

A physical quality improvement of special operations force candidates by means of a proprietary program

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Purpose: to determine the level of preparedness of cadets of the second year of military university – potential candidates for admission to the units of the Special Operations Forces.

Material & Methods: experimental material was the official test results of cadets during the admission of current and test standards during the year of their studies at a military high school. Cadets of the second year took part in the experiment. Two groups of 26 cadets were created, identical in terms of physical preparedness. The testing of the physical readiness of the cadets was assessed by the exercises "Manual on physical training in the Armed Forces of Ukraine" (2014): running to different distances, exercises for strength and strength endurance, overcoming the combined arms obstacle course. A program for the development of endurance using the interval method of training is proposed.

Results: after training on the proposed program, the results grew by almost 10%, and in the group that trained according to the traditional scheme, the results only increased by 3%.

Conclusion: increase in results depends on the organization of the educational process and on the methods of training are used. In the CG the results are largely inferior to the increase in the results in the EG. The proposed program gives a significantly better result.

Keywords: forces of special operations, author's program, coefficient of technical efficiency.

Introduction

Among the components of the physical fitness of soldiers one of the main physical qualities is endurance. This is especially true for the personnel of special forces, which usually fulfill their combat missions far from the place of deployment of the military unit, overcoming long distances. The combat activities of the personnel of the units of the special operations forces (SOF) include the implementation of many kilometers of foot marches in full equipment, movement at night, overcoming water obstacles, versatility of professional and applied skills, management of any military equipment requiring significant physical effort (Y. P. Sergienko, 2005; O. M. Olkhovyi, 2005; V. M. Krasota, 2007; I. S. Ovcharuk, 2008; S. S. Fedak, 2013). In addition to general endurance, Special Forces must have a high level of development of strength and strength endurance.

The first experience of the selection of servicemen in SOF divisions revealed a certain problem. Only 20% of the candidates who participated in physical fitness testing could overcome this first stage. One of the main reasons for screening was insufficient overall endurance of candidates.

Given that the main candidates for SOF should be young people under the age of 30, and this is mainly cadets and graduates of military educational institutions, there was a need to study the level of development of the general (aerobic) and strength endurance of the cadets. It is also important to find ways to improve this level. Considering that the physical readiness of the officers of the Armed Forces is largely formed during their studies at the military university, it is advisable to

constantly study the dynamics of endurance indicators for cadets in order to optimize the educational process in order to improve it.

An analysis of the research of scientists (V. M. Afonin, 2008; S. V. Romanchuk, 2011) showed that in the context of military operations, professional activity has certain characteristics and high demands on the physical and psychological preparedness of the servicemen of the Ground Forces [1; 2; 4; 6].

The modern view of military operations requires the military to have the necessary level of physical readiness for the rapid and high-quality performance of their official duties in various conditions, including extreme ones. Among physical qualities, endurance is important in the structure of physical preparedness of servicemen [1; 2]. This position is confirmed by the materials of foreign studies and recommendations [3; 13; 14]. Individual types are included in the list of tests, the results of which assess the level of physical preparedness in the Ukraine Army [6–8].

In many studies, it is noted that the speed qualities are quite conservative and difficult to improve in the conditions of the military university. For several years, the time of running exercise (100, 400, 1000, 3000 meters) improves in the range of 4–5%. On 3–4 courses the results practically do not improve. One of the reasons for this suspension is the scientists (A. M. Olkhova (2013), I. S. Ovcharuk (2007)) consider the loss of the incentive to improve the results if they are already at the level of positive (or good) evaluation. In addition, in the classroom does not always apply modern methods of various physical properties.

So, for example, S. G. Kharabuga (2008) proposed the author's coefficient of coordination and technical efficiency (CTE) under the conditions of manifestation of special endurance, which is expedient for applying to assess the effectiveness of cadets' training in the technique of overcoming obstacles [11]. M. Ena, A. Loiko, V. Afonin (2008) proposed to use the interval training method with the calculation of the «critical speed» for the time of overcoming two distances – 300 m and 1000 m for each cadet. This has improved the results on long distances to 10%.

If the topic of development of endurance is encountered and discussed in many scientific studies, then the strength endurance of the upper and lower extremities of publications is small. There is a statement of the results of pulling on the bar with an emphasis on the large coefficients of variation of this indicator, which indicates a significant difference in the level of preparedness of the subjects. In many cases, the level of development of the strength of the lower limbs. In our opinion, this is a lack of research, since in modern conditions the warrior in the performance of combat missions must move with a full combat layout, which weighs 40–50 kg or more. With weak legs it is difficult to count on the successful accomplishment of tasks.

Thus, the role of endurance (general and strength) in training a modern soldier is important, but there are still many ways to develop and improve it.

The purpose of the research

to determine the level of preparedness of cadets of the second year of military university – potential candidates for admission to the units of the SOF.

Before the study, the following *tasks* were posed:

1. Identify the dynamics of endurance indices in cadets during their studies at the military university.
2. Develop a program to develop the general and strength endurance of NAA cadets and test its effectiveness.
3. Determine the influence of endurance on the level of results of the performance of a specialized complex test (overcoming the obstacle course).

Material and Methods of the research

The following *research methods* were used in the work: analysis of special scientific and methodological literature, testing of physical readiness of cadets, methods of mathematical processing of research results.

The study was attended by second-year cadets (as a contingent of prospective training for participation in the selection for SOF units in the future). Two groups of cadets of equivalent physical preparedness were created. Physical readiness of students was evaluated by Manual on physical training in the Armed Forces of Ukraine (MPT-2014) [6]: running on 100 m, 400 m, 1000 m, 3000 m, 5000 m; a accelerated march for 5 km in full equipment; exercises on strength and strength endurance (flexion-extension of the arms in the supine position; tilts forward from the supine position on the back pulling on the crossbar; jump in length from the place); overcoming

the obstacle of combined arms length 400 m.

The material of the study was the official test results of cadets during the admission of current and test standards during the year of their studies at the military university. Mathematical processing of the results was standard [1; 9; 10].

The growth in test scores was calculated in absolute numbers and in percentage values at their baseline level, at which the results were taken at the beginning of the study.

The exercises were carried out in accordance with the requirements of MPT-2014 [6; 10]. All exercises are performed in military shoes (combat boots).

Results of the research and their discussion

Mandatory control standards for the physical development of servicemen is a run of 1000 and 3000 m, which determines the level of endurance. Therefore, much attention is paid to the development of this quality. In practice, during physical training sessions, the simplest way of developing this quality is used, which consists in overcoming the normative distance of 1000 m or 3000 m. There is a simple «pulling» on the norm. Such training does not require special methodological skills from the leaders of physical education classes and the time for training can be reduced. But the effectiveness of such studies is also insignificant and the level of quality development is slow and insignificant. According to the data of the research [2; 5; 8], during the training at the military university, the result in the run of 3000 m improves on average by 3–5% from the initial (on the 1 course). During endurance training, the body must be in an oxygen shortage, and this is difficult to control when overcoming the control distance without specifying the load.

Therefore, to obtain better results, we used interval training with a near-critical speed. It is the overcoming of distance segments 200 and 400 meters for a given time [2]. Critical speed (V_{cr}) for the existing level of training is calculated for each student by the time of overcoming two distances – 400 and 1000 m. Further calculations were performed using the formula: $V_{cr} = (1000 - 400) / (t_{1000} - t_{400})$, where t_{1000} – time to overcome the distance 1000 m i t_{400} – time to overcome the distance 400 m in second.

Interval training is conducted at a rate of 70–80% of the critical (the maximum possible speed of a serviceman in a given period). To bring the organism into an oxygen deficiency state, it is planned to run short segments with a supercritical velocity (200–400 m). For collective training, the critical speed was determined by the average performance of the cadets. The critical speed indicator constantly changes with the change in the state of preparedness.

The second methodical method of training endurance was the use of interval running at 200 m and 400 m with weighting in the form of transfer of a serviceman on his shoulders. Such work gave a significant load on the muscles of the legs and the cardiovascular system. The monthly schedule of training is presented in the Table 1.

Each lesson began with an active warm-up and the execution of scheduled tasks. The duration of the session was 45–50 min. Pauses between approaches (races) were within

Table 1

The program of endurance development in a month (shock cycle)

Days of the week	1-st week, load 20 km	2-nd week, load 23 km	3-rd week, load 25 km	4th week, load 22 km
Monday	Warm-up – 15 min control races on 1 km and 400 m, twice	Warm-up – 15 min control races on 3 km	Warm-up – 15 min control races on 3 km	Warm-up – 15 min control races on 3 km
Tuesday	Warm-up – 15 min interval training (5x 400 m), run on 1 km with «critical» speed. Exercises for developing the strength of the muscles of the arms, legs	Warm-up – 15 min interval training (8x 400 m), run on 1 km with «critical» speed. Exercises for developing the strength of the muscles of the arms, legs	Warm-up – 15 min interval training (8x 400 m), run on 1 km with «critical» speed. Exercises for developing the strength of the muscles of the arms, legs	Warm-up – 15 min interval training (6x 400 m), run on 1 km with «critical» speed. Exercises for developing the strength of the muscles of the arms, legs
Wednesday	Warm-up – 15 min interval training (4x100 m with burdening), running 2x1000 m. Flexibility exercises	Warm-up – 15 min interval training (2x200 m with burdening), running 2x1000 m. Flexibility exercises	Warm-up – 15 min interval training (3x200 m with burdening), running 2x1000 m. Flexibility exercises	Warm-up – 15 min interval training (2x300 m with burdening), running 2x1000 m. Flexibility exercises
Thursday	Warm-up – 15 min interval training (6x400 m), run on 1000 m «critical» speed. Exercises for developing the strength of the muscles of the arms, legs	Warm-up – 15 min interval training (8x400 m), run on 1000 m «critical» speed. Exercises for developing the strength of the muscles of the arms, legs	Warm-up – 15 min interval training (8x600 m), run on 1000 m «critical» speed. Exercises for developing the strength of the muscles of the arms, legs	Warm-up – 15 min interval training (5x600 m), run on 1000 m «critical» speed. Exercises for developing the strength of the muscles of the arms, legs
Friday	Warm-up – 15 min interval training (8x400 m), with «supercritical» speed. Flexibility exercises	Warm-up – 15 min interval training (8x400 m), with «supercritical» speed, slow running 1 km. Flexibility exercises	Warm-up – 15 min interval training (6x600 m), with «supercritical» speed, slow running 1 km. Flexibility exercises	Warm-up – 15 min interval training (3x600 m), with «supercritical» speed, slow running 1,2 km. Flexibility exercises
Saturday	Warm-up – 15 min slow run on 5000 m. Exercises for developing the strength of the muscles of the arms, legs	Warm-up – 15 min slow run on 5000 m. Exercises for developing the strength of the muscles of the arms, legs	Warm-up – 15 min slow run on 5000 m. Exercises for developing the strength of the muscles of the arms, legs	Warm-up – 15 min slow run. Control 5000 m
Sunday	Rest	Rest	Rest	Rest

3–4 min. In the first lesson, the maximum distance traveled at a distance of 400 m and 1000 m was determined. After that, the “critical” speed for the entire group was calculated, which was the benchmark for performing the tasks on interval run. In the second part of the exercise, the complexes of strength exercises “to failure”.

This training program was conducted for 3 months. The results of comparative tests are presented in the Table 2.

Analysis of the results of the study showed that at the end of the experiment the average results of cadets in both groups improved. But the results in the control group are significantly lower than those in the experimental group. Thus, the results of control measurements for almost all indicators increased by 7–11% (with the exception of running on 100 m – 2,7%). In the control group, the increase was 1–4%.

At the end of the experiment, the difference in the indices between the groups was reliable at the level $P < 0,05 - 0,001$, except for the results in running at 100 m, pull-up and hand dynamometry. Sprinter qualities develop very slowly, and in power tests there are large fluctuations in results. The coefficient of variation is 10–33%. Therefore, with the growth of the results for weak cadets, the stronger they almost do not grow (lack of incentive to improve the results).

To ensure the readiness of servicemen to perform their official duties, the level of results of performing special tests with

emphasis on endurance. Such tests include a general control exercise on an obstacle course 400 m long. As the results of our study showed, the improvement in the time of passage of the obstacle course during the experiment in the EG was 13 s or 10,1% of the baseline. The comparison shows that the improvement in the results of this exercise is dominated by the similar dynamics of other tests. Given this fact, an attempt has been made to determine the influence of various factors on the effectiveness of this test. On the one hand, it is clear that the result of overcoming the obstacle course is affected by the level of development of speed endurance (run on 400 m, 1000 m). However, in our study, the results of overcoming the obstacle course are dominated by the rate of increase in endurance. This allowed to assume the presence of influence on the overall performance of another factor: it is about improving the effectiveness of techniques to overcome individual obstacles in the training of cadets. The basis of this assumption is the well-known proposition that repeated repetition of physical exercises forms effective and better performance [3; 12].

To study this, we compared the results of overcoming the obstacle course and the results in the 1000 m run as the closest exercise time. The ratio of the time of overcoming the obstacle course to the result in the 1000 m run gave the coefficient by which the level of overall technical skill of the cadets was tried to be overcome in the obstacle course. This approach is constantly used in athletics in assessing the technical skill of the hurdlers.

Table 2
Results of cadets testing

Exercises	EG (beginning)	CG (beginning)	EG (final)	CG (final)
100 m, s	14,7±0,56	14,6±0,55 t ₁₋₂ - 0,493	14,3±0,21 t ₁₋₃ - 1,109	14,5±0,65 t ₂₋₄ - 0,606; t ₃₋₄ - 1,15
400 m, s	82,2±7,2	81,8±6,2 t ₁₋₂ - 0,483	76,4±5,1 t ₁₋₃ - 3,35***	80,3±7,1 t ₂₋₄ - 0,813; t ₃₋₄ - 2,28*
1000 m, s	252,2±18,9	253,1±20,6 t ₁₋₂ - 0,163	231,2±12,3 t ₁₋₃ - 3,74***	249,7±18,8 t ₂₋₄ - 0,63; t ₃₋₄ - 4,19***
3000 m, s	803±36,4	799±31,4 t ₁₋₂ - 0,44	752,8±17,2 t ₁₋₃ - 6,35***	781±27,3 t ₂₋₄ - 2,33*; t ₃₋₄ - 4,45***
5000 m, s	1712±47,4	1699±52,2 t ₁₋₂ - 0,94	1579±48,3 t ₁₋₃ - 10,05***	1659±50,2 t ₂₋₄ - 2,81**; t ₃₋₄ - 5,83***
Obstacle strip, s	142,2±8,4	141,1±9,3 t ₁₋₂ - 0,94	129,1±4,2 t ₁₋₃ - 7,12***	136,5±5,2 t ₂₋₄ - 2,24*; t ₃₋₄ - 5,63***
Pull-up, times	9,2±3,2	9,5±4,3 t ₁₋₂ - 0,28	10,3±2,7 t ₁₋₃ - 1,34	9,8±3,3 t ₂₋₄ - 0,28; t ₃₋₄ - 0,60
Flexion-extension of hands, times	51,6±6,2	52,2±4,8 t ₁₋₂ - 0,39	57,4±3,9 t ₁₋₃ - 4,04***	54,1±4,6 t ₂₋₄ - 1,46; t ₃₋₄ - 2,75*
Slopes forward, times	63,3±7,1	62,8±6,4 t ₁₋₂ - 0,26	68,2±5,6 t ₁₋₃ - 3,27***	64,4±6,3 t ₂₋₄ - 0,91; t ₃₋₄ - 2,88**
Long jump from the place, cm	199,7±8,2	202,3±7,2 t ₁₋₂ - 1,21	214,6±5,8 t ₁₋₃ - 7,56***	206,6±6,8 t ₂₋₄ - 2,21*; t ₃₋₄ - 4,28***
Dynamometry of the right hand, kg	40,1±6,1	39,1±5,4 t ₁₋₂ - 0,84	43,6±5,8 t ₁₋₃ - 2,91**	42,6±6,6 t ₂₋₄ - 2,8**; t ₃₋₄ - 0,77
Dynamometry of the left hand, kg	38,2±5,7	38,5±6,6 t ₁₋₂ - 0,23	41,8±6,7 t ₁₋₃ - 2,79*	42,6±5,6 t ₂₋₄ - 3,23**; t ₃₋₄ - 0,63
VC, cm ³	4053±51	4103±54 t ₁₋₂ - 0,35	4265±46 t ₁₋₃ - 15,7***	4153±61 t ₂₋₄ - 3,7***; t ₃₋₄ - 7,5***

Note. Significance of differences: P<0,05*, P<0,01**, P<0,001***.

At the same time, the improvement of technical efficiency should be accompanied by a decrease in the coefficient value. The smaller the numerator (the time to overcome the obstacle course), the higher will be the technical skill in performing this exercise. This indicator was called the coefficient of coordination and technical efficiency (CTE). In the study, CTE decreased throughout the training period, which indicates a gradual mastery of the technique of overcoming obstacles. So, at the beginning of the CTE was 0,564 – in EG and 0,557 – in CG. At the end of the experiment, these indicators improved to 0,558 and 0,545, respectively. The overall improvement in CTE was 1,06% – in the EG and 2,1% – in the CG from the indices at the beginning of the experiment. Given that the result of overcoming the obstacle course in the EG improved by 10,1%, and the result of running at 1000 m – by 9,1%, it can be assumed that the technique of overcoming individual obstacles improved the result on 1%. In the CG, similar indicators were 3,7% and 1,4%, which suggests an improvement of 2% due to improved obstruction techniques. So, in the EG more involved in running exercises and the result of overcoming the obstacle course distance increased by 10,1%. In the CG less attention was paid to running exercises and the result grew by only 3,7%. But the technique of overcoming obstacles has improved. CTE was better in CG than EG.

The improvement in the result in overcoming the obstacle course in the process of cadets' training depended, on the one hand, on the improvement of endurance, which was estimated by the results of running at 1000 m, and on the other hand, on the effectiveness of the technique for overcoming individual obstacles, is confirmed by the dynamics of CTE.

This suggests that using the CTE coefficient, it is possible to evaluate the effectiveness of the learning process both individually and collectively.

Thus, during the training using the proposed program, the results grew by almost 10%, while in the group, trained according to the traditional scheme, the results grew by only 3%. Particularly significant is that the overall assessment of EG increased from 3 points to 5. In the control group, there was also an improvement in the result, but a less significant – from 3 to 4 points. Thus, our studies have confirmed previous studies by military experts that, with an equal total time in training, the greater effect of increasing aerobic capacity (the direction associated with overall endurance) is achieved with an interval training method [4; 5].

Conclusions

1. The dynamics of the results of running at different distances during the training of cadets in the military university has a wavy positive character. The increase in results depends on the organization of the educational process and the methods of training are used.
2. The increase in the results in the run at 1000 m, 3000 m in the CG is significantly inferior to the increase in the results in the EG. The same picture is also found in the strength indicators of physical readiness, which are controlled in the cadets' teaching process.
3. The application of the coefficient of technical efficiency

in conditions of manifestation of special endurance is most expedient to apply for assessing the effectiveness of training cadets in the technique of overcoming obstacles.

4. The proposed endurance program using the interval training method gives a significantly better result than traditional training.

5. The application of the proposed strength training program (with burdening) gave reliable improvements in the results of the studied indicators.

Prospects for further research are related to the study of the influence of various factors on the level of special physical performance of future officers, which is determined by the results of overcoming the obstacle course.

Conflict of interests. The author declares that there is no conflict of interests.

Financing sources. This article didn't get the financial support from the state, public or commercial organization.

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Received: 09.05.2017.

Published: 30.06.2017.

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