

## Research on the organism response of reconnaissance officers on the specific load of military exercises

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### Abstract:

The article provided the results of the research of servicemen's organism functional systems response, who served in reconnaissance units, on the load of military all-round exercises. It is shown that in a period of rest after the load of various kinds, restoring of functional indices comes heterochronously. The greatest influence on the functional state of the servicemen's organism makes swimming (55.2%,  $p < 0.05$ ) and overcoming the obstacle course exercises (55.7%,  $p < 0.05$ ). It is defined the staging of military training according to the general and specific objectives and tasks for each stage of training.

**Keywords:** organism functional systems, physical quality, motor skills, physical load, recovery, central nervous system (CNS), heart rate (HR), military pentathlon (MP).

### Introduction

It is known that the man state after loading is fully characterized by indices of organism functional systems during their recovery (M.S. Korolchuk, 1996). Functional physical condition - a general, comprehensive characteristic of representation degree of all men's basic vital biological functions, his organs and systems, which provide sufficient (high) or insufficient (low) level of physical working efficiency of military personnel. Military readiness for the military professional activities is connected with a functional physical condition, a performance of certain specific actions, movements in difficult conditions of combat situation and an impact of various adverse factors: stress, physical and mental load, acceleration, motion sickness, vibration, high or low temperature, oxygen starvation and noise background.

The influence of loads on servicemen's certain functions and organs, who doesn't go into active sports, and the determination of optimal rest intervals are reviewed in the research works of Balsevich V.K. (1987), Eleynyca V.S. (1977). The effect of rest on the further military personnel work efficiency of various military specialties was studied by Bybylov I.E. (1986). The researches of Ilyin E.P. (2001), Smyrnova V.M. (2002), Korolchuk M.S. (2003) established the functional recovery of organs and systems staging which is connected with phase changes in the excitability of the central nervous system and work efficiency after fatigue. The staging is also a characteristic to cardiovascular and respiratory systems, neuromuscular system, as well as to restore body temperature regulation, biochemical processes and the level of efficiency (Murza V.P., 2007). The consequences of load are dependent on the specific muscle activity. Different structure and nature of the military exercises load have different effects on the energy exchange, functioning of certain organs and systems, on different parts of the skeletal system and on the nature of the interaction of regulation functions (Osodlo V.I., 2001, Payevskiy V.V., 2004, Rovnyi A.S., 2001).

The actions that have the greatest load during their educational and combat trainings were identified in previous studies by observing and questioning of reconnaissance officers. These actions were: overcoming various obstacles on the battlefield and in the movements (41.6%), fully equipped swimming (23.4%), grenade throwing and shooting (16.6%), long-distance running (18.4%).

The researches of Romanchuk S.V. (2004), Romanenko V.A. (2005) shows that the force, quickness and power-speed qualities reach their optimal development in basic military training period and then change slightly. It is a period of stabilization. These physical qualities as speed, special and speed-strength endurance are improving further.

Applied skills indicators have the largest increase in initial professional development in the exercises that are associated with a greater degree of strength expression, speed and power-speed qualities. These are exercises in grenade throwing for the accuracy and range and overcoming obstacles. With the professionalism increasing rises the role of fine motor coordination (machine gun shooting, grenade throwing for accuracy). All

of these various actions and loads, which servicemen get during educational and combat training, are similar with the influence of all-round exercises. Therefore, all-round exercises take a considerable place in the system of military physical training, which influence on the professional skills of military personnel and assist the development of necessary physical qualities for the improvement of specific professional motor skills. Consequently, while assessing the effects of training sessions it is important to have a clear idea about the features of body recovery when using all-round military exercises.

### Methods

The study was conducted during training classes as well as during the competition. There were involved 168 people in the experiment. This paper studied the nearest restitution period after loads in such a way: firstly, the physical training classes data were changed immediately after its completion and then for two hours (with indicators registration every half an hour). The changes in the state of the CNS and neuromuscular system indices were studied: focus, speed motor responses to light and sound stimuli, accuracy of time and efforts, tremometry and speed-power movement (long jump from place). The following methods were used to achieve the objectives of the study: theoretical analysis and synthesis; poll as interviews with experts in physical training, trainers of military-applied sports, servicemen; testing of servicemen functionality of the organism and statistical analysis of the results.

The psychological physiological state was investigated by means of electric appliance stopwatch. The device consists of two blocks: the experimenter and the subject tested. The psychological physiological state was estimated before load and after it.

Static tremor investigated by retaining a military pin thickness of 1 mm to 2,3 mm diameter hole for 30 seconds without touching its walls. Supply meter, which was embedded in a experimenter block, recorded the number of touches.

Dynamic tremor figure was determined by the stroke of apertures on the plate. After 3 samples tries, the test was given. Alternately the following tasks were put: outline all shapes quickly for a certain time; all the figures circle slowly without time. The supply meter recorded the number of errors, stopwatch - time, that is spent on outline of figures.

Simple sensorimotor reaction (SMR) was determined by the reaction of subject tested on light and sound signal, which was given with 5 to 10 seconds alternating intervals. The subject had three samples and 10 test tries.

Muscular sense was defined by carpal dynamometer. At the beginning the maximum result was recorded, then the subject had loads, at the level of 25%, 50%, 75% from maximum. Before each experimental series the subject performed 3 samples and then five tests. The average sum of deviation from given time was recorded in each series.

A sense of time was determined by switching off the stopwatch by the subject after time frame (15 seconds). Three sample tests and five scoring tests were performed. The average sum of deviation from given time with accuracy up to 0,1 sec. was recorded.

### Results

The results of the study (Table 1) show that immediately after heavy loads in terms of servicemen functional state changes of various kinds are observed. Thus, immediately after shooting training using Kalashnikov the indices of simple sensorimotor become worse significantly (motor and a latent time  $P < 0.05$ ), muscle sensations accuracy ( $P < 0.05$ ), tremometry ( $P < 0.05$ ), time accuracy ( $P < 0.05$ ), heart rate ( $P < 0.05$ ). Recoverable processes of functional systems occur with the respect to time unevenly ( $P < 0.05$ ). Thus, the rate of muscle feeling, time evaluation and heart rate recover to baseline within 10 minutes after exercises ( $P < 0.05$ ). Tremometry indicators and focusing after 1 hour ( $P < 0.05$ ), simple sensorimotor reaction to light, carpal dynamometry and a single long jump remain at before-working level. And the indicator of simple sensorimotor reaction to sound is still above baseline throughout the entire study period ( $P < 0.05$ ).

There were credible negative changes after grenade throwing training on the accuracy in the following terms: muscular perception accuracy (44.5%), static tremor (37.7%), accuracy of the time (36.6%), heart rate (52.0%), carpal dynamometry (14.8), focusing (10.9%), simple sensorimotor reaction (9,1-9,3% motor and latency time). The recovery time of these indicators is different: accuracy muscular perception is restored after 1 hour, time assessment accuracy, focusing (simple reaction to light and sound) in 0.5 hour. A longer period of recovery has indices of carpal dynamometry and tremometry, the indices continue to be reduced throughout the period of renewal ( $P < 0.05$ ).

Running leads to a significant inhibition of all functional indices ( $P < 0.05$ ). During the studied period the power-speed movement and carpal dynamometry became close to the baseline.

After obstacle course training, as well as after running, there was a significant inhibition of studied functional indices ( $P < 0.05$ ). However, changes in some of them were much higher. Thus, immediately after obstacle course training load the indicators of simple motor response (motor and latency time) deteriorate to 75.7% and 45.3%, respectively, muscular perception accuracy to 85.8%, tremometry to 84.3%, accuracy of the

time to 78.1%, heart rate to 74.3%, the sound reaction to 75.7%. Restorative processes of functional systems were much more slowly than after shooting training and grenade throwing. Over the studied period only the indicators of focusing, heart rate, carpal dynamometry were close to baseline. All indicators which characterize simple reaction (motor and latency time), muscular sensations accuracy, tremometry were far from baseline.

Training swimming load leads to a significant inhibition of functional indicators that characterize a simple motor response (motor and latency time), muscular sensations accuracy, tremometry, accuracy of the time, heart rate, a simple reaction to the sound ( $p < 0.05$ ).

## Discussion

Our previous studies have shown that the professional activities of reconnaissance officers has a high correlation with exercises included in the content of the military pentathlon. Therefore, we have investigated the effect of exercise on reconnaissance officers functional systems and time of recovery after significant physical exertion. Previous studies aimed to determine the development peculiarities of servicemen physical qualities, skills and functionality give the opportunity to establish that they express a mechanism of servicemen organism adaptation in the process of professional skills formation.

Table 1. Deterioration of the servicemen organism functional state after various types of load in % from baseline

	3 km running		Machine gun shooting		Grenade throwing		Obstacle course		Swimming		Average for all activities, %
	%	P	%	P	%	P	%	P	%	P	
A simple motor response to sound	59,8	$p < 0,05$	10,1	$p < 0,05$	9,1	$p < 0,05$	75,7	$p < 0,05$	76,6	$p < 0,05$	<b>46,3</b>
A simple motor response to light	72,8	$p < 0,05$	12,5	$p < 0,05$	9,3	$p < 0,05$	45,3	$p < 0,05$	42,2	$p < 0,05$	<b>36,4</b>
Tremometry	98,7	$p < 0,05$	16,9	$p < 0,05$	37,7	$p < 0,05$	84,2	$p < 0,05$	84,9	$p < 0,05$	<b>64,5</b>
Carpal dynamometry	12,2	$p > 0,05$	12,4	$p > 0,05$	14,8	$p > 0,05$	19,5	$p < 0,05$	32,3	$p < 0,05$	<b>18,3</b>
Time sense	53,1	$p < 0,05$	25,3	$p < 0,05$	36,6	$p < 0,05$	78,1	$p < 0,05$	69,4	$p < 0,05$	<b>52,4</b>
Muscle sensations	41,3	$p < 0,05$	27,8	$p < 0,05$	44,5	$p < 0,05$	85,8	$p < 0,05$	88,4	$p < 0,05$	<b>57,6</b>
Focusing	24,6	$p < 0,05$	11,4	$p < 0,05$	10,9	$p > 0,05$	21,4	$p < 0,05$	26,2	$p < 0,05$	<b>18,9</b>
Heart rate after exercise	41,1	$p < 0,05$	38,3	$p < 0,05$	52,0	$p < 0,05$	74,3	$p < 0,05$	68,8	$p < 0,05$	<b>54,9</b>
Long jump from place	16,8	$p > 0,05$	13,3	$p > 0,05$	11,9	$p > 0,05$	17,2	$p < 0,05$	26,7	$p < 0,05$	<b>17,2</b>
<b>Average result %</b>	<b>45,6</b>		<b>17,2</b>		<b>25,2</b>		<b>55,7</b>		<b>57,2</b>		<b>44,57</b>

It was found that the greatest influence on the servicemen organism functional state is made by swimming and obstacle course. The smallest is made by small arms training. Great physical and mental loads in military pentathlon cause serious physiological changes primarily in those functional systems that are used in this exercise. Thus, Kalashnikov shooting training leads to a deterioration of the auditory analyzer, focusing and increased tremometry. Grenade throwing training on accuracy and range impairs coordination, carpal dynamometry, tremometry, focusing and muscle sensitivity. Machine gun shooting and grenade throwing on accuracy are similar on functional system influence. The greatest changes in functional systems of the body are after obstacle course, swimming and running. In this case, the indicators of mental and motor functions of the cardiovascular system are inhibited. Among the dynamics servicemen organism functional state indicators with the greatest fluctuations in the results have CNS excitability due to tremometry (64.5%), muscle sensations accuracy (57.8%), cardiovascular system stress reaction (54.9%). This mechanism reveals the nature and direction of the relationships of physical qualities, military applications of motor skills and functional capacity of the reconnaissance officer organism.

Due to definite peculiarities, it is considered perspective to implement research materials obtained during the physical training of military personnel. The applied skills indicators have the largest increase in initial professional development that are associated with a greater strength degree, speed and power-speed skills. These are exercises in grenade throwing on accuracy and range and overcoming obstacles. With professionalism increasing the role of fine motor coordination increases (machine gun shooting, grenade throwing on accuracy).

The correlation analysis allows to define the staging changes in peculiar aspects of training depending on solution of general and specific military tasks, their initial physical and coordination abilities and applied skills mastering success.

Thus, the military exercises in the early stages of preparation should be directed on the development of power-speed skills and general endurance, as they provide a servicemen implementation of special qualifying standards. This is evidenced by a large number of statistically significant relationships between the level of data development quality and results in military pentathlon. The development speed and special endurance occupies a

leading position with increasing of preparedness. The principal attention is paid on technical kinds of all-round training (Kalashnikov mg shooting, MP, obstacle course and grenade throwing on accuracy and range), which was confirmed by correlation analysis.

The structure of servicemen physical and applied sports while increasing their preparedness undergoes significant changes. The leading factor of reconnaissance officers physical preparedness becomes special technical preparedness, whose contribution increases up to 25.7%. This factor joins together not only the characteristics of technical preparedness, but also results in 400 and 8,000 meters running. The following change of structure of reconnaissance officer preparedness is an effect of sport improvement process, that reflects the specific adaptation of the organism to work conditions. Moreover, the specificity is the more significant if the level of qualification is higher. The mentioned above peculiarities of physical qualities development and the formation of military-applied motor skills cause external mechanism of long-term adaptation of reconnaissance officer organism while improving them. This mechanism reveals the nature and direction of the relationships between the physical qualities and professional skills and determines three main stages of reconnaissance officer improvement. In the first stage, the reconnaissance officer that do not have a sufficient level of physical training, the formation of motor skills exercises in military pentathlon, strength development, speed, power-speed and overall endurance is going on; the most significant connection between the level of development of physical qualities and results of military pentathlon exercises are marked. The second stage of the reconnaissance officer with a satisfactory level of physical fitness is characterized by fixation and further improvement of technical actions, gradual optimization of power indicators, increasing the importance of speed and power-speed endurance. In the third stage where the reconnaissance officer has a sufficient level of physical fitness, the utilization occurs of the existent physical capacity with the aim to achieve high professional results and to maintain an optimal level of development, excellence in technical types (Kalashnikov mg shooting, MP and grenade throwing on accuracy and range) and increase level of special endurance.

## Conclusions

The study allowed to determine the influence of the military all-round exercises to the reconnaissance officer functional systems and the recovery time after loads. According to the results of the research, three stages of physical and professional military servicemen readiness formation to the military pentathlon exercises are determined, that allows to recommend this type of military all-around to include it into the programs of intelligence units physical training.

## References

- M.S. Korolchuk. 1996. Actual problems of psychophysiology of military activities, K.: KVHI, 160 p.
- V.K. Balsevich, V.A. Zaporozhanov. 1987. Physical activity of a person, K.: Zdoroviya, 224 p.
- Bibilov I. E. 1986. Volume, intensity and shipping of physical loads, which are done by personnel in the course of days-long tactical training / E. I. Bibilov // Physical Preparation of servicemen due to demands of modern combat: Col. of scient. method. work on tactical scientist / ed. A. Raspopov. - L.: VDKYFK, - P. 101-112.
- Eleynyk V.S. 1977. The effect of motor activity different levels on military specialists functional state / V.S. Eleynyk // Military and labor problems of hypokinesia. - L., - P. 33-34.
- Ylyn E.P. 2001. Differential psychophysiology / E.P. Ylyn. - SPb. : Piter, - 464 p.
- Korolchuk M.S. Psychophysiology activity / M.S. Korolchuk. - K. 2003. Elga Nika Center, 400 s.
- Osodlo V.I. 2001. Psychodiagnostics and correction of operators functioning states in the dynamics of professional activities: Thesis of psychol. sc-s.: spes.19.00.03 " Work psychology: engineering psychology" / V.I. Osodlo, Kyiv National University named after Taras Shevchenko. - K., - 19 p.
- Paevskiy V.V. 2004. Role of physical training in the preparation of tasks improvement and functional peculiarities in educational and combat activities of the ADA Army personnel / V.V. Paevskyy, O.A. Shevchenko // Pedagogy, psychology, medical-biological problems of physical education and sport: Coll. Science. w. / [ed. S.S. Yermakova]. - Kh., - № 9. - P. 53-62.
- Rovnyi A.S. 2001. Sensor mechanisms of the person movements / A.S. Rovnyi. - Kh.: HDAFK, - 200 p.
- Romanenko V.A. 2005. Diagnosis of motor abilities: tutorial / V.A. Romanenko. - Donetsk: Donetsk National University, - P. 181-183.
- Romanchuk V.M. 2004. Physical training in the Armed Forces of Ukraine: teach. guidances / V.M. Romanchuk, S.V. Romanchuk. - Zh.: ZMIRE, 144 p.
- Smirnov V.M. 2002. Physiology of physical education and sport: textbook for students / V.M. Smirnov, V.I. Dubrovsky. - Moscow: Vlados-Press, - P. 243-370.
- V.P. Murza, O.A. Arkhipov, M.F. Khoroshukha. 2007. Sports Medicine: teach. guidances / - K.: University "Ukraine", 131 p.