

FUNCTIONAL FITNESS LEVEL OF MILITARY COLLEGE CADETS

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Abstract. *Purpose:* to work out and study influence of author's physical training program on functional fitness of military college officers. *Material:* in the research 83 3rd year cadets of military college participated (experimental group, n=41; control group, n=42), of age 19-21 years. The cadets' functional state was registered by indicators of Shtange's test, Genchi test, test of Ruffiet – Dixon, Cooper's test. The volume of trainings was 4 hours a week. *Results:* it was found that the acting training programs do not permit to completely prepare combat soldier's organism for fulfillment of his tasks. We also found the purposefulness of special exercises and means' application in physical trainings, which would be approached by their structure to military officers' professional actions. *Conclusions:* it is recommended to conduct training with complex combining of different physical training sections (accelerated motion, overcoming obstacle course, hand-to-hand fighting and etc.) with special means (armor vest, tactic unloading system, helmet, weapon, gas mask, training grenades and so on).

Key words: military, college, functional state, readiness, physical load.

Introduction

Analysis of scientific works [1, 6] showed that in conditions of anti-terrorists operation professional functioning has certain specific features and put forward high requirements to physical and psychological fitness of ground troops' military officers.

In works [3, 6] it is noted that the main characteristics of professional functioning are watching at checkpoints, guarding of strategic objects (airports, railway stations, hospitals, storehouses and etc.) fulfillment of tasks in cities and towns (moving in ruined buildings, in premises with restricted space and so on.). Fulfillment of tasks in such condition requires from soldiers to manifest high coordination in complex conditions.

Scientists [2, 4, 8] mention that significant physical and psychic loads result in military officers' nervous-emotional tension. All these cause tensed work of cardio-vascular and respiratory systems. A number of authors [10, 11, 19] say that nervous-emotional tension results in the following: weakening of workability; increase of heart beats rate (HBR), breathing and BP; weakening of attention concentration; narrowing of attention and memory; increase of mistaken actions; quick fatigue.

In works of many scientists [14, 16, 17] it is underlined that regular physical training increase plasticity of organism's regulatory systems. It happens at the account of functional reserve improvement. High physical fitness of military officers significantly expands their functional potentials [9]. With it adaptation to regular physical loads results in economizing of energy losses, when fulfilling military tasks [5, 8].

Analysis of works [10, 15] showed that in the process of physical training it is necessary to use special exercises and means, which by their structure would be maximally approached to soldiers' professional actions. It also significantly raises functional potentials of military officers' organism.

Scientists remark that in acting programs of military college cadets' training the content of exercises has no special orientation on professional functioning. It does not permit to prepare soldier's organism completely for fulfillment of his tasks. In this connection it is necessary to improve physical training program for military college cadets [1, 7, 18].

Hypothesis: it was assumed that military college cadets trainings by the author's physical training program is more effective, comparing with acting program from Interim instructions on physical training in Armed Forces of Ukraine. Such approach will facilitate improvement of cardio-vascular and respiratory systems' operation that, in heir turn, will improve combat effectiveness of military officers.

The purpose of the research – is to work out and study influence of author's physical training program on functional fitness of military college officers.

Material and methods

Participants: in the research 83 3rd year cadets of military college participated (experimental group, n=41; control group, n=42), of age 19-21 years. All cadets had statistically equal physical fitness and physical condition indicators. Experimental and control groups were formed by method of equal pairs. All participants gave written consent for participation in experiment.

Organization of the research: the research was conducted on the base of sergeants' Military college of National academy of land troops (Lvov) from September 2015 to July 2016.

Physical training according to Interim instructions on physical training in Armed Forces of Ukraine took 4 hours a week. The training consisted of three parts: warming up, main and finalizing. Dozing of loads at trainings considered individual physical condition of every cadet. The load value was determined by heart beats rate, according to cadet's age.

The author's physical training program envisages fulfillment of exercises, maximally approach to practical actions in military professional functioning. Its main distinction from traditional program is the fact that the author's trainings complexly combined different parts of physical training. Besides, experimental group cadets used special means (armor vests, helmet, gas mask, training grenades and stimulators of hand-to-hand combat. The trainings were conducted on the base of military detachment (see table 1).

Table 1. Main distinctions of physical training programs for military college cadets

Description	Acting physical training program	Author's physical training program
Content of physical training program	Endurance – 40%. Quickness and physical qualities – 25%. Strength – 20%. Hand-to-hand combat – 15%.	Endurance – 50%. Quickness and physical qualities – 10%. Strength – 25%. Hand-to-hand combat – 15%.
Parts of physical training	Gymnastic and athletic training Accelerated motion and light athletic Obstacle course Hand-to-hand combat Military-applied swimming and rowing	Complex combination of different physical training parts
Means of physical training	Exercises from Interim instructions on physical training in Armed Forces of Ukraine	Interim instructions on physical training in Armed Forces of Ukraine combined with exercises of combat training (actions on combat machinery, on march; fortification works; shooting and so on).
Special means	No	Gas mask, general protection kit, weapon, armor vest, tactical unloading system, rucksacks, pioneer spade, knives, grenades.

The cadets' functional state was registered by indicators of Shtange's test, Genchi test, test of Ruffiet – Dixon, Cooper's test [12, 13].

Shtange's test envisages breath pause after inhale and is to be fulfilled in sitting position. The tested shall make deep (but not maximal) inhale and keep pause as long as possible (pressing nostrils with fingers). The time of pause is registered with stop-watch. For healthy untrained persons the range of pauses is: 40-60 sec for men and 30-40 seconds for women. In sportsmen this time is bigger (up to 60-120 sec. – men and up to 40-95 sec. – women).

Genchi's test envisages breath pause after exhale and is used for detection of hidden coronary insufficiency and organism's resistance to hypoxia. It is fulfilled in lying position. The tested makes usual (not excessive) exhale and keep pause. The time of pause is measured with stop-watch. For healthy untrained persons the range of pauses is: 25- 40 sec for men and 15-30 seconds for women. In sportsmen this time is bigger (up to 50-60 sec. – men and up to 30-50 sec. – women).

Ruffiet's-Dixon's test serves for assessment of heart workability under physical load. The test envisages registration of heart beats' rate in different periods of recreation after relatively not high loads. The tested is in lying position during 5 minutes. Then HBR for 15 seconds is registered (P1). Then the tested makes 30 squats for 45 seconds

and again takes lying position. His HBR is again registered after first 15 seconds (P2). Then HBR for the last 15 seconds from the first minute of recreation is registered (P3). Heart workability is assessed by formula:

$$\text{Ruffiet's index} = [4*(P1+P2+P3) - 200]/10.$$

The results are assessed by the value of index: from 0 to 15. Less than 3 units mean good workability; 3-6 – average; 7-9 – satisfactory and 10-14 means bad (strong cardiac de-compensation).

Organism's reaction to physical loads in the process of experiment was assessed on the base of pedagogic observations.

Statistical analysis: the processing of experimental results was fulfilled with the help of Microsoft Office Excel programs. The confidence of differences between indicators was checked with Student's criterion and considered to be significant at $p < 0.05-0.001$.

Results of the research

Dynamic of Shtange and Genchi's tests results points at insufficient level of physical fitness (experimental group 37.31 ± 0.72 sec. and control group – 37.25 ± 0.71 sec.; $t=0.059$, $p>0.05$). At the end of first stage of the research Shtange's test results in control group were 37.81 ± 0.76 sec. ($t=0.538$, $p>0.05$). At second stage control group indicators improved up to 38.16 ± 0.82 seconds. But they did not differ confidently from initial indicators ($t=0.839$; $p>0.05$). Shtange's test results at the end of acting physical training program illustrated that the acting physical training program does not permit to confidently improve the work of military officers' respiratory system (38.37 ± 0.83 seconds at $t=1.025$, $p>0.05$) (see fig. 1).

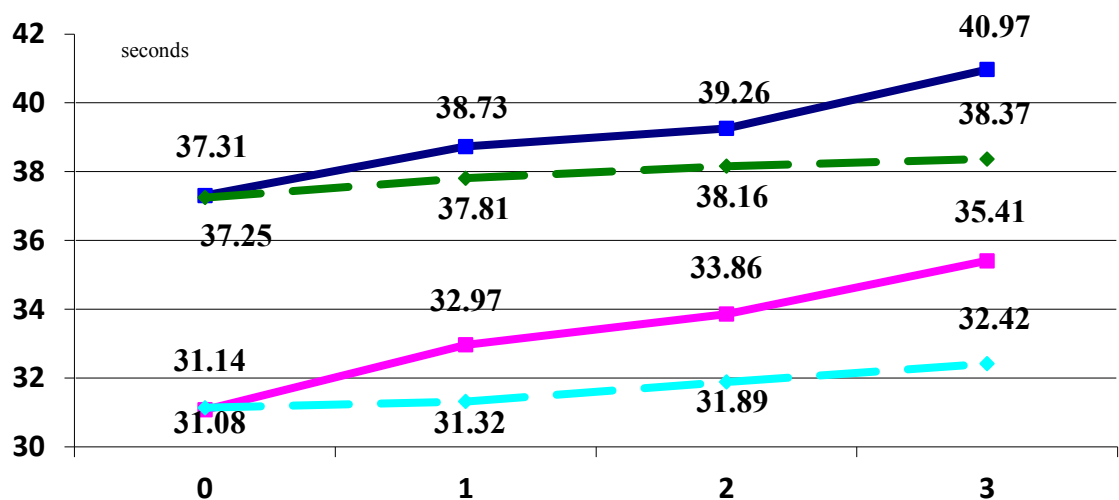


Fig.1. Dynamic of Shtange and Genchi's tests results in experimental and control groups during formation experiment, seconds

- — - results of control group cadets;
- — — - results of experimental group cadets;

0 – initial indicators; 1 – first stage of the research; 2 – second stage of the research; 3 – third stage of the research.

Experimental group indicators in Shtange's test reach level of fitness by assessment table. It corresponds to satisfactory level and confidently exceeds initial data (40.97 ± 1.17 seconds, $t=2.664$; $p < 0.05$).

Testing of respiratory system, by Genchi's test also proved positive influence of author's physical training program, comparing with the acting one. At the beginning of experiment these indicators (31.14 ± 0.85 sec.) confidently did not differ from control group indicators at second stage of experiment (31.32 ± 0.58 sec.; $t=0.583$; $p > 0.05$). In the course of experiment experimental group results constantly grew. At the end of the first stage (32.97 ± 0.64 sec.) Genchi's test results exceeded initial data by 1.83 sec. ($t=1.719$; $p > 0.05$). At the end of second stage of the experiment

the difference of results in respect to the beginning of the experiment was 2.72 sec. ($t=2.441$; $p<0.05$). At the end of experiment Genchi's test results in experimental group were 35.41 ± 0.69 sec. This 4.27 sec. ($t=3.900$; $p<0.001$). It corresponds to standard indicators for this age people (satisfactory work of respiratory system).

In control group Genchi's test initial results (31.08 ± 0.58 sec.) corresponded to unsatisfactory work of respiratory system. At the end of first stage (31.32 ± 0.64 sec.) they improved by 0.24 sec. ($t=0.277$; $p>0.05$). At the end of second stage (21.89 ± 0.68 sec.) the results improved by 0.81 sec. ($t=0.906$; $p>0.05$). At the end of experiment they improved by 1.31 sec. ($t=1.425$; $p>0.05$).

Testing of cardio-vascular system's functioning was fulfilled with test of Ruffiet-Dixon. Assessment of heart workability in control group cadets showed that the received data correspond to mark "satisfactory". The obtained indices of Ruffiet-Dixon in experimental group, at the end of experiment, (8.76 ± 0.22 bpm) correspond to average level of heart workability (see table 2).

It was noted that Ruffiet-Dixon's indices in control and experimental groups improved and have confident changes in respect to initial data ($t_{CG}=11.182$; $t_{EG}=9.286$; $p<0.001$). But comparative analysis of testing results of the tested groups showed that experimental group results confidently exceed indicators of control group ($t=2.198$; $p<0.05$). Further, difference between control and experimental group results increases up to 0.98 bpm at the end of second stage ($t=3.201$; $p<0.01$) and up to 1.48 bpm at the end of experiment ($t=5.558$; $p<0.001$).

Table 2. Dynamic of Ruffiet-Dixon's test results in experimental and control group cadets in the course of experiment, bpm

Stages	Control group (n=42)		Experimental group (n=41)		Confidence of difference	
	Mean arithmetic	Mean error of mean arithmetic	Mean arithmetic	Mean error of mean arithmetic	t	p
Initial data	12.32	0.11	12.29	0.31	0.09	>0.05
1 stage	11.89	0.15	11.23	0.26	2.19	<0.05
2 stage	11.01	0.24	10.03	0.19	3.20	<0.01
3 stage	10.24	0.15	8.76	0.22	5.55	<0.001

For complex assessment of cardio-vascular and respiratory systems' physical fitness of experimental and control groups' cadets we fulfilled Cooper's test (see table 3).

Table 3. Dynamic of Cooper's test results in experimental and control groups during experiment, meters

Stages	Control group (n=42)		Experimental group (n=41)		Confidence of difference	
	Mean arithmetic	Mean error of mean arithmetic	Mean arithmetic	Mean error of mean arithmetic	t	p
Initial data	2114	25.9	2127	29.7	0.32	>0.05
1 stage	2159	30.8	2296	32.2	3.07	<0.01
2 stage	2207	27.6	2349	30.8	3.43	<0.01
3 stage	2278	27.9	2425	33.1	3.39	<0.01

Discussion

Modern conditions of Armed Forces of Ukraine combat (professional) functioning require high level of physical fitness and military applied skills from military officers. That is why there appears demand in training of military officers (cadets) of land troops to professional activity with better quality and in the shortest time. As on today for optimization of military college cadets' physical training study of loads' characteristics, which they endure in fulfillment professional tasks, remains relevant.

The results of our research proved the data of scientists [9], that military officers' high physical fitness significantly expands their functional potentials. With it adaptation to regular physical loads results in economizing their energy losses [5, 8], when fulfilling combat tasks. It significantly raises military officers' combat effectiveness.

We also supplemented the data of scientists [10, 15] about purposefulness of special exercises and means' application in physical trainings (which, by their structure are approached to military officers' professional actions). By our researches' and other scientists' results [1, 7, 18], we substantiated the program of physical training for military college cadets. Implementation of the author's physical training program permitted to improve military college cadets' functional readiness for fulfillment their tasks.

Conclusions

The research showed that trainings with complex combining of different physical training parts (accelerated motion, overcoming obstacle course, hand-to-hand combat and so on) and with application special means (armor vests, tactic-unloading system, helmet, weapon, gas mask, training grenades and etc.) facilitate improvement military officers' functional state. For example in experimental group cadets results of cardio-vascular and respiratory systems' functioning are confidently better than in control group.

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Conflict of interests

The author declares that there is no conflict of interests.

References:

1. Afonin VM, Iena MO, Pocilujko PV. Fizichna pidgotovlenist' majbutnikh oficeriv Zbrojnikh Sil Ukraini [Physical fitness of future officers of Armed Forces of Ukraine]. *Moloda sportivna nauka Ukraini*, 2015;20(2):56-60. (in Ukrainian)
2. Velichko OI. Reformuvannia fizichnoi pidgotovki – ob'ektivna potreba s'ogodennia [Reformation of physical training – objective demand of to-day]. *Nauka i oborona*, 2006;2:53-57. (in Ukrainian)
3. Oderov AM, Fedak SS, Kuznecov MV. Fizichna pidgotovlenist' kandidativ do vstupu u vishchij vijs'kovij navchal'nij zaklad [Physical fitness of candidates to military higher educational establishment]. *Moloda sportivna nauka Ukraini*, 2015;19(2). – S. 188-191. (in Ukrainian)
4. Pichugin MF, Grihan GP, Romanchuk VM, Romanchuk SV. *Fizichne vikhovannia vijs'kovosluzhbovciv* [Physical education of military officers], Zhitomir: ZHVI of NAU; 2011. (in Ukrainian)
5. Romanchuk SV, Boyarchuk AM, Romanchuk VN. Existent state and prospective directions of physical training improvement in Land Forces. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2010;12:125–128.
6. Romanchuk SV. Doslidzhennia fizichnoi pidgotovlenosti vijs'kovosluzhbovciv pid chas vedennia bojovikh dij [Study of military officers' physical fitness during combat operations]. *Naukovo-pedagogichni problemi fizichnoi kul'turi*, 2015;3(56):316-319. (in Ukrainian)
7. Romanchuk SV, Petruk AP, Baldec'kij AS. Obgruntuvannia vikovoi periodizacii vijs'kovosluzhbovciv dlia zaniat' z fizichnoiu pidgotovkoiu [Substantiation of military officers' age periodization for physical trainings]. *Moloda sportivna nauka Ukraini*, 2015;19(2):250-256. (in Ukrainian)
8. Fedak S. Fizichna pidgotovka iak zasib zavchasnoi adaptacii vijs'kovosluzhbovciv mirotvorchoho kontingentu do dij v nezvichnikh umovakh sluzhbi [Physical training as a mean of prior adaptation of peacekeeping contingent military officers for activity in unfamiliar conditions]. *Naukovo-pedagogichni problemi fizichnoi kul'turi*, 2011;11:442-446. (in Ukrainian)
9. Finogenov Iu, Glazunov S. Utochnennia konceptual'nikh osnov funkcionuvannia ta strukturi sistemi fizichnoi pidgotovki vijs'kovosluzhbovciv Zbrojnikh Sil Ukraini [Specification of conceptual principles of physical training structure and functioning for military officers of Armed Forces of Ukraine]. *Naukovij chasopis*, 2009;14:255-260. (in Ukrainian)

10. Chukh L. Vpliv ekstremal'nikh faktoriv sluzhbovo-bojovoi diial'nosti na psikhofizichnij stan vijs'kovosluzhbovciv [Influence of professional-combat extreme factors on military officers' psycho-physical state]. *Naukovo-metodichna konferenciia "Fizichna pidgotovka vijs'kovosluzhbovciv"* [Scientific practical conference "Physical training of military officers"], Kiev; 2003. P. 185-189. (in Ukrainian)
11. Bulicz E, Murawow I. Human health and diagnostics: health effects of motor activity. Radom: Politechnica R.; 2003.
12. Ivashchenko O. V., Khudolii O. M., Yermakova T. S., Wiesława P., Radosław M., & Błażej S. Simulation as method of classification of 7-9th form boy pupils' motor fitness. *Journal of Physical Education and Sport*, 2015. 15(1), 142-147. doi:10.7752/jpes.2015.01023
13. Ivashchenko O., Khudolii O., Yermakova T., Iermakov S., Nosko M., Nosko Y. Factorial and discriminant analysis as methodological basis of pedagogic control over motor and functional fitness of 14–16 year old girls. *Journal of Physical Education and Sport*, 2016. 16(2), 442-451. doi:10.7752/jpes.2016.02068
14. Konovalov VV, Poddubny AG, Poltavec AI. Forming a motivation to the studies by the military-applied exercises for the cadets of few specialties of university of civil defence of Ministry of emergency measures of Ukraine. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013;3:31-35. doi:10.6084/m9.figshare.653978
15. Lisowski VO, Mihuta P.Yu. Importance of coordination skills essential psychophysical demonstrated competencies as a military specialists. *Physical Education of Students*, 2013;6:38-42. doi:10.6084/m9.figshare.840501
16. Romanchuk S, Gryban G, Romanchuk V, Tkachenko P. Teaching students a positive attitude to the educational process of physical training. *Australian Journal of Scientific Research*, 2014;2(6):54-60.
17. Romanchuk S, Gryban G, Romanchuk V. Normalization of physical loads in physical training educational process by means of students' self-rating of one's own physical state. *Canadian Journal of Science, Education and Culture*, 2014;1(5):67-75.
18. Sergienko YP, Andreianov AM. Models of professional readiness of students of higher military schools of the Armed Forces of Ukraine. *Physical Education of Students*, 2013;6:66-72. doi:10.6084/m9.figshare.840507
19. Wilmore JH, Costiill DL. *Physiology of sport and exercise*, Champaign, Illinois: Human Kinetics; 2004.

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