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"VACCINATION" BY STRESS IN PHYSICAL PREPARATION OF PROFESSIONAL SOLDIERS

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ABSTRACT. ***Introduction.*** This article deals with the issue of the use of "vaccination" techniques using stress in the physical training of professional soldiers. In the practice of a military professional, exposure to stressors is a common phenomenon, so it is important in the physical training of professionals to include in exercise programs training means to increase adaptation to stress. ***Results.*** The professional article contains a description of the issue of the influence of stressors on the performance of professional soldiers, adaptation, response to stress and proposals for individual training methods to increase stress tolerance.

Keywords: *stress, adaptation, professional soldier, physical preparation.*

Introduction

A professional soldier must engage in many physically and mentally demanding activities in the battlefield. The speed with which these activities can be performed can affect the combat effectiveness and survival of soldiers. Therefore, it is important to create training programs that will be able, within the time, space and material constraints of the army, to prepare soldiers for combat missions. Based on these requirements, a comprehensive exercise program of physical training of professional soldiers was created. This program was scientifically verified and according to Markovič (2018a) 74 tested professional soldiers showed significant improvements in all tested disciplines at 1% level of statistical significance ($p \leq 0.01$) and was also proven to be more effective compared to the current physical training system (Markovič, 2018b; Markovič, 2019). An important part of this comprehensive exercise program of physical training of professional soldiers are also exercises that increase the adaptation of soldiers against the effects of stress, which we will describe in more detail in this professional article.

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Stress

Security forces are exposed to stress and fatigue not only during the exercise of their profession, but also in everyday life. Our lives are very variable and during them we encounter a number of situations that require constant adaptation. Once our adaptive abilities stop increasing or there are many problems in our lives, they grow into emotions that quickly turn into stress (Blahutková et al., 2010). Stress according to Černý (2006) can be expressed by the following equation:

STRESS = STRESSOR + STRESS RESPONSE
STRESS = reaction of the organism to a negative life event
STRESOR = stimulus that triggers a stress response,
STRESS RESPONSE = a reaction in which the subjective ability to control decreases.

Selye (1976) described as stressors everything that has certain requirements for us and our organism and to which we have to adapt. It is therefore common or extraordinary situations and events of our lives that unbalance our organism, whether they are negative or positive. Stressors are usually divided into physical and mental, sometimes also social. Classification of stressors in the military environment, according to the US Army Manual FM 8-51 (1994):

Psychic stressor - this is information given to the brain, without direct action on the body. This information can burden both the utilitarian and cognitive systems, as well as the emotional systems of the brain, or both. Thus, psychological stressors are further divided into two types - cognitive and emotional.

Physical stressor - has a direct, potentially harmful effect on the body. These can be, for example, environmental conditions or the internal physical / physiological needs of the human body required or tolerated. Physical stressors are also further divided into two categories - physiological stressors and stressors from the external environment.

Macrostressors - thermal extremes, atmospheric influences, gravitational influences, lack of sleep, lack of rest, starvation, thirst, lack of stimuli (sensory deprivation), reduction of social contact (social deprivation), etc.

Microspressors - humiliation of a person in interpersonal contact (devaluation), destructive criticism, impossibility to agree with someone, get along with him in good times, reduction of social space, its compaction, etc. This is approached by an inadequate ability to cope with stress, lack of social recognition, lower self-esteem, limited social contact, poor skills in social contact.

Stress factors in soldiers

According to Driskell and Salas, (2009), during II. World War the biggest stressors for soldiers were excessive noise, smoke, earthquakes, debris and rubble. In the field of military, in the professional literature (Driskell, Salas 2009) we can meet with the term, Combat stress. It is actually a reaction of the organism to a combat situation - the so-called fatigue from the fight. This stress is created by a combination of several stressors such as: danger, hanger, environmental factors (noise, heat, cold), stamping and insulation, fatigue, sufficient sleep, uncertainty, insufficient control, time pressure.

Development of stress adaptations

Stress response

Kunimatsu and Marsee (2012) describe reactions to stress so that when it comes to a violent or potentially violent encounter, we have several reaction options: escape, avoidance, subordination, collapse, struggle, "freezing" and collapse. Avoiding, subordinate attitude and collapse are learned types of behavior, but they are not always appropriate for tackling social violence. Escape, fighting, and "freezing" are physiological reactions that can occur when we respond to or perceive danger. Physiological responses to danger begin in the hypothalamus, which activates the sympathetic nervous system and the adrenal cortex, from which the stress hormones adrenaline (epinephrine) and noradrenaline (norepinephrine) are released. These hormones can have many effects on the body, including increased heart rate, tunnel vision, absence of hearing, time distortion, memory loss, and loss of fine motor skills (Suresh et al., 2014).

According to Pendas (2014), there are many ways to work to make you resistant to exaggerated reactions to stress:

"Anti-freezing" - basically this means that when you have to do an awkward task (get out of bed, cold shower, etc.), do not hesitate and do it immediately and vigorously. It is also important to get used to unpleasant stimuli. One way to do this is, for example, to take a cold shower, fast, exercise, or participate in activities completely outside of your comfort zone (Miller, 2011).

Visualization - you play a "what if" game inside. Create a scenario of a stressful situation and visualize how you would react in a real situation. It is important to note that when using visualization, it is necessary to visualize

success and be as realistic as possible with details (Pendasa, 2014). Physiological responses to danger begin in the hypothalamus, which activates the sympathetic nervous system and the adrenal cortex, from which the stress hormones adrenaline (epinephrine) and noradrenaline (norepinephrine) are released. These hormones can have many effects on the body, including increased heart rate, tunnel vision, absence of hearing, time distortion, memory loss, and loss of fine motor skills (Suresh et al., 2014).

Stress "vaccination" - Just as a vaccine contains a certain amount of virus, stress inoculation must contain a certain amount of the same type of stress that you want to be vaccinated. The dashed line in Figure 1 is where the stress vaccination comes from. By participating in stress inoculation training, we can condition our mind and body to move the limits of our optimal performance from the red state (145 pulses / min) to the gray state (145-175 pulses / min). This basically means that when we are confronted with a high stress situation, we can avoid the effects of releasing hormones during the gray state. Stress vaccination must be carried out in such a way that it is effective. The best way to work on stress vaccinations is to mimic the type of stress you are preparing for. Physiological responses to danger begin in the hypothalamus, which activates the sympathetic nervous system and the adrenal cortex, from which the stress hormones adrenaline (epinephrine) and noradrenaline (norepinephrine) are released. These hormones can have many effects on the body (Suresh et al., 2014).

Grossman (2008) describes 5 conditions that a fighter can experience in combat. Each condition occurs within a specific heart rate range and is associated with predictable changes in performance. During the fight, it is important to know what state you are working in. Only then can you deliberately begin to control your physiological responses and perform your tasks. The 5 physiological readiness conditions according to Grossman (2008) provide a spectrum from the quiescent state of white through the almost non-functional state of black. Increased heart rate due to fear or stress is physiologically different from exercise-induced changes, although they may be increased in the presence of increased activity. When the heart rate reaches a certain limit, the chambers of the heart that receive deoxygenated blood are unable to fill completely and heart rate begins to decline. When you exercise, your blood vessels usually dilate, allowing more blood to flow to your muscles and certain organs. During life-threatening stress reactions, blood vessels narrow, which increases blood pressure and depletes many muscles of oxygen.

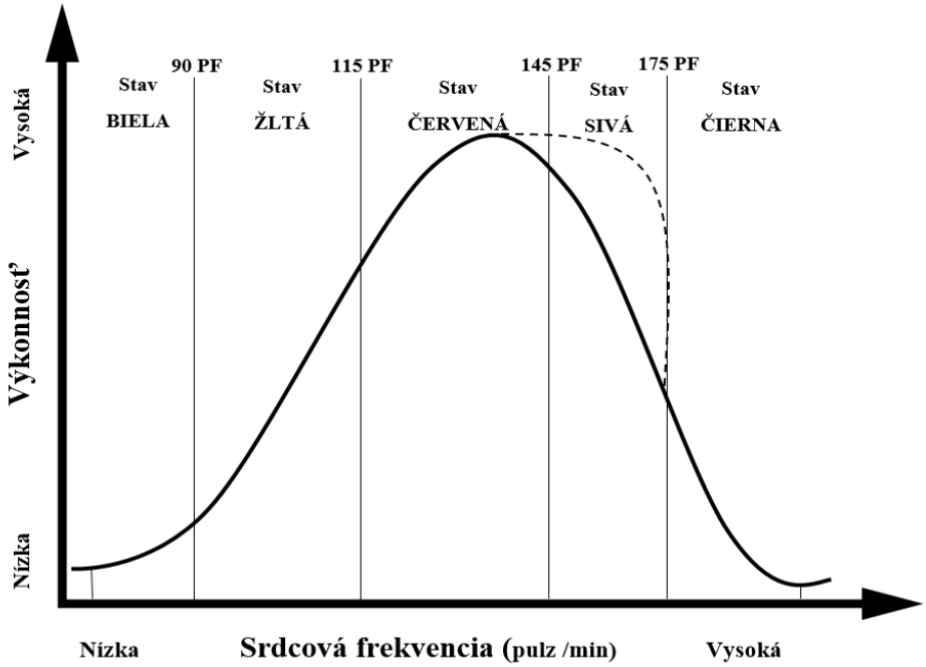

Fig. 1. Grossman (2008) model of the effect of stress "vaccination" on stress performance

Grossman (2008) recommends that soldiers achieve and maintain a red state during combat situations due to the best reaction times and mechanisms needed to survive. For a professional fighter pilot, the red condition is already a disadvantage, because rough motor skills prevail at the expense of fine motor skills. For fighter pilots, the yellow condition is much more suitable, where fine motor skills are preserved. As the heart rate rises from 115 -145 pulses / min, the aircraft's fine control begins to fade rapidly and the pilot's ability to make simple entries into its aeronautical, radar and combat technologies degrades. During periods of extreme stress, the body's sensory and cognitive abilities may not behave the same way you are used to. If you enter a state of red, gray, and finally black, your body devotes more and more of its limited resources to the most established mechanism of survival. Below are some of the most commonly described examples of what happens when you get gray and black: attenuated sounds (hearing impairments), intensified sounds, tunnel vision, increased visual clarity, temporary paralysis, memory loss for some or all events / actions, memory distortions, and more.

Stav	Pulzová frekvencia (pulz/min)	Reakcia
Biela	60 80	Normálny pokojový stav
Žltá	90 115	Psychologický pripravený na boj Jemné motorické zručnosti sa zhoršujú
Červená	120 145	Stav optimálného prežitia bojovníka Prevládajú hrubé motorické zručnosti na úkor jemných motorických zručností Doba vizuálnej reakcie a doba kognitívnej reakcie sú najvyššie
Sivá	150 175	Prechodná fáza medzi stavom Červená a Čierna, ktorá môže byť upravená s tréningom, Zhoršené kognitívne vnímanie, strata periferného videnia (tunelové videnie), krátkodobej pamäte, HÍbky a dočasná strata sluchu
Čierna	175 a viac	Katastrofická porucha duševného a fyzického výkonu. Boj / útek / zamrznutie

Fig. 2. Stress performance model (adapted from Grossman, 2008)

The strategy for improving combat performance under stress is the technique of tactical breathing. Tactical breathing is a technique for controlling your reaction (fight, escape, „freezing“) to stress. The only two autonomous nervous system responses you can control are respiratory rate and blinking. By training tactical breathing, we try to intentionally slow down the heart rate caused by stress. Tactical breathing technique according to Grossman (2008):

- 4 seconds slow inhale
- 4 seconds breath holding in breath
- 4 seconds slow exhalation
- 4 seconds holding your breath in the exhalation
- repeat the technique 4 times.

Conclusion

The requirement of the armed forces is to effectively and efficiently prepare and train a professional soldier to perform combat tasks during his deployment in real combat conditions as soon as possible. In the field of physical training and special physical training, the requirements are mainly placed on increasing physical performance and the correct performance of individual exercise techniques under the influence of various stressors. In order to meet the conditions for the correct and successful execution of a combat task, it is important to have automated certain selected movement patterns and to be adapted to high stress loads. Therefore, we decided to incorporate into the comprehensive movement program for professional

soldiers stress exercises, which are performed simultaneously with the training of movement techniques (athletic, combat, climbing, swimming and skiing), which the soldier needs to handle demanding combat tasks. Figure 3 shows the informative part of the program and the application of stress-inducing exercises. The intensity of action of these stressors gradually increases in two-week mesocycles.

KOMPLEXNÝ POHYBOVÝ PROGRAM - 1-2 týždeň			
MIESTO VYKONÁVANIA: telocvičňa, rovný spevnený povrch, trávnik, lesný povrch, blato, piesok, štrk, sneh, voda.			
MATERIÁLNE ZAŤAŽENIE: športový odev a obuv, vojenský odev a obuv, batoh s rôznou hmotnosťou, prilba, nosný modulárny systém s balistickou ochranou.			
PODMIENKY VYKONÁVANIA: vhodné poveternostné podmienky, vysoké teploty, mrholenie, dážď, mráz, vietor, sneženie.			
VYSTAVENIE PÔSOBENIU STRESOROV: zadržiavanie dychu, nedostatok osvetlenia, tma, hluk, nedostatok času, bolesť			
Interval 20s + 10s	**Popis**	**PONDELOK, STREDA, PIATOK v čase od 5:40 do 6:00**	
30	apnoe v nádychu do 20s, ventilácia od 10s	očná gymnastika - pohyby očí do tvaru +	Marković (2019) Imitačné cvičenia v telesnej príprave
1		atletická abeceda - nízka chôdza na mieste	
1:30		atletická abeceda - stredná chôdza na mieste	
2		atletická abeceda - vysoká chôdza na mieste	
2:30		atletická abeceda - zakopávanie na mieste	
3		atletická abeceda - predkopávanie na mieste	
3:30		imitácia lezenia - unožovanie skrčmo na mieste	
4		imitácia lezenia - unožovanie skrčmo na mieste	
4:30		imitácia plávania - pomalý pohyb dolnej končatiny pri voľnom štýle	
5		imitácia plávania - pomalý pohyb dolnej končatiny pri štýle prsia	
5:30		imitácia behu na lyžiach - lyžiarský krok na mieste (stoj na ľavej nohe)	
6		imitácia behu na lyžiach - lyžiarský krok na mieste (stoj na pravej nohe)	
6:30		imitácie boja zblízka - kop kolenom	
7		imitácie boja zblízka -priamy kop pretláčací	
7:30		imitácie boja zblízka - priamy kop švihový	
8		imitácie boja zblízka - bočný kop	
8:30	údery otvorenou dlaňou na (30s)	oblasť brušných svalov	
9		oblasť sedadcích svalov	
9:30		oblasť vonkašia a vnutorná strana stehien	
10		oblasť predkolenia	
pôsobenie hladu (pred cvičením nebudú probandi prijímať žiadnu potravu), **pôsobenie chladu a trenia** (trenie celého tela studeným mokrým uterákom), **pôsobenie časového stresu** (cvičenie v časovom intervale a cvičenie v skorých ranných hodinách), **pôsobenie hypoxie** (apnoe tréning), **pôsobenie bolestivými podnetmi** (údery otvorenou dlaňou)			

Fig. 3. Comprehensive exercise program: 1-2 weeks - Part 1 - the effects of stressors

The use of stress "vaccination" techniques significantly streamlines the training of special physical training (close combat, military-practical swimming and climbing, accelerated movements, obstacle courses) and helps to combat readiness of professional soldiers to perform challenging tasks. We recommend that stress "vaccination" techniques and exercises be included in training and education for police, fire and rescue services, as well as professional athletes, taking into account the particular specifics of stressors working in the given profession or sport.

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