IMPROVEMENT OF PHYSICAL QUALITIES OF SERVICEMANTS, WHO RECEIVED CONCUSION OF THE BRAIN

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Ensuring a high level of combat capability of servicemen is a necessary and sufficient condition for their successful fulfillment of the task of defending our state. The activity of a serviceman is characterized by increased physical and mental stress, the impact on the psyche of various stressors, performing tasks in special conditions associated with risk to life and health [1, 2, 3]. However, extreme stress, eating disorders and rest, as well as other harmful factors of work, no doubt, reduce the body's adaptive reserves and lead to the development of maladaptation syndrome, psycho-emotional status and disability [4].

The participation of the Armed Forces of Ukraine in hostilities in the east of the country has led to a significant increase in the number of servicemen with combat injuries, mutilations or injuries. According to experts, almost all participants in hostilities have health problems, in particular 2–3 times higher probability of diseases such as hypertension, gastritis, osteochondrosis, spinal hernia [5; 6]. One of the most common combat injuries is contusion, its prevalence among the total number of injuries is 70 [7; 8; 9; 10]. Changes in mental and physical states are observed in servicemen with contusions [5; 11; 12]. This contingent of servicemen is important for the Ukrainian army, as their combat experience is important as a basis for the development and improvement of military training. But their health can be an obstacle to the successful performance of their duties.

Therefore, the *purpose* of our study is to substantiate, develop and evaluate the effectiveness of a comprehensive program of ergogenic orientation for servicemen after contusion to increase their combat capability. To achieve this goal, the following tasks are *defined:*

- analysis and generalization of modern scientific and methodological approaches to the recovery and rehabilitation of servicemen who had combat injuries;

- analysis of the peculiarities of the way of life and the state of special physical qualities of servicemen who had contusions as factors that ensure combat readiness;

- substantiation and development from the theoretical and methodological standpoint of measures to optimize the lifestyle and physical training program for servicemen who have suffered a concussion.

Material: The article analyzes and summarizes modern scientific and methodological approaches to the recovery and rehabilitation of servicemen who have suffered injuries, substantiates measures to optimize lifestyles and physical training programs for servicemen who have suffered a concussion.

Results: Our previous studies have found that the dosed use of exercise balances the processes of excitation and inhibition in the central nervous system, enhances its regulatory role in coordinating the activities of important organs and systems involved in the pathological process.

Key words: contusion, program, exercise, health, servicemen.

Оксана Матвейко, Артур Одеров, Тетяна Людовик, Олександр Зонов, Євген Іщенко, Богдан Семенів. Підвищення фізичних якостей выйськовослужбовців, що отримали струс мозку

Анотація. Забезпечення високого рівня бойової здатності військовослужбовців є необхідною та достатньою умовою успішного виконання ними завдання із захисту нашої держави. Діяльність військовослужбовця характеризується підвищеним фізичним і психічним напруженням, впливом на психіку різноманітних стресчинників, виконання завдань в особливих умовах, пов'язаних із ризиком для життя і здоров'я [1, 2, 3]. Разом з тим надзвичайна напруженість праці, порушення режиму харчування та відпочинку, а також інші шкідливі чинники службової діяльності, без сумніву, зменшують адаптаційні резерви організму та призводять до розвитку дезадаптаційного синдрому, порушень психоемоційного статусу та працездатності [4].

Участь Збройних Сил України в бойових діях на Сході держави призвела до значного зростання кількості військовослужбовців, які мають бойові поранення, каліцтва або травми. За даними експертів, майже у всіх учасників бойових дій, є порушення стану здоров'я, зокрема в 2–3 рази вища ймовірність таких захворювань, як гіпертонічна хвороба, гастрит, остеохондроз, грижі хребта [5; 6]. Однією з найпоширеніших бойових травм є контузія, її поширеність серед загальної кількості травм становить 70 [7; 8; 9; 10]. У військовослужбовців з контузією спостерігають зміни психічного та фізичного станів [5; 11; 12]. Цей контингент військовослужбовців є значущим для українського війська, оскільки їх бойовий досвід важливий, як підґрунтя для розвитку та удосконалення підготовки військових фахівців. Але їх стан здоров'я може виступати як перешкода для успішного здійснення своїх функціональних обов'язків.

Тому *мета* нашого дослідження полягає в обґрунтуванні, розробці та здійснення оцінки ефективності комплексної програми ергогенної спрямованості для військовослужбовців після контузії задля підвищення їх бойової здатності. Для досягнення цієї мети визначено наступні *завдання:*

- аналіз та узагальнення сучасних науково-методичних підходів щодо відновлення та оздоровлення військовослужбовців, які мали бойові травми;

- аналіз особливостей способу життя та стан спеціальних фізичних якостей військовослужбовців, що мали контузію, як чинників, що забезпечують бойову готовність;

- обґрунтування та розроблення з теоретико-методологічних позицій заходів щодо оптимізації способу життя та програми фізичної підготовки для військовослужбовців, які перенесли контузію.

Ключові слова: контузія, програма, фізичні вправи, здоров'я, військовослужбовці.

Introduction

During the four years of the war in the east of Ukraine, thousands of servicemen were injured, treated and rehabilitated. Not only physicians but also volunteers are taken care of the wounded. At the same time, the injured soldiers remained in the shadows.

According to the Deputy Chief of the Ukrainian Military Medical Academy, Colonel of the Medical Service, Professor Vsevolod Steblyuk, by 2016, head injuries accounted for one third of all combat injuries, but now, due to the changed nature of the war, this figure has increased to 40 . Of the total, close to 80 is a mild head injury called a concussion [13].

Specialists define the contusion as an injury resulting from the movement of the brain inside the cranial box. This occurs when a shock wave, hit any objects in the head, fall from a height.

The injury itself is not as dangerous as the primary damage as the consequences. In compliance with the regimen and following the doctor's recommendations in 70 of cases, the contusion goes away without consequences. But 30 is transformed into post-concussion syndrome.

The main symptoms of this pathology are disorders of the three components of mental health. First, physical is a headache, weakness, poor tolerance of noise. Secondly, emotional – mood swings, aggression attacks, depressive state. Third, cognitive impairment of memory, concentration of attention, performance [14].

Concussion and post-concussion syndrome are not a problem for the individual and his family, and must be addressed with national standards. Injuries and injuries suffered by young men at the height of their social and professional activity, who should be responsible not only for themselves but also for two or three generations of their family. But coping with this mission does not allow them physical and psychological condition [15].

According to the guidance documents of the Ministry of Defense of Ukraine, traumatized soldiers are allowed to serve in military educational establishments and military units in teaching and administrative positions.

Upon completion of treatment and rehabilitation at the medical centers, the injured personnel have only medical prescription in case of deterioration of their health status.

The Physical Training Guidelines and orders of the Ministry of Defense of Ukraine on the health care of military personnel do not contain recommendations for improving the health indicators by means of physical exercises.

These military personnel are exempted from physical training by their health status, only a few are engaged independently, but they are not able to properly control the functioning of the body [16].

Considering that the number of personnel in the Armed Forces of Ukraine who are diagnosed with a contusion or post-concussion syndrome counts thousands of servicemen, there is an urgent question of maintaining the professional capacity of this category not only medical but also by means of physical training [17].

Aim of the study: To substantiate and develop an exercise program for servicemen who have received brain injuries of varying degrees to improve fitness and health.

Materials and methods

The study uses theoretical analysis, systematization and generalization of scientific literature, documentary sources and guidelines in the field of physical education, compilation of literature sources to identify the essence of the problem and identify ways to solve it; synthesis - to substantiate the structure and content of the physical training program and identify the main problems of the physical education system to develop an ergogenic program for servicemen after contusion to improve their combat capability.

A program of physical education classes for servicemen with injuries has been developed and proposed as specific rehabilitation measures. The program is differentiated depending on the severity of existing disorders, meets the basic principles of physical education and the rules of construction of therapeutic physical education classes and aims to eliminate existing health disorders identified in the previous stages of work [tables 2, 3, 4].

The exercise program is designed for people with injuries and aims to eliminate existing health problems. Its use in the general program of ergogenic orientation will allow to optimize the functional state due to the impact on physical and mental performance, will contribute to the correction of existing pre-nosological conditions. An important point is to prove the effectiveness of the program, which was the task of the next stage of work.

At the first stage, exercises are performed in a complex for 20–30 minutes. 3–4 times a week and supplemented by swimming, tennis, skiing, running [tables 2].

In the second stage there is an adaptation to physical activity. Exercises will be performed at a slow pace lasting 20-25 minutes. 4–6 repetitions. Morning gymnastics is used with 10–12 simple exercises for all muscle groups, namely: pulling, swinging arms, legs, turns (without turning the head), exercises on simulators (walking on a treadmill at a slow pace, on an exercise bike at a slow pace). In the future there is a gradual increase in workload and duration of classes [tables 3].

The third stage is characterized by performing exercises with strict control by a doctor. Exercises of medical physical culture are performed, namely: in the initial position lying on your back with a high raised headboard, and then, when the condition improves, perform the same action in

a sitting position; exercises for the joints of the legs and arms with deep breathing in small doses with pauses and rest after each exercise; exercises to relax the muscles of the arms and legs, attention, simple coordination [tables 4].

Results

Our previous studies have found that the dosed use of exercise balances the processes of excitation and inhibition in the central nervous system, enhances its regulatory role in coordinating the activities of important organs and systems involved in the pathological process [15].

Exercise has a normalizing effect on the response of blood vessels, helping to reduce their tone. This, in turn, is accompanied by a decrease in blood pressure [18].

Under the influence of metered exercise increases the adaptation of the body to the environment and various stimuli. Particularly beneficial effects on the body are exerted by special physical exercises, the so-called therapeutic physical training (exercise). Under the influence of exercise therapy in patients with a contusion, the mood improves, headache, unpleasant sensations in the heart area and so on [19].

The dosed therapeutic physical training is shown in the I and II stages of the contusion without complications. The intensity and volume of training depends on the overall preparedness and functional status of the cardiovascular system, which is revealed when conducting dosage tests with load [20].

People with Stage I and Stage II injuries are advised to: morning hygienic gymnastics, metered walking, gymnastics, close tourism (mainly in the spa), sports games or their elements; exercise in water, exercise on simulators, massage of the cervical spine.

During the third stage of the injury, physical exercises can also be applied, but taking into account the complications that are, and necessarily under the guidance and supervision of a doctor. Before performing the exercises, you need the advice of a doctor, who should determine the motor regime that is most beneficial for the patient.

Our author's program of physical training allows to supplement medical treatment and achieve the main goal – to increase the physical endurance of the human body and resistance to physical activity. This, in turn, helps to strengthen the heart muscle, allows to activate the body's own systems.

Each stage of the injury is provided with its own training system. But keep in mind a number of general provisions:

- during the hypertensive crisis physical exercises are not shown, bed rest is recommended;

- it is impossible to be engaged at figures of arterial pressure above 180/110 mm of mercury. Art. and the phenomena of heart failure of the second stage (edema, pain in the right hypochondrium, etc.);

- exercises should be introduced gradually, as pressure normalizes;

- developmental exercises alternate with breathing;

- it is advisable to massage the head, neck and upper arm area before and after class;

- duration of one session from 15 to 60 minutes;

Exercises should be performed freely, at a quiet pace, with full amplitude, without respiratory delay, without effort and exertion;

- the load should not be too sharp for the body to gradually get used to it.

Exercise at least 2–3 times a week;

- Exercises for the hands are performed with caution as this can lead to increased pressure as opposed to leg exercises;

- bending, turning, rotation of the torso and head during the first weeks of the class to perform no more than 3 times in a slow pace with low amplitude of movements (over time, the number of repetitions can be increased);

- in the first two weeks to perform only general and special exercises for coordination, relaxation of muscles, training of the vestibular apparatus;

- in the third or fourth week, you can begin to perform isometric exercises for 30–60 seconds, followed by relaxation and static breathing for 20–30 seconds for stage I hypertension and 1.5–2 minutes for stage II.

In the first stage of the disease, when there is no damage to the organs – the target (vessels of the kidneys, eyes, heart muscle), physical activity, physical exercises are mainly aimed at prevention, prevention of disease progression. It is allowed to perform (within reasonable limits) any exercise complex of 20–30 minutes, an average of 3–4 times a week, which can be supplemented by swimming, tennis, skiing, jogging.

In the second stage there are restrictions and the training program is developed depending on the state of health and the presence of complications. During the first week it is necessary to adapt to physical activity - exercises should be performed at a slow pace, the total duration of training is 20-25 minutes, for each exercise – 4–6 repetitions. Morning gymnastics consists of 10–12 simple exercises for all groups of muscles (pulling, swinging arms, legs, turns (but not rotation of the head), possible exercises on simulators (walking on a treadmill in slow pace, training on a bicycle ergometer, also in In the following days, you can gradually increase the load, increase the duration of training, first up to 40, and then up to 60 minutes. no contraindications), you can onuvaty exercises with dumbbells (0,5–3 kg), medical balls. dosed walking (including the gym) depending on the health indicators may be increased to 3 or even up to 8 km.

Table 1 – Flowchart of the author's physical training program for military personnel with a brain injury

Medical examination	Exercise program			
	Kind of physical activity	Frequency to take a week	Duration of lessons	The degree of intensity
And the degree	- general developmental exercises; - stretching exercises; - Exercise for strength, endurance, flexibility; - recreational exercises	3–4	30–35 min	40–80 %
III degree	- generally developing exercises; - stretching exercises; - Exercise; - recreational exercises - general developmental exercises; - stretching exercises; - Exercise for strength, endurance, flexibility; - recreational exercises	2–3	20–25 min	30–40 %
		2–3	20–40 min	40–50 %
II degree	- generally developing exercises; - stretching exercises; - Exercise; - recreational exercises	2–4	5–20 min	20–40 %

The third stage of the contusion is characterized by the presence of serious complications (heart attack, stroke, significant renal dysfunction), so any physical activity should be strictly controlled by a doctor. In stage 3 hypertension, after the hypertensive crisis, the physical therapy is carried out in the initial position, lying on the back with a high raised headboard, and then, with the improvement of the condition, in a sitting position. Useful exercises for joints of feet and hands with deep breathing in small dosage, 2-4 times and pauses of rest in a few seconds after each exercise. The pace of execution is slow. With a satisfactory condition, you can include exercises to relax the muscles of the hands and feet, attention, and easy coordination.

All the exercises that are performed, as well as the fact of active motor activity at any stage of the injury, should be coordinated with the doctor, and the training program should be individual. You should not rely on the advice of friends and acquaintances.

At the initial stage, or after a long break, even in the case of considerable previous physical activity experience, it is necessary to slowly enter the training process. The initial phase can be stretched for 3-4 months, with a regimen of three to four workouts a week. During training, from time to time, you should check your condition: monitor your breathing, heart rate, skin condition (whether or not redness), or feel comfortable. If you feel negative, you should consult a doctor and measure the pressure.

For the organization of physical exercises it is possible to offer schemes of classes at different stages of contusion [tables 2, 3, 4].

Table 2 – Exercise for Stages i Stage

Part of the lesson	Starting position	Exercises	Duration (min)	Methodical instructions
Preparatory	Standing	Walking is the usual step with gradual acceleration and deceleration. Elementary exercise with dynamic breathing in a ratio of 1:3.	5–6	Rhythmic at a quiet pace. Exercise with medium and large amplitude of movements.
Basic	Sitting standing	Elementary exercises for hands, feet, torso with different directions	5–6	Exercise alternate with breathing dynamic exercises
	Standing	Exercises in throwing and passing balls and medicines, exercises for relaxation of hands and feet	5–6	Alternate with breathing exercises and lower extremity exercises
	Sitting standing	Exercise for arms, legs, torso alternate with exercises on the gymnastic wall (such as mixed hangs) and with breathing	5–6	In between exercises – deep breathing
	Standing	Low-speed ball games (relay, tipping, etc.) and short runs	5–6	Adjust emotional state, include rest breaks and breathing exercises.
final	Standing	Walking is the usual step and difficult, exercises to relax the muscles of the torso, arms, legs. Breathing static exercises.	5	Walking rhythmic at a slow pace

Table 3 – Exercise for Stage II Stage

Part of the lesson	Starting position	Exercises	Duration (min)	Methodical instructions
Preparatory	Sitting on a chair	Elementary gymnastic exercises for hands, feet	5	Perform the exercises freely, without tension, alternating them with breathing exercises.
Basic	Lying with his head slightly raised	Exercises for hands and feet with no great amplitude. Easy exercises for abdominal muscles and pelvic floor muscles.	5	Do not allow tension and irregular rhythm of breathing. After relatively heavy exercise, deep breathing.
	Standing	Walking in different directions at a quiet pace. Breathing exercises.	2–3	Follow the rhythm of breathing
Final	Sitting on a chair	Generally developing exercises for the arms, legs and torso. Breathing dynamic exercises then - static breathing exercises.	6–7	Do not make sudden head movements during movements

Table 4 – Exercise with stage III injuries

Part of the lesson	Exercises	Duration (min)	Methodical instructions
Preparatory	Walking, exercises for small and medium muscle groups of extremities.	2–3	In the III century. apply exercises only for small and medium muscle groups of extremities.
Basic	1. Exercises for the torso. 2. Breathing exercises. Pause for rest 3. Exercises for extremities. 4. Breathing exercises. Pause for rest 5. Walking or exercising vestibular apparatus. Pause for rest 6. Breathing exercises. Pause for rest 7. Exercises with sports items. 8. Breathing exercise. Pause for rest. 9. Coordination exercises. 10. Breathing exercise. Pause for rest. 11. Exercises for training the vestibular apparatus. Pause for rest.	10–20	In the III century. apply lightweight exercise options. In the III century. Exercises 3,4,7,9 – Do Not Perform. In the III century. walking is easy to use. Exercise for the hands to perform at a slow pace.
Final	1. Exercises for small muscle groups of extremities. Walking 2. Breathing exercises	2–3	Do not make sudden movements.

Discussion

Joseph C research on the reliability of military personnel states that behavior in extreme conditions is influenced by factors such as combat stress, emotional resilience, coping strategies used in emergencies, and so on. It was found that ways of responding to and overcoming extreme conditions determine the quality of emergency assessment and the level of adaptation to service conditions. It is emphasized that the skills of rapid decision-making and effective overcoming of unforeseen circumstances arising in extreme conditions, as well as situations with a high degree of uncertainty, should be within the competence of specialists in hazardous occupations.

Bunn P. D., Meireles F.D., Sodre R.D., Rodrigues A.I., and Silva E.B. have studied the risk factors for injuries in military personnel and argue that the main risk factors include age, being overweight or obese, and previous injuries. The probability of injury depended on the effectiveness of running at a distance of 1600–3200 m, which is interpreted as the effect of general physical fitness.

Analyzing the research and research of Elder GA, Cristian A., who notes that mild traumatic brain injury was called a typical trauma during the wars in Iraq and Afghanistan, conducted their own research and proposed their own program, referring to the current warfare of the military Armed Forces of Ukraine in the East. Foreign scientists note that during both military operations, traumatic brain injury was a significant cause of death and morbidity, the most common cause being explosive trauma, which raised fears that these injuries could have long-term adverse health effects, affect combat readiness of troops. Thus, our research is related to similar injuries.

Thus, the available sources in the literature indicate a significant number of risk factors in the professional activities of servicemen, which can lead to deterioration of their health and reduced combat effectiveness. Among the consequences of hostilities a significant place is occupied by contusion or contusion shock and their consequences, which determined the direction of further literary analysis.

In restoring professional performance, military personnel play a key role and a healthy lifestyle, and success in achieving the goal depends largely on the individual. Forming a healthy lifestyle is impossible without normalizing motor activity. It has long been known that

adequate motor activity has beneficial effects on the human body as a whole. Academician IP Pavlov rightly emphasized that people are reducing their life expectancy by their unrestrained, disorganized, careless attitude towards their own health. Because a brain injury is a chronic condition, it needs attention throughout life, issues with blood pressure and pulse are the major comorbidities. Its prevention and treatment requires an action program that will allow you to believe in the possibility of correcting your physical condition through differentially selected adequate physical training. Naturally, this is possible only in the absence of contraindications for physical activity.

Properly organized training sessions, increasing the reserve of adaptation of the organism and normalizing the state of all its systems, is an effective way to normalize the level of pressure, increase efficiency, prevent complications and increase life expectancy. There is currently a great deal of potential for action to avoid or reduce high blood pressure and to maintain it adequately through motor activity. In addition to having a direct beneficial effect on blood pressure, exercise helps to reduce the risk of a variety of diseases, such as obesity and diabetes, that lead to comorbidities. In some cases, medication is necessary, but it is often avoided due to lifestyle changes.

In order to determine and substantiate the structure and content of the author's program, we planned to conduct a study taking into account the categories of servicemen. A control group of n = 80 (of which: cadets from among civilian youth n = 40, cadets – contract servicemen who received a concussion, n = 40) and an experimental group of n = 78 (of which: cadets from among civilian youth n = 40, cadets - contract servicemen who received a concussion n = 38). A total of 158 military college cadets, aged 17–30, took part in the study. The initial (input) data of the experimental and control groups and their statistical processing were determined.

Analysis of diastolic blood pressure indicators of the studied cadets showed that in KG1 and KG2 between the stages of the experiment there were changes, but unreliable (t = 1.20–1.68; p>0.05) (Table 5). A study of KG1 and KG2 at the beginning and end of the experiment showed that there was no significant difference between groups of cadets (t = 0.83–1.33; p>0.05).

The study of the results of the Harvard step test of cadets showed that the average results at the beginning of the study are: KG1 – 94.7 um.od., KG2 – 95.8 um.od. and at the end of the experiment KG1 – 96.2 um.od., KG2 – 97.1 um.od. (Table 6).

Table 5 – Dynamics of heart rate and blood pressure of cadets during the experiment

	KG1, civilian youth, (n = 40)			KG 2, in / with contract services, (n = 40)			P KG1-KG2 Beg.	P KG1-KG2 Kin.
	Beginning	P Beginning. Kin.	Kin.	Beginning	P Beginning. Kin.	Kin.		
Heart rate at rest, beats / min								
$\bar{x}$	69,1	t=1,38 > 0,05	69,8	69,5	t=1,00 > 0,05	70,1	t=0,78 > 0,05	t=0,50 > 0,05
σ	2,39		2,62	2,75		2,68		
m	0,35		0,38	0,41		0,39		
Systolic blood pressure, mm Hg								
$\bar{x}$	120,3	t=1,01 > 0,05	120,8	120,7	t=1,60 > 0,05	119,9	t=0,92 > 0,05	t=1,65 > 0,05
σ	2,43		2,62	2,26		2,66		
m	0,35		0,38	0,33		0,39		
Diastolic blood pressure, mm Hg								
$\bar{x}$	74,2	t=1,68 > 0,05	75,1	74,9	t=1,20 > 0,05	75,5	t=1,33 > 0,05	t=0,83 > 0,05
σ	2,56		2,66	2,58		2,46		
m	0,37		0,38	0,38		0,36		

N o t e p<0,05 при t=2,00; p<0,01 при t=2,66; p<0,001 при t=3,46.

Table 6 – Dynamics of indicators of the Harvard step test of cadets during the experiment, um.od.

	KG1, civilian youth, (n = 40)			KG 2, in / with contract services, (n = 40)			P KG1-KG2 Beg.	P KG1-KG2 Kin.
	Beginning	P Beginning. Kin.	Kin.	Beginning	P Beginning. Kin.	Kin.		
$\bar{x}$	94,7	t=1,10 > 0,05	96,2	95,8	t=0,90 > 0,05	97,1	t=0,74 > 0,05	t=0,63 > 0,05
σ	7,07		6,61	7,31		6,62		
m	1,02		0,95	1,08		0,98		

N o t e p<0,05 при t=2,00; p<0,01 при t=2,66; p<0,001 при t=3,46.

Table 7 – Dynamics of Cooper's test cadets during the experiment, m

	KG1, civilian youth, (n = 40), age 17–19 years			KG 2, in / with contract services, (n = 40), age 17–30 years		
	Beginning	P Beginning. Kin.	Kin.	Beginning	P Beginning. Kin.	Kin.
$\bar{x}$	2590,1	t=1,45 > 0,05	2602,8	2298,1	t=0,90 > 0,05	2306,6
σ	45,34		40,51	41,24		42,04
m	6,54		5,85	60,8		6,20

N o t e p<0,05 при t=2,00; p<0,01 при t=2,66; p<0,001 при t=3,46.

The study of CG1 and CG2 showed that the initial data and the results of the second test have changes, but do not differ significantly (t = 0.90–1.10; p>0.05). Comparative analysis of KG1 and KG2 at the beginning and end of the experiment showed that there was no significant difference between groups of cadets (t = 0.63–0.74; p>0.05). In addition, it was determined that the cadets of KG1 and KG2 at all stages of the study the results of the step test index correspond to the average score.

The study of the results of the Cooper running test by cadets showed that the average results at the beginning of the study are: KG1 – 2509.1 m, KG2 – 2298.1 m and at the end of the experiment KG1 – 2602.8 m, KG2 – 2306.6 m (table 7).

The study of KG1 and KG2 showed that the initial data and results at the end of the experiments have changes, but do not differ significantly (t = 0.90–1,45; p>0.05). In addition, it was determined that the cadets KG1 and KG2 at all stages of the study, the results of the Cooper test correspond to the average level, according to age group.

The study of functional status KG1 and KG2 testing allowed to establish the study that for all indicators (height, body weight, heart rate in combination, systolic and diagnostic blood pressure, Harvard step test and Cooper test) the initial data and results in the experimental experiment change , but are not reliably displayed. It can also be used that in courses KG1 and KG2 at all stages of the study, the results of the Cooper test correspond to the average level, according to age group, and the indicators of the Harvard step test average.

Our recommendations are aimed at understanding how to achieve normalization of blood pressure precisely through preventive measures and exercise.

Conclusions

Our research has shown that adequate exercise can maintain and even improve the performance of the body's functional systems. We have substantiated the author's program of physical training for servicemen who have suffered a brain injury. We offer types of physical activity, frequency, duration and intensity of training for different stages of the disease.

Conflict of interest. The authors declare no conflict of interest.

References

1. Borodin, Y. A., Krasota, V. M., Olkhovyi, O. M., Piddubny, O. G. (2006). Influence of unfavorable factors of military-professional activity on the physical condition of officers - cameramen specialists. *Pedagogy, psychology and medical and biological problems of physical education and sports,* pp. 10-12.
2. Korchagin, M., Kurbakova, S., Olkhovyi, O. (2017). Dependence of success of professional activity of servicemen-operators on the level of psychophysiological qualities. *Sports Bulletin of the Dnieper,* 5 (3), pp. 65-68.
3. Korchagin, M., Olkhovoyi, O. (2017). Set of indicators of professional performance of servicemen-operators*. Slobozhansky scientific and sports bulletin,* 4 (60), pp. 73-77.
4. Romanchuk, S., Rolyuk, A., Vorontsov, A., Yavorsky, A. (2017). Physical loads of servicemen in modern combat. *Ukrainian Journal of Medicine, Biology and Sports.* 6 (90): 47-52.
5. Gavrilova, L. A., Gavrilov, A.V. (2018). Psychological rehabilitation of Ukrainian military personnel and their readaptation to the conditions of service. *Pedagogy, Psychology and Sociology.* 2018; 3 (9): 35-42. DOI: 10.30888/2415-7538.2018-09-3-001.
6. Chin, D. L., Zeber, J. E. (2020). Mental Health Outcomes Among Military Service Members After Severe Injury in Combat and TBI. *Military Medicine*. 185(5-6): E711-E718. DOI: 10.1093/milmed/usz440.
7. Ekimov, M. Y., Sazhina, N. S. (2005). Problems of psychological rehabilitation of combatants // *Materials of the V All-Russian scientific-practical conference dedicated to the 60th anniversary of the Great Victory "State and prospects of social and medical work with veterans and participants in armed conflicts." Yekaterinburg,* 288 p.
8. Ivchenko, E. V., Tsygan, V. N. (2013). Medical and biological technologies for the prevention and treatment of combat trauma: state and prospects. *Military Medical Journal*. 6: 86-89.
9. Konovalov, A. N., Likhterman, L. B., Potapov, A. A. (1998). Clinical guidelines for traumatic brain injury: in 3 volumes, vol. 1. M.: Antidor.
10. Benedict, P. A., Baner, N. V., Harrold, G. K. et al. (2015). Gender and age predict outcomes of cognitive, balance and vision testing in a multidisciplinary concussion center *. J Neurol Sci.* 353:111-115. https://doi.org/10.1016/j. jns.2015.04.029.
11. Bunn, P. D., Meireles, F. D., Sodre, R. D., Rodrigues, A. I., da Silva, E. B. (2021). Risk factors for musculoskeletal injuries in military personnel: a systematic review with meta-analysis. *International Archives of Occupational and Environmental Health.* DOI 10.1007/s00420-021-01700-3.
12. *Working Group to Develop a Clinician's Guide to Cognitive Rehabilitation in mTBI: Application for Military Service Members and Veterans*. (2016). Clinician's guide to cognitive rehabilitation in mild traumatic brain injury: Application for military service members and veterans. Rockville, MD: American Speech-Language-Hearing Association. Available from http://www.asha.org/uploadedFiles/ASHA/Practice_Portal/Clinical_Topics/Traumatic_Brain_Injury_in_Adults/Clinicians-Guide-to-Cognitive-Rehabilitation-in-Mild-Traumatic-Brain-Injury.pdf.
13. Klymovych, V., Olkhovyi, O., & Romanchuk, S. (2016). Adoption of youth`s bodies to educational conditions in higher educational institutions. *Journal of Physical Education and Sport*, *3*(1), 620–622.
14. Rolyuk, A., Romanchuk, S., Romanchuk, V., Boyarchuk, A., Kyrpenko, V., Afonin, V. & Orest, L. (2016). Research on the organism response of reconnaissance officers on the specific load of military exercises. *Journal of Physical Education and Sport, 16* (1), 132-135. https://doi.org/10.7752/jpes.2016.01022.
15. Prontenko, K., Griban, G., Prontenko, V., Opanasiuk, F., Tkachenko, P., Zhukovskyi, Y. & Kostyuk, Y. (2018). Health improvement of cadets from higher military educational institutions during kettlebell lifting activities. *Journal of Physical Education and Sport, 18* (1), 298-303. doi:10.7752/jpes.2018.01040.
16. Olkhovyi, O. M. (2012). Theoretical and Methodical Foundations of Professional-Directed Physical Training of Cadets of the Secondary School of the Armed Forces of Ukraine. *Kharkiv University of Air Forces*, 3(4), 367-369.
17. Romanchuk, S., Yavorskyy, A. (2015). Peculiarities of officers' fitness shape. *Journal of Physical Education and Sport,* 15(3). 441 – 445. doi: 10.7752/jpes..03066.
18. Oderov, A., Klymovych, V., Korchagin, M., Olkhovyi, O., & Romanchuk, S. (2019). Optimization of the content of the physical training program of cadets-gunners. *International Journal of Recent Scientific Research*. Vol. 10, Issue, 07(A), 33340-33343. ISSN 0976-3031, (DOI: 10.24327/IJRSR).
19. Romanchuk, S. (2015). Peculiarities of officers' fitness shape. *Journal of Physical Education and Sport, 15*(3), 441**–**445.
20. Oderov, A., Klymovych, V., Korchagin, M., Olkhovyi, O., & Romanchuk, S. (2019). Motivation of forming students healthcare culture on principles of interdisciplinary integration. *Sport Mont Journal*. Vol. 17 (3), 79-83. – ISSN 1451-7485, eISSN 2337-0351, (DOI 10.26773/smj.191017).

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