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Physical Fitness of Soldiers in the Armed Forces of Slovakia

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ABSTRACT

The paper deals with physical preparation of professional soldiers. It is focused on the development of aerobic endurance within practical physical preparation lessons at military units. In order to fulfil the goals of the research, the authors organised a natural pedagogical experiment to find out which of the 7 typical aerobic activities implemented in the experimental and reference couples (n=28) during the 6-week-long experimental period have the most effective impact on the development of aerobic endurance in professional soldiers in the Slovak Armed Forces. The results showed that the most effective means for the development of endurance were found obstacle track, terrain running in combination with fast road marches, various types of shuttle runs and jumping and acrobatic exercises. Swimming, cycling, ski running and sport games can be recommended as suitable complementary activities. From the point of view of methodology, the most effective organisation pattern represented the one in which exercises were organised in 4 training sessions during 20 minutes each, performed for 6 weeks in a row. Statistically significant changes in the level of aerobic endurance proved the hypothesis that physical fitness and psychic resistibility of professional soldiers can be improved by the selected most effective means also in shorter time period of physical preparation.

Keywords: Physical preparation; Physical fitness; Aerobic endurance; Professional soldiers; Armed forces

1. INTRODUCTION

Physical preparation belongs among the most important kinds of preparation of a professional soldier. It results in physical fitness and psychic resistibility of soldier for the fulfilment of demanding tasks of combat actions.

The current engagement of members of the Slovak Armed Forces in various parts of the world intensifies the requirements on every subject and his complex preparedness. Variability of military actions leads to increase the demands of every soldier, increasing responsibility for the fulfilment of commands, orders and tasks in the conditions of physical and psychic load. This task is ensured to a large degree by the special physical preparation. Our article aimed at pointing out which areas are necessary to stress during the special physical preparation. The special preparation prepares the soldier to extreme situations and develops his physical fitness and psychic resistibility.

The main impact should be put on interconnecting physical exercises with such actions, which develop activity of soldiers, teaching them overcome various kinds of obstacles accompanied with stress, danger, risk, intensity and unexpectedness. Loading in physical preparation must put high claims on physical and strength of the individual, but may not overstep the threshold of his potentialities. To find out the optimum limit of loading for every soldier is the most serious task of the commander, since it is just loading and coping with it plays the decisive role in the formation of physical fitness and psychic resistibility. If the professional soldier wants to be well prepared and wants to reach a goal, he must count with painful training methods.

Nothing can replace the training, it will help soldiers when they have troubles, feel bad and suffer stress. Maximum performance in the final phase of combat action requires power and resistibility. That is why it is necessary in the physical preparation of soldiers frequently work on the limit of exhaustion to improve the rough power and resistibility. We can agree with the opinion of the formerly well-known Italian trainer of cyclists Francesco Conconi, who said that when you feel totally tired you still have some power in yourself[1]. It is up on the trainer, in our case the commander, how he is able to mine these strengths from his soldier out. It is important that the solider under the conditions of extreme loading knows his potentialities and knows how to perform in an optimum way just in this situation, when it is necessary.

From the methodological point of view we should carry out physical activity under the conditions of a threat, in unusually psychically and physically demanding environments, under motivating conditions and circumstances. This requires observing the well-known pedagogical principles such as adequacy, systematic character and progressiveness in training, proceeding from easier to more difficult, from well-known to less-known content, at first the solution of simple situations,

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then solving of complex situations, solving situations after exertion and in field conditions. However, physical fitness is a daily habit that needs to be developed 4 to 6 times a week[2]. For the build-up of psychic resistibility we can recommend to take into account also basic idea of the team-work of American Marine Corps: 'to learn to be unsuccessful'[3].

Methodical requirements to increase physical and psychic resistibility in the physical preparation of armed forces can be briefly presented in the following principles[4]:

- Gradual increase of the load into maximum values
- Increase in the exertion through making the conditions extremely hard
- Shortening the time for the drill execution
- Overcoming the obstacles from various directions
- Increasing the number of obstacles
- Increasing the load at the onset of fatigue
- Improving the action after an intensive loading
- Employing acoustic and light effects at training
- Clearing obstacles built by the 'enemy'
- Employing mutual assistance of exercising soldiers
- Creating dangerous situations connected with adequate risk
- Fulfilment of physical exercises also at other jobs
- Performing exercises at various daily and yearly period.

Optimisation of training programmes of professional soldiers helps to increase the level of physical fitness, motor performance and psychic resistibility in their preparation for the fulfilment of the demanding tasks of military service. Observing the influence of various kinds of aerobic physical activities on physical and functional fitness of professional soldiers allows for the specification of the most suitable aerobic physical activities for individual units with regard to their material and spatial conditions. In our research we dealt with the impact of aerobic exercises on the level of fitness of soldiers. The level of aerobic endurance (aerobic power and aerobic capacity) directly determines the performance of the soldier at fulfilment of demanding tasks in the terrain. Higher level of aerobic potentialities has an influence on the health state of soldiers and creates also a certain perspective of achievement rise. To improve aerobic endurance we can use various content of movement activities (running, cycling, swimming, games, etc.) while observing intensity and duration.

Various factors decide on the effectiveness of aerobic activity: type of activity, applied load (volume and intensity) and their frequency, as well as the training method employed. Professional literature recommends to improve endurance by exercising 3-5 times a week, 20 min or more in one training unit, pulse rate between 60 per cent to 80 per cent of the maximum one[5].

High intensity interval training (HIIT) with short intervals of 10 s -15 s at 90 per cent - 100 per cent of maximum heart rate, with rest/recovery periods of 30 s - 60 s (i.e. recovery periods should be three times as long as the effort), trains the ATP-CP system. HIIT increases the muscle's resting levels of ATP-CP. It is also responsible for neuromuscular changes in the rate and pattern of the movement performed by recruiting the motor units used during training[6].

There have been several reports from similar research studies on endurance development in military forces. Kowal[5], *et al.* demonstrated a mean increase of 13 per cent in aerobic power for males tested before and after a 6-week basic training (BT) course. In a study of 87 males Patton[7], *et al.* reported a 3.2 per cent increase in $VO_{2\ max}$ following 7 weeks o farmy BT. On account of their high level of initial fitness (mean $VO_{2\ max}$ = 59.4 ml (kg min) $^{-1}$), Daniels[8], *et al.* failed to observe a change in $VO_{2\ max}$ in 29 male army officer cadets following an intense 6-week training programe. Stacey[9], *et al.* reported a 16.2 per cent increase in the $VO_{2\ max}$ predicted from best effort 2.4 km run times for 50 male New Zealand army recruits following 10 weeks of BT. In contrast, Marcinik[10], *et al.* reported a 6.2 per cent increase in maximal work capacity predicted from cycle ergometry for one group of 55 naval recruits after 8 weeks of BT, but a decrease of 0.4 per cent in another group of 56.Hottenrott[11], *et al.* present in their study that high intensity training as well as continuous endurance exercise lead to significant improvements in body composition, resting heart rate and aerobic power with less than 2 h 30 min training weekly. Gosselin[12], *et al.* showed that 5 bouts of high intensity training (HIT) are no more physiologically taxing than 20 min steady state exercise performed at 70 per cent VO2max, so that HIT might be safe and suitable for recreationally active people as well. Depending on intensity the load can vary from some seconds to several minutes, followed by a few minutes of rest or an exercise phase at low intensity[13,14]. A whole training session can take 20 to 40 minutes. High-intensity interval training (HIT) can serve as an effective alternate to traditional endurance-based training, inducing similar or even superior physiological adaptations in healthy individuals and diseased populations, at least when compared on a matched-work basis. While less well studied, low-volume HIT can also stimulate physiological remodelling comparable to moderate-intensity continuous training despite a substantially lower time commitment and reduced total exercise volume[15].

In our research we measured effectiveness of various types of aerobic activities in a 6-week training period performed in real conditions. Our aim was to study optimum means to develop aerobic fitness of professional soldiers. The research tasks included:

- Monitoring the 6-week-long loading at various aerobic activities
- Evaluation of the impact of the specified training load on the development of functional indicators of soldiers
- Optimisation of aerobic physical activities for the departments with regard to their logistic provision.

2. METHODS

The basic methods of the research were pedagogical experiment and measurement (testing). The research plan was realised at the Academy of Armed Forces at Liptovsky Mikulas (Slovakia) during the physical education lessons and service physical preparation. 28 cadets attending 2nd and 3rd grades were involved in the research based on voluntary principle. The cadets were divided into couples, while 7 couples formed the experimental group and 7 couples formed the reference group. The reference group practiced 2 times a week during 40 minutes at regular physical training sessions. The experimental

group performed 4 times a week during 20 min at each training unit. Our intention was to compare effectiveness of performing exercises with the frequency 2x40 min a week (traditional extent) and 4x20 min a week (experimental design). We expected that aerobic physical activities lasting for at least 20 min performed 4 times a week at the pulse rate 130 – 170/min, will be more effective than the training executed 2 times a week during 40 min at the same pulse rate levels. The following aerobic activities were included in the experiment:

- Terrain run – fartlek
- Joint control exercise on an obstacle track
- Swimming
- Shuttle run 20x20 meters
- Stationary bicycle
- Running treadmill
- Eliptic simulator

The following parameters were measured in all cadets involved: body weight, body height, W170, percentage of fat, body mass index (BMI), visceral fat, percentage of muscle mass, 20 x 20 m shuttle run (from standing start). For the measurement of functional parameter W 170 (for predicting maximal oxygen intake) the measuring device cycling ergometer Cardiovit AT 104 PC from the Department of Functional Diagnostics of the Department of P.E. and Sport was used. Pulse rates during practices were taken by pulse meters Garmin Forerunner 305, body weight was measured by electronic scale Omron BF 500. Input and output tests and measurements were performed one week prior and one week after the experimental period.

3. RESULTS

Standards used for the assessment of fitness (W170/kg)[4] are shown in Table 1.

Table 1. Standards for the assessment of fitness (W170/kg)

Performance	Men	Women
Perfect	3.26 and more	2.61 and more
Aboveaverage	2.94 – 3.25	2.28 – 2.60
Average	2.61 – 2.93	1.96 – 2.27
Underaverage	2.28 – 2.60	1.63 – 1.95
Unsatisfactory	2.27 and less	1.62 and less

Results of the measurements of basic indicators are presented in Tables 2 – 8.

- Input values: values measured at the beginning of the experiment
- Output values: values measured at the end of the experiment
- Reference group: 12 training units - 2 x 40 min per week
- Experimental group: 24 training units 4 x 20 min per week.

Evaluation in Obstacle track

In the reference couple no significant changes were recorded, with the exception of the 20x20m shuttle run. Experimental couple recorded marked decrease in body weight and good improvement in the shuttle run test.

Evaluation in Terrain run - fartlek

Despite the improvement of indicators in both couples, more pronounced improvement was recorded in the experimental couple, mainly in the following indicators: per cent fat, W 170 and BMI. A slight decrease in per cent muscles was recorded in the experimental couple.

Table 2. Changes in parameters (Obstacle track)

Obstacle track	Weight (kg)		% fat		Visceral fat		BMI		W 170		Fat (per cent)		Test 20x20	
	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex
Input - Cadet 1	70	87	14.7	15.1	4	7	21.7	26	2.67	2.30	42.1	44.0	82	81
Output - Cadet1	70,5	84	14.2	14.2	5	6	21.8	24.1	3.21	2.96	42.0	44.8	90	92
End of training	+0,5	- 3	- 0.5	- 0.9	+ 1	-1	+0.1	-1.9	+ 0.54	+ 0.66	- 0.1	+ 0.8	+ 160 m	+ 220 m
Input - Cadet 2	77	81	9.7	24.2	3	9	22	26.8	3.66	2.54	35.9	42.5	85	80
Output - Cadet 2	76	79	9.1	23.0	3	8	21.6	24.5	3.79	2.92	36.3	43.0	92	94
End of training	-1	- 2	- 0.6	- 1.2	No change	- 1	- 0.4	- 2.3	+0.13	+0.38	+ 0.4	+ 0.5	+140 m	+280 m

Table 3. Changes in parameters (terrain run – fartlek)

Running treadmill	Weight (kg)		% fat		Visceral fat		BMI		W 170		Fat (per cent)		Test 20x20	
	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex
Input - Cadet 1	84	82	17.3	21.2	8	8	27	26	3.11	2.19	43.2	44.7	84	76
Output – Cadet 1	83	80	16.8	18.2	8	6	25.1	21.1	3.21	2.87	43.0	43.1	87	86
End of training	- 1	- 2	- 0.5	- 3	No changes	-2	-1.9	-4.9	+ 0.10	+ 0.68	- 0.2	- 1.6	+ 60 m	+ 200 m
Input - Cadet 2	82	88	15.8	24.1	9	10	26.2	26.9	2.64	2.54	41.7	45.3	78	79
Output - Cadet 2	82	85	15.3	20.8	8	8	24.1	19.6	2.71	2.92	42.0	44.1	85	87
End of training	No change	- 1	- 0.5	- 0.5	- 1	- 1	- 2.1	- 2.1	+1.3	+1.3	+ 0.3	- 1.2	+140 m	+160 m

Evaluation in Running treadmill

No significant changes were observed in any couples.

Evaluation in Shuttle Run

In both couples a marked increase in the performance of tests W 170 and 20x20 m was recorded. Moreover, a decrease in body weight and per cent fat was found in the experimental couple.

Evaluation in Swimming

In both couples were not recorded any significant changes, however, a slight decrease in the 20 m x 20 m run test in three cadets was recorded.

Evaluation in Stationary bicycle

No marked changes were observed in the measured indicators in both couples.

Table 4. Changes in parameters (Running treadmill)

Running treadmill	Weight (kg)		Fat (%)		Visceral fat		BMI		W 170		Fat (%)		Test 20x20	
	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex
Input - Cadet 1	72	80.6	22.7	14.4	6	5	23.5	23.8	3.51	3.53	42.8	38.6	88	89
Output – Cadet 1	71	79.0	22.1	14.0	6	5	23.2	23.1	3.55	3.55	42.5	38.6	90	91
End of training	- 1	- 1.6	-0.6	- 0.4	No change	No change	- 0.3	-0.7	+0.04	+ 0.02	- 0.3	No change	+40 m	+ 40 m
Input - Cadet 2	95	77.3	14.4	14.2	6	5	25.8	23.9	4.24	3.30	44.2	42.2	95	84
Output - Cadet 2	94	77.0	14.3	14.1	5	5	25.4	23.1	4.25	3.28	44.0	42.0	99	85
End of training	- 1	- 0.3	- 0.1	- 0.1	-1	No change	-0.4	-0.8	+0.01	- 0.2	- 0.2	- 0.2	+ 80 m	+ 20 m

Table 5. Changes in parameters (Shuttle run)

Shuttle run	Weight [kg]		Fat (%)		Visceral fat		BMI		W 170		Fat (%)		Test 20x20	
	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex
Input - Cadet 1	64	84	12.7	22.2	4	8	21.6	24.1	2.89	2.44	39.6	42.8	79	77
Output – Cadet 1	64	82	12.6	20.8	4	7	21.7	22.4	3.21	3.11	39.7	42.7	85	86
End of training	No change	- 2	- 0.1	- 1.4	No change	-1	+ 0.1	-1.7	+ 0.32	+ 0.67	- 0.2	- 0.1	+ 120 m	+ 220 m
Input - Cadet 2	77	80	15.1	20.1	7	8	19.2	25.1	2.92	2.66	41.9	44.3	81	76
Output – Cadet 2	77	77.5	15.2	19.1	7	7	19.0	24.0	2.71	2.94	41.5	44.0	92	84
End of training	No change	- 2.5	- 0.5	- 1	- 1	- 1	- 2.1	- 1.1	+1.3	+0.28	- 0.4	- 0.3	+220 m	+160 m

Table 6. Changes in parameters (Swimming)

Swimming	Weight (kg)		Fat (%)		Visceral fat		BMI		W 170		Fat (%)		Test 20x20	
	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex
Input - Cadet 1	81	77	18.3	14.2	9	5	25.1	18.9	2.90	2.62	42.5	42.8	89	83
Output – Cadet 1	81	77	18.4	14.4	9	5	25.0	19.1	2.98	2.89	42.4	42.8	85	83
End of training	No change	No change	+ 0.1	+ 0.2	No change	No change	-0.1	+ 0.2	+ 0.08	+ 0.27	- 0.1	No change	- 80 m	No change
Input - Cadet 2	78	83	16.0	16.5	7	7	19.3	24.5	3.12	3.12	41.1	44.1	91	84
Output - Cadet 2	79	82.5	16.1	16.7	7	7	19.5	24.4	3.22	3.21	41.3	40.0	90	83
End of training	+ 1	- 0.5	+ 0.1	+ 0.2	No change	No change	+ 0.2	- 0.1	+0.10	+ 0.11	+ 0.2	- 0.1	- 20 m	- 20 m

Table 7. Changes in parameters (Stationary bicycle)

Bicycle	Weight (kg)		Fat (%)		Visceral fat		BMI		W 170		Fat (%)		Test 20x20	
	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex
Input - Cadet 1	75	85.5	13.6	16.7	5	6	23.1	25.2	3.04	3.53	41.6	44.3	86	89
Output - Cadet 1	75	84.0	13.5	16.5	5	6	22.9	24.9	3.11	3.60	41.8	44.6	87	90
End of training	No change	- 1.5	- 0.1	-0.2	No change	No change	-0.2	-0.3	+ 0.7	+ 0.7	+ 0.2	+ 0.3	+ 20 m	+ 20 m
Input - Cadet 2	70	78	15.1	19.5	4	7	21.6	23.7	2.51	2.79	43.2	40.5	78	81
Output - Cadet 2	69	78	15.0	19.3	4	7	21.0	23.5	2.48	2.83	43.1	40.5	79	80
End of training	- 1	No change	- 0.1	- 0.2	No change	No change	- 0.6	- 0.2	-0.3	+0.4	- 0.1	No change	+20 m	+20 m

Table 8. Changes in parameters (Eliptic simulator)

Eliptic simulator	Weight (kg)		Fat (%)		Visceral fat		BMI		W 170		Fat (%)		Test 20x20	
	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex	Ref	Ex
Input - Cadet 1	79	78	19.6	16.5	8	6	24.3	23.0	2.90	2.95	43.6	42.8	82	86
Output - Cadet 1	80	78	19.7	16.4	8	6	24.5	23.2	2.87	2.91	43.5	43.0	83	87
End of training	+ 1	No change	+ 0.1	- 0.1	No change	No change	+ 0.2	+ 0.2	- 0.3	- 0.4	- 0.1	+ 0.2	+ 20 m	+ 20 m
Input - Cadet 2	81	88	20.3	19.8	9	8	26.1	26.3	2.74	2.65	45.1	44.3	78	76
Output - Cadet 2	80	86	20.0	18.9	9	8	26.0	25.5	2.80	2.71	45.1	44.1	80	79
End of training	- 1	- 2	- 0.3	- 0.9	No change	No change	- 0.1	- 0.8	+ 0.6	+ 0.6	No change	- 0.2	+ 40 m	+ 60 m

Evaluation in Eliptic Simulator

No marked changes were found in the reference group, while in the experimental couple a slight increase was recorded only in one cadet.

4. DISCUSSION

The main aim of our experimental study was to assess effectivity of the development of endurance by various aerobic means. Our expectations that the most effective means for the development of endurance will be clearing obstacle tracks, fartlek and shuttle runs were experimentally confirmed. Discussion related to individual means used.

4.1 Obstacle track

This was the most demanding physical activity, where the improvement of endurance was connected with the development of strength and coordination. Both couples improved their performance in endurance shuttle run. Experimental couple showed a more pronounced decrease in weight. Both couples improved also in the W170 test. From the practical point of view we consider performing obstacle track in a shorter time period several times a week to be more effective. According to the statements of soldiers performing 40 min training was too demanding as to physical and psychic load and stereotyped. Despite that, we can evaluate this activity as highly effective, improving aerobic endurance and other physical skills of soldiers, which can be employed within the military practice.

Positive features:

- High physical demands, developing power, coordination and endurance,
- High effectiveness of the training in a short time interval.

Negative features:

- Danger of injury at performing exercises in bad climatic conditions,
- Insufficient equipment with obstacle tracks at military units of the Armed Forces.

4.2 Terrain running – fartlek

The most frequently and commonly used aerobic physical activity in military forces. In both couples an increase in the measured indicators was observed. It was manifested in the experimental group more significantly mainly in the decrease of % fat, increase in W170 and 20 x 20m test. A slight decrease in per cent muscular mass at the parallel reduction of % fat is quite interesting. At this variant we also recommend training with the frequency of more than 2 times a week.

Positive features:

- Effective aerobic physical activity when frequency, time and optimum pulse rates are observed,
- Possibility to perform also at worse climatic conditions

Negative features:

- Frequent injuries as a result of overtraining (overloading).

4.3 Running treadmill

Physical activity performed in a bodybuilding gym suitable for the development of endurance also at in favourable climatic conditions. Minimum improvement, statistically significant in both couples.

Positive features:

- Possibility to effectively change the intensity of loading at training.

Negative features:

- Stereotype, boring activity for the majority of soldiers,
- Inadequate equipment of military units with running treadmills.

4.4 Shuttle run

Suitable aerobic physical activity for the development of endurance in a mass scale. In both couples a marked improvement was recorded in the 20 m x 20 m test, in the experimental couple also muscular mass reduction.

Positive features:

- Simple exercise, possibility to perform it in terrain and also in a gym, simple self-control of pulse rate values at performing exercises.

Negative features:

- In case of performing only this activity, it is boring and stereotyped.

4.5 Swimming

Suitable aerobic physical activity for professional soldiers in case of availability of a swimming pool. No improvement of the observed parameters was recorded during our experiment. On the contrary, at 20 m x 20 m test there came to a decrease in performance. We expect that the 6-week-long period of training in a pool is insufficient for the changes in the performance of

soldiers.

Positive features:

- Effective physical activity in the training of power and endurance
- suitable relaxation and weathering physical activity.

Negative features:

- financially demanding, requires a swimming pool, which is inaccessible for the majority of professional soldiers.

4.6 Stationary bicycle

Suitable complementary aerobic physical activity in a bodybuilding gym. In our experiment no statistically significant changes were recorded in any of the couples as far as the measured parameters and increase in performance level are concerned.

Positive features:

- Suitable physical activity in case of slight injuries of the motor system not allowing to perform running
- Possibility to set up intensity of loading in the course of training.

Negative features:

- Insufficient provision of military units with cycling simulators.

4.7 Eliptic simulator

Suitable complementary aerobic physical activity employable at infavourable climatic conditions in a gym. In our experiment, no statistically significant changes were observed, with the exception of 20 m x 20 m test.

Positive features:

- Adequate aerobic activity in case of injuries of the motor system and infavourable climatic conditions.

Negative features:

- Insufficient provision of military units with the cycling simulators.

5. CONCLUSIONS

In the previous scientific observations of professional soldiers we stated that BMI was rather high in soldiers and also the level of aerobic endurance was quite low for professional soldiers in Slovakia. Based on this we decided to focus on the development of endurance abilities in our soldiers with the aim to find out the most suitable endurance physical activities for the training of the troops. The main task was to assess effectivity of the development of endurance by various aerobic means. Having accomplished the tasks of the research we can state that: *the most suitable and effective* endurance physical activities of professional soldiers are: Exercises on an obstacle track, terrain running in combination with fast road marches, various types of shuttle runs and jumping and acrobatic exercises. Swimming, cycling, ski running and sport games can be recommended as suitable complementary activities. Simulators for training can also be considered effective for the development of endurance in body building gyms. We are aware of the fact that in the majority of military units in Slovakia obstacle tracks, which are considered the best choice for the development of endurance, are unavailable or in bad condition. However, this activity can be executed also in improvised conditions, but requires serious preparation of commanders. Important factors of maintaining and improving endurance in soldiers are intensity, duration and time span of the training. In our experiment the 6-week-long training period was proved short for any marked changes in the level of aerobic endurance of soldiers, especially when implemented in the 2 x 40 min pattern, as planned in the majority of military units in Slovakia. From the point of view of the development of endurance the pattern 4 x 20 min proved to be more effective. Variability of means for the development of endurance plays also an important role in order to avoid unilateral and monotonous loading of soldiers. We can thus prevent overloading, injuries and organism wearing. The lack of financial means and logistic provision of military units with suitable premises and training simulators is a serious shortcoming in the preparation of armed forces in Slovakia.

6. RECOMMENDATIONS

1. When planning professional physical preparation it is inevitable to design the training of endurance in the 4x 40 min pattern, rather than 2 x 80 min per week one.
2. When developing endurance always observe the intensity of movement within the range of 60 per cent – 80 per cent maximum pulse rate during at least 20 min, 3 to 5 times a week (maximum pulse rate = 220 – age).
3. To implement in the training of endurance overcoming of obstacles and fast transfers in terrain, running in terrain, various types of running and jumping and acrobatic exercises. Swimming, cycling, sport games and exercises on simulators should be used as complementary activities as well.
4. In case of inadequate material and technical conditions at military units, we recommend to lease swimming pools and fitness centres in the local area.
5. *Overcoming of obstacles* is focused on the acquisition of special skills, increasing psychic resistibility and improvement of habits in overcoming natural and artificial obstacles, in grenade throwing and performing practical military activities. Training is performed on specially built tracks or in terrain with overcoming natural obstacles. Based on our experimental study this kind of means can be recommended to soldiers for the improvement of their endurance.

The content of exercises should include:

(a) Overcoming of horizontal, vertical and inclined obstacles
(b) Grenade throwing on target
(c) Performing special exercises and drills on equipment, dummy hardware and with a burden
(d) Fulfilment of the tasks of the control exercises on obstacle tracks.

The above presented methods and techniques of performing the obstacle track are fully recommended for the physical preparation of professional soldiers. It is up on the commanders and governors in the armed forces how they decide to organize physical preparation of soldiers to improve their physical preparedness and psychic resistibility. The goal is to

build well prepared soldiers capable of making fast decisions, showing creative attitude, goal-orientation, braveness, physical fitness and psychic resistibility inevitable for any member of the Slovak Armed Forces.

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