed. During training, the results of the test for the assessment of explosive power, standing long jump, indicate that there are no statistically significant differences in the values. On the basis of mean values, the ranging from 223 cm to 227 cm, it is possible that the explosive power is more genetically caused 11–12. It is evident that the number of examinees with the maximum results in the sit-ups and pull-ups tests within the time limit of 60 sec varies by years of training. After the fourth year of training, over 74% of the examinees were in the group with 50 repetitions in the sit-ups tests, and in the pull-ups test, over 24% of the increased the number of those over 14 repetitions. It should be noted that the program for any of the four years is the same. It should be noted, also that among the examinees there were those who did not meet the criteria of the tests at the end of the school year, but they managed to do that in the subsequent examination periods before the new school year. After the fourth year, the examinees achieved the required results in the period before their promotion to the rank of lieutenant. The reason may be a better psychophysical readiness and motivation for the final part of the exam, because after four years of training, within the next two months, the examinees graduate and are promoted into the professional members of the Armed Forces of Serbia.
Conclusion

The results obtained at the end of each year training vary within the norms required for the assessment of physical abilities of the Military Academy cadets. The planned program is satisfactory, as far as the set standards, but is insufficient to achieve maximal results. The values of the tests performed might be a consequence of genetic predisposition of cadets, less motor engagement in the last two years of the study or less motivation of cadets. With the existing program, the best results are achieved in the test for pull-ups of the ground troops, and the worst in the multiple motor control tests (endurance, strength and speed).

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