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SOME THEORETICAL AND PRACTICAL ISSUES OF MAINTAINING SOLDIERS' PHYSICAL FITNESS DURING AN EPIDEMIC OR IN LIMITED CIRCUMSTANCES

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ABSTRACT: *Following the measures taken to contain the novel coronavirus, some attention was drawn to the matter of maintaining the physical performance of soldiers in limited circumstances. This scientific paper analyses the problem of the "detraining" effect and proposes an efficient strategy to counter this phenomenon, in relation to the degree of its severity.*

KEYWORDS: *detraining, physical fitness, quarantine, "gilded cage", mission*

The Hungarian Defence Forces (HDF) does not only perform military tasks with the aim of protecting the country's independence, territorial integrity, and border. Due to the HDF's level of equipment, its organisation and qualifications, it is also deployable during the aftermath of catastrophes and during epidemics, and it is capable of providing humanitarian assistance as well as, in accordance with the Hungarian Constitution.[1]

It is not a new phenomenon that soldiers are deployed in epidemiological emergencies. In the 18th century, during the plague of Marseille in 1720–1721, the famous Bercsényi hussar regiment carried out law enforcement tasks in the French army in southern France. The soldiers patrolled between the plague-infected and healthy areas, blocking traffic. Under strict military orders, they had to act ruthlessly against illegal trespassers.[2]

In the spring of 2020, during the novel coronavirus pandemic, numerous tasks have been assigned to the HDF. Hungarian soldiers are supporting the Police in securing the borders and maintaining the humanitarian corridor. Patrolling military police officers partake in securing and guarding warehouses. The Chemical Defence Battalion plays a major role in the disinfection of contaminated buildings. Assistance and liaison teams (comprising representatives from the military, law enforcement and disaster relief agencies) are ensuring the steady and functional operation of large corporations and hospital commanders are working in the country's health institutions facilitating the necessary flow of information. At the Hungarian Defence Forces Medical Centre's sites, vaccination points, and mobile

[1] "Fundamental Law of Hungary". 25 April 2011. para 45. https://www.parlament.hu/documents/125505/138409/Fundamental+law/73811993-c377-428d-9808-ee03d6fb8178, Accessed on 22 April 2020.

[2] Zachar J. „A franciaországi Bercsényi-huszárezred története: 1721–1791". *Hadtörténelmi Közlemények* 105/4. 1992. 38.

vaccination stations soldiers help with the civilian population's vaccination efforts, as reported by media coverage.[3]

In addition to fulfilling daily tasks and international commitments, and completing tasks stemming from countering the pandemic, it is also a priority to maintain the combat readiness of the HDF. In these transformed circumstances, it is also essential to prevent the spread of the virus among military personnel as well as to maintain good mental health and physical fitness.

The goal of this paper can be defined as follows. Soldiers often face limited opportunities during their service, e.g. during the initial phase of relocation, under command, during courses, operations, and in cases of epidemiological restrictions. In these situations, there is a lack of adequate sports infrastructure, there is little to no time to partake in activities intended to maintain physical fitness, and there is no sports-focused professional help. The present analysis will examine the sustainability of one's physical condition in a timeframe of maximum six months within limited circumstances.

With these goals in mind, the following hypothesis can be constructed. The problem can be represented along three different dimensions: by the number of limitations, by their duration, and by goals we aim to achieve. By dividing these dimensions into three further categories, a three-dimensional matrix can be constructed whose values can be used to propose an efficient strategy for the purpose of solving this problem.

In this article, the main questions I'm trying to answer are:

– What consequences do limited circumstances have?
– Are countermeasures needed against these consequences? If so, what kinds to be deployed?

To find answers to the raised questions, the following methods seem relevant. During the examination of limited circumstances, overviewing of triggered physiological changes is a must as they create the backbone of the changes in conditioning and physical fitness. The dimensions and categories of the examination are put together, for the study of which a mathematical model is constructed. Using this mathematical model, a proposed solution to the problem is created. Regarding this mathematical model, it is important to note that due to its nature, it is only capable of naming possible solutions. Human activities, including sports, maintenance of fitness and more, however, do not only follow mathematical laws, they are influenced by human factors as well, which are impossible to be mathematically algorithmicised.

By the examination of relevant literature, I concluded that in relation to the main question, no comprehensive study had been done before. Articles studying the changes in physiological processes and the changes in conditioning were especially helpful. A book by Dr. Radák Zsolt titled "Edzésélettan 2.0" has been of tremendous help, as well. The creation of the mathematical model was supplemented with ideas from cluster analysis.

The COVID-19 pandemic has fundamentally changed the lifestyle of most people. They have to live their lives in quarantine or in rather limited circumstances. This poses new challenges to today's society, which is accustomed to free movement and diverse activities.

Soldiers on duty often face limited circumstances. When under command, or during relocation, training and courses, operations, or in other cases of extraordinary duties, they

[3] „A katonák is aktívan részt vesznek a járvány elleni védekezésben". Honvedelem.hu. 18 April 2020. https://honvedelem.hu/cikk/a-katonak-is-aktivan-reszt-vesznek-a-jarvany-elleni-vedekezesben/, Accessed on 22 April 2020.

are likely to come across such conditions. This, however, should not affect combat readiness and preparedness; this is why this subject is worth further investigation and examination of the impact that limitations have on changes in physical fitness and health condition.

MAINTAINING PHYSICAL FITNESS IS KEY TO SUSTAINING COMBAT READINESS

The average time spent by soldiers in limited circumstances does not exceed half a year; we are also confident, that the civilian population will not face pandemic-caused hardships for a longer time period – henceforth, I will examine changes within this six-month timeframe. Depending on time and the possibilities available, the goal is to decelerate, stabilise, and halt the deterioration of physical performance, and favourably to improve and increase it.

Physiological changes as a result of detraining

The effects of soldiers' reduced exercise within limited circumstances are similar to the changes in performance, which competing athletes, regular trainers, or sick/injured individuals experience, resulting from either partial or complete abandonment of physical activity. Literature refers to this period of decreased physical activity as "detraining", "decondition", or "off-season". When normal physical activity or training suddenly decreases or stops in its entirety, the body responds to this event. As a result of the reduced load, physiological changes occur in the cardiovascular system, in metabolic processes, and body composition, and can also cause psychological fluctuations. Research is being carried out in connection with these occurrences in the fields of medicine and sports sciences. Several studies deal with the changes in and deceleration of metabolic processes, the increase in blood sugar levels, the mass of visceral fats, and the risk of metabolic diseases and cancer.

For instance, observations in a group of healthy young men have shown reduced peripheral insulin sensitivity as early as two weeks of reduced exercise,[4] which carries the risk of developing diabetes.

After five weeks of no training, professional swimmers experience an increase in body weight, body fat, and abdominal circumference, and a decrease in levels of the VO2 max and the resting metabolism rate.[5] These morphological changes portray that after the human system is no longer subjected to loading, metabolic processes gradually decelerate and excesses begin to be stored within the body. In the long run, the accumulation of visceral fats increases the risk of developing several diseases.

According to one study, Type I (red, slow) and Type II (white, fast) muscle fibres demonstrated a 29% increase after a six-month long high resistance training period, then showed a 12% decrease after a three-month long period of detraining, as compared to previous peak

[4] Krogh-Madsen, R., Thyfault, J. P., Broholm, C., Mortensen, O. H., Olsen, H. R., Mounier, R., Plomgaard, P., van Hall, G., Booth, F. W. and Pedersen, B. K. "A 2-wk reduction of ambulatory activity attenuates peripheral insulin sensitivity". Journal of Applied Physiology 108/5. 2010. 1034–1040. DOI: 10.1152/japplphysiol.00977.2009

[5] Ormsbee, M. J. and Arciero, P. J. "Detraining Increases Body Fat and Weight and Decreases VO2peak and Metabolic Rate". *Journal of Strength and Conditioning Research* 26/8. 2012. 2087–2095. DOI: 10.1519/JSC.0b013e31823b874c

performance.[6] The results of another research show that in the first weeks spent without training the skeletal muscle does not alter significantly, however, after eight weeks, a decrease can be detected.[7] A loss of muscle mass is not only detrimental to mobility, but it also has an adverse effect on the regulation of blood sugar levels, as muscles' sugar uptake is insulin dependent; thus, in case of muscle mass loss, a certain amount of insulin will reduce the skeletal muscles' ability to uptake sugar from the blood. A feature of insulin resistance is the skeletal muscles' lessened uptake of sugar.[8] Decreased physical activity has significant effects on the cardiovascular system. Changes in the values of blood pressure were examined during training period and in a no-load period. It was found that just within two weeks of inactivity, the values of blood pressure formed as a result of six months of training returned to the values of the period preceding the workout phase,[9] and that the acquired skills and advantages can be lost rapidly.

Changes in motor skills as a result of detraining

Physical performance changes in synchrony with physiological changes. The effects of an inactive period on physiological changes can be measured in motor skills, too.

Motor skills can be divided into three groups: condition-based skills, coordination skills, and joint mobility. Condition-based skills provide the energetic conditions of the movements, they successfully characterise the current performance capability of the body. Coordination skills play a role in the accurate, effective, and economical execution of movements. Joint mobility reflects the anatomical limitations and neurological regulations of the scope of the movement.[10]

Condition-based skills are: strength, speed and endurance. With regard to their optimal interaction and the specificity of the branch of sport, we also distinguish complex condition-based skills, such as maximum strength, strength endurance, speed strength, movement speed, speed endurance, short-term endurance, medium-term endurance, and long-term endurance.[11]

Condition-based skills are well quantifiable. Research is being conducted to determine the state of fitness and the effects of inactivity. The results clearly portray how quickly the body's abilities – acquired through training – can deteriorate. The generally accepted method of estimating endurance and measuring its change is by determining the VO2 max, which can be calculated from the difference in arterial and venous blood oxygen concentration, heart rate, ventilation and body weight (ml/kg/min).[12] Higher values indicate better aerobic capacity and better endurance. Development in VO2 max – gained during a

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6 Fleck S. J. „Detraining: Its Effects on Endurance and Strength". *Strength and Conditioning* 16/1. 1994. 22–28. https://journals.lww.com/nsca-scj/Citation/1994/02000/Detraining__Its_Effects_on_Endurance_and_Strength.3.aspx, Accessed on 18 May 2020.

7 Mujika, I. and Padilla, S. "Muscular characteristics of detraining in humans". Medicine and Science in *Sports and Exercise* 33/8. 2001. 1297–1303.

8 Radák Zsolt: *Edzésélettan 2.0.* Budapest: Krea-Fitt Kft, 2019. 47.

9 Moker, E. A. et al. "The Relationship between the Blood Pressure Responses to Exercise following Training and Detraining Periods". P*LoS ONE* 9/9. 2014. e105755. DOI: 10.1371/journal.pone.0105755

10 Meszler B., Tékus É. and Váczi M. *Motorikus képességek mérése.* Pécs: Pécsi Tudományegyetem Természettudományi Kar Sporttudományi és Testnevelési Intézet, 2015. 3–6.

11 Koltai J. and Nádori L. *Sportképességek fejlesztése.* Budapest: Sport, 1973. 13–16.

12 Radák. *Edzésélettan 2.0.* 238.

two-three month period of training – can be lost in 2–4 weeks of inactivity,[13] showing an exponential decrease in value.[14]

Speed responds most sensitively to periods of inactivity. Progress, achieved through twelve weeks of speed and speed endurance training, drops to the baseline value in 20–40 days during detraining.[15]

Determinants of force are age, gender, and the cross-section and type of muscle fibres. Concerning the physiological effects, we have already seen that muscle mass increases due to proper training and hypertrophy develops; meanwhile, the withdrawal from training causes degradation, atrophy in the muscles. Physically active women and men, and men engaged in strength-based sports were studied in one study. Following a ten and a half week long training period, their performance increased significantly in all three skill-groups. Then, after two weeks of detraining, the performance of physically active women and men involved in strength-based sports deteriorated, while the performance of physically active men only slightly increased. Observations gathered from weightlifting Olympians illustrate that their performance decreases very quickly when they stop training.[16]

This physiological and sports science research excellently reflects what changes can be expected if physical activity is restricted.

Changes in physical fitness depend on the initial status of fitness, the amount of time spent without training, age, gender, time available to exercise, accessible equipment, expertise, motivation, and nutrition. Among these factors, some may be easily identified and defined, while others less so. For this reason, the examination of the obtainability of desired results along the duration of the limited circumstances and its specific conditions is noteworthy.

Physical fitness requirements of soldiers

The overarching aim is to make the general physical condition of the soldiers in given circumstances as good as possible, to ensure their ability to fully implement their duties, and to preserve their health and combat readiness. The HDF's expectations from its soldiers are determined in Decree 10/2015 (VII. 30.) of the Ministry of Defence, by which all personnel needs to abide.

Objective measurement and evaluation of physical performances provide an assessment of physical fitness, differentiated by gender, age and exercise form. These assessments are evaluated based on the scoring tables in Annex R of Decree 10/2015 (VII. 30.). In accordance with the current legislation, in order to obtain the necessary qualifications of "eligible" and "adequate", it is necessary to achieve 220 points. This can be considered a basic desired result.

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[13] Kemi, O. J. et al. "Aerobic Fitness Is Associated With Cardiomyocyte Contractile Capacity and Endothelial Function in Exercise Training and Detraining". *Circulation* 109/23. 2004. 2897-2904. DOI: 10.1161/01.CIR.0000129308.04757.72

[14] Bosquet, L. and Mujika, I. "Detraining". In Mujika, I. (ed), *Endurance training: science and practice.* Vitoria-Gasteiz: Inigo Mujika, 2012, 100–106.

[15] Singh, Y. W. B. "Investigation of varied intensity interval sprint training and detraining impact on selected speed parameters". *International Journal of Physical Education, Fitness and Sports* 3/1. 2014. DOI: 10.26524/1416

[16] Fleck. „Detraining …".

An analysis of limited circumstances

In limited circumstances, the task is to slow down the deterioration of the physical performance necessary for achieving the basic desired result, to maintain physical condition, and in a favourable case, to improve or even to increase it.

I divided the time spent in limited circumstances into three categories. Subsequently, there is a *short,* one- or two-week interval (this may correspond to the initial phase of quarantine or relocation), a *medium,* one- or two-month interval (which corresponds to the length of training courses, or orders, as well as short, pandemic induced restrictions), and a *long,* one-to-six months interval (which is the average duration of a mission or of a wave of a pandemic).

The grouping of these specific conditions, that is, the degree of restrictions in limited circumstances, is also three-tiered. The first is "quarantine": the strictest, with the highest magnitude of restrictions. It is a form of complete confinement, such as being in an apartment with limited space at hand, where there is no sports equipment, where no outdoor activities are allowed, where there is no personalised professional help; there are no options, yet one's schedule is free. The second is the "gilded cage": where the soldier is also in confinement, where there is no opportunity for outdoor activities, when the sports infrastructure and pool of equipment is limited, and one's schedule is fixed. The third is the "mission": the most favourable of limited circumstances. Although the opportunities of sports infrastructure and equipment are limited and one's schedule is fixed, both indoors and outdoors activities are possible.

In examining the achievement of desired results, under these specific conditions, I consider an activity unjustified if it is not useful for attaining the desired results and if change cannot be detected. An activity of any sort is justified if it results in a detectable, positive change.

The desired result is realistic, if it can be achieved under certain circumstances, in a certain timeframe, and if it promises the attainment of the best possible result. It is unrealistic, if it is not achieved under given circumstances, in the given timeframe, yet, the task remains justified, thus efforts still must be made.

In the tables below, I have included the possibility of achieving the desired result.

Table 1 *Possibility of decelerating the deterioration of physical performance within given limited circumstances*

Circumstance/Time	Short	Medium	Long
Quarantine	unjustified	justified and realistic	justified and realistic
Gilded cage	unjustified	justified and realistic	justified and realistic
Mission	unjustified	justified and realistic	justified and realistic

The results of the above-mentioned research show that performance is maintained for a short amount of time and then it decreases by varying degrees. For that reason, the deceleration of the deterioration of physical performance is only justified in medium- and long-term limited circumstances. However, this does not mean that the one- or two-week long period of detraining can be ignored, as this is where deterioration begins. During this period, we tend to experience slight fatigue and laziness, and we can lose our motivation, which can be dangerous in the long run. In the medium-to-long term intervals, decelerating

deterioration has a major role, especially within stricter restrictions where the preservation of physical performance cannot be solved.

Table 2 *Stabilisation and maintenance of physical performance*

Circumstance/Time	Short	Medium	Long
Quarantine	justified and realistic	justified and realistic	justified and unrealistic
Gilded cage	justified and unrealistic	justified and realistic	justified and realistic
Mission	justified and unrealistic	justified and realistic	justified and realistic

The preservation of their physical condition is a constant responsibility of soldiers. In order to perform their duties, soldiers must have an adequate level of performance at all times, must be combat-ready and must meet the requirements stipulated in the legislation. In the short run, where the degree of deterioration is insignificant, physical performance is stable and its maintenance at a constant rate is not a realistic desired result. In the medium and long run, however, it is both realistic and important, as research has shown that physiological processes as well as physical performance can undergo significant changes as quickly as in one or two months. This research is also supported by the new term that was coined during the novel corona virus pandemic – "quarantine tummy". People who have lived in confinement for a few weeks' time and have not been physically active, quickly notice changes on their bodies, which are proportionate to the deterioration of their physical performance and health. In the long run, preserving one's physical condition in quarantine is not feasible either. Efforts must be made in order to maintain physical condition. While the incorporation of even little physical activity into everyday life is enough to decelerate deterioration, physical fitness requires proper nutrition, choosing the right amount of loading, following the principles of 'gradual increase of loads' and 'regularity', plus maintaining a balance between exercise and rest.

Table 3 *Increase and improvement of the level of physical performance*

Circumstance/Time	Short	Medium	Long
Quarantine	unjustified	unjustified	unjustified
Gilded cage	justified and unrealistic	justified and unrealistic	justified and unrealistic
Mission	justified and unrealistic	justified and realistic	justified and realistic

Among the set desired results, the most difficult one is to establish the increase of physical performance as usually this requires special circumstances and a rather long period of time.

Due to limited opportunities in quarantine, general development is not feasible. An increase in the progression of certain skills can be achieved, an example being prisoner training programs developed in prisons. However, it is difficult, if not impossible, to improve endurance and speed, thus no development can be realised in a complex manner.

The conditions in the "gilded cage" are not favourable for improving motor skills either, but in a given situation it is formulated as a desired result. Therefore, it is worth addressing at least at a theoretical level.

Development is also unattainable when considering a short-term mission; however, it can very much be a realistic goal during medium- or long-term timeframes. The circumstances and the time available are conditions which allow a deliberate and strategically executed

training program to be successful. However, this also requires motivation, proper professional guidance, and assistance.

These findings can also be analysed in an abstract manner by assigning numerical values to them. By establishing numerical values, the necessity of expected development can be quantified. In the present context, the concept of necessity refers to (measures) the extent to which we can and must make an effort to achieve a desired result. All in all, the greater the necessity, the greater the condition is for success and the greater the need for effort.

Accordingly, the rating "unjustifiable" does not involve necessity, so its numerical value is "0".

Necessity is directly proportional to justifiability (i) and reality (r). It thus follows, that the more justified and the more realistic an activity, the greater its underlying necessity is. Henceforth, necessity can be expressed as the product of the above-mentioned two features, that is (P = ir).

Establishing the proportionality factor between values (i) and (r) seems irrelevant to the result at first glance, as it is difficult to measure which of the two factors is stronger in terms of necessity – therefore, such value is not initially applied in the function. In the given problem, the independent variables (i) and (r) can yield discrete values. That is, a set goal is either justified or not, or the achievement in a given situation is either realistic or not. It seems to be obvious to construct a binary system (0,1), however, in case of the formula described above (P = ir), the function would involve a significant loss of data, since on either side of the function, the product of either value and zero is zero, and the product of the ones would also stay one. However, all goals that are justified, even if not realistic, have potential – and thus should be strived for in order to achieve the desired results, despite this situation – 'should one strive to achieve unrealistic goals?' – being a complex matter. This problem can be translated into the language of mathematics by supplementing the formula in a way, that any justifiable objective obtains an initial value. Subsequently, the modified formula not only includes direct proportionality but also a constant (k):

$$P = ik + ir$$

P = necessity
i = justifiability, discrete (binary) values {0; 1} 0 = unjustified, 1 = justified
k = constant, which requires effort (1) if the desired result is justified
r = reality, discrete (binary) values {0; 1} 0 = unrealistic, 1 = realistic

Table 4 *The summary of value calculation (self-edited)*

Characterisation	**Value**	**Explanation: P = ik + (ir)**
Unjustified	0	If i = 0, there is no need to measure the value of 'r', since unjustified activity involves no hidden potential. $P = 0 + 0$
Justified and unrealistic	1	$P = 1 \times 1 + 1 \times 0$
Justified and realistic	2	$P = 1 \times 1 + 1 \times 1$

After applying the function, various desired results can be expressed numerically as follows.

Deceleration of deterioration in performance			
	Short	**Medium**	**Long**
Quarantine	0	2	2
Gilded cage	0	2	2
Mission	0	2	2

Sustaining/preserving performance			
	Short	**Medium**	**Long**
Quarantine	1	2	1
Gilded cage	1	2	2
Mission	1	2	2

Intensification/development of performance			
	Short	**Medium**	**Long**
Quarantine	0	0	0
Gilded cage	1	1	1
Mission	1	2	2

The matrices above can be summarised and quantified based on the numerical values at the intersection of rows and columns, resulting in the following table.

	Short	**Medium**	**Long**
Quarantine	1	4	3
Gilded cage	2	5	5
Mission	2	6	6

This matrix can be visualised in a three-dimensional chart as follows.

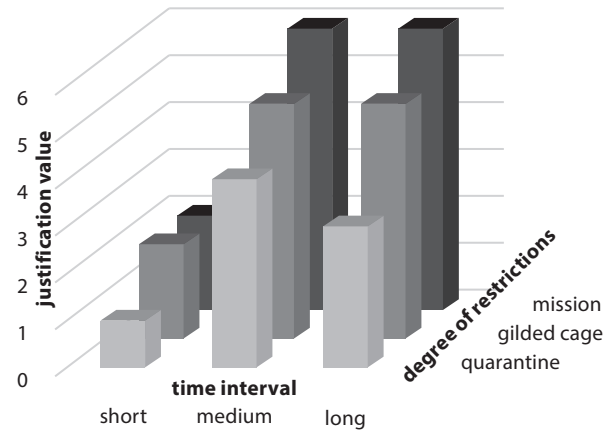

Figure 1

In *Figure 1,* the higher a column the greater the necessity of the desired result in a given timeframe. Or, in a given interval of time we can see the change in the degree of necessity along various desired results.

The central message the figure wishes to illustrate is that there is no specific condition in which there would not be an opportunity, and that there is no specific condition where one should not make efforts as either time or circumstance provide an opportunity to achieve some sort of a result.

However, it is evident, that the situation promising the highest results is mostly in the circumstances of a 'long-term mission'.

It also seems worthwhile to examine the results of these two positions in combination with average values.

Objectives can be studied along the factors of time and specific condition. A summary in diagram-format was constructed, which illustrates where the best results can be achieved and in which cases special attention should be paid to maintaining the physical condition of soldiers, thus also sustaining combat readiness.

Respective of the conditions, the results with the incorporated average are depicted in the graph below.

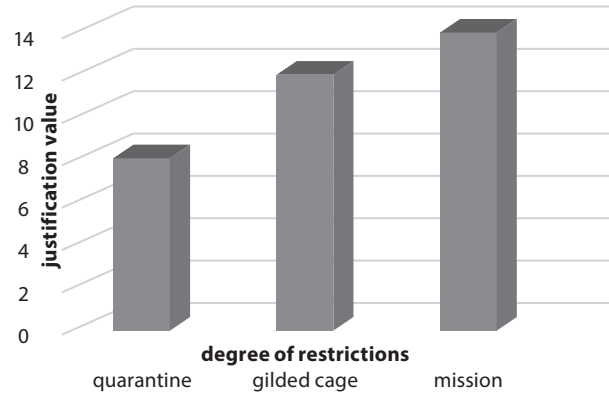

Figure 2

Figure 2 shows a strictly increasing exponential relationship as conditions improve. Consequently, it can be deduced that in terms of fulfilling aims and attaining the desired results, the improvement in special conditions brings forth an increase in potential, too. In other words, the same activity conducted is increasingly effective as limited circumstance improves, thus aiding us achieving our desired results. Henceforth, it is worth investing our specific conditions.

However, the analysis of the factor of time shows an interesting result.

Figure 3 indicates that the initial value of necessity, being very low, shows a preliminary jump in value and is then followed by a slight decline. In practice, this translates to how our objectives of preserving physical condition in various limited circumstances have a better chance of realisation in the short run, than in the long run where opportunity becomes narrower and generally worse.

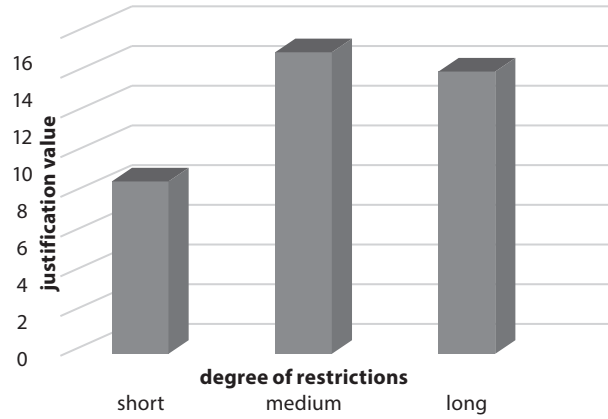

Figure 3

PRACTICAL ADVICE FOR ACHIEVING DESIRED RESULTS

General skill development

The methods used to develop skills portray certain generic features. In many cases, the force is developed on the basis of the same principles, only the means of execution, the movements that is, are different from one another in technicality (e.g.: throwing movements, etc.). These principles prevail mainly in natural movements, because the basic forms of movement are almost the same. Other, special movements require particular techniques of motion, therefore, to acquire, practice, and also develop these skills, a much more concrete movement-mechanism is required. The latter is primarily necessary for the requirements of competitive sports. Subsequently, literature distinguishes between physical ability and athletic ability. The situation is similar regarding the development of endurance. In the training of swimmers, mid- and long-distance runners, cyclists, „the principles of loading may be identical, despite the fact that each sport differs in the structure of movement and effort".[17] In some cases, different movements elicit approximately the same mode of action. For example, running at medium speed, swimming, rowing, skating, cycling, even jumping or skipping rope have a rather similar effect on endurance.

The selection of training methods

The contents of one's workout is determined by the ability or abilities intended to undergo development. All training parameters should be compiled and defined in line with to the desired result(s). In this case, while under limited conditions, general fitness should be the main goal. Achieving overall fitness requires a workout plan that develops all condition-based skills.

During the definition of training methods, one also faces social and existential challenges. The conditions for achieving better performance are to increase the magnitude and intensity of the load. Increasing magnitude in certain sports and in limited circumstances

[17] Koltai and Nádori. *Sportképességek fejlesztése.* 7.

is already pushing the boundaries of opportunity. The number of daily and weekly workouts also poses existential problems in balancing privacy, work, learning, and training. Therefore, it is more important to increase training intensity in achieving, maintaining and raising physical fitness levels, which has a beneficial effect on increasing performance too.[18]

Our smart devices have gained massive momentum. Online platforms and applications give birth to countless "personal trainers" and training programs. With everything available online, we do not suffer from a lack of a training partner. Since we are talking about general abilities and not specific sports abilities, the overwhelming amount of material available is not a problem. While these, almost without exception, can be used for preparation and training, it is advisable to seek the personal guidance of a professional, whose expertise and objectivity positively impact one's physical performance.

Sports science-based background

Extensive studies have been carried out by sports scientists and medical professionals in hopes of eliminating sedentary lifestyles, the prevalence of sedentary work, and the health risks associated with these conditions.

- In the 1980s, Cooper defined optimal training for maintaining health in 80 to 90 minutes of aerobic activity per week.[19]
- In 1995, the American College of Sports Medicine (ACSM) and the Centres for Disease Control and Prevention (CDC) recommended a total of at least 30 minutes of moderate physical activity per day.[20]
- In 2008, previous recommendations were revised,[21] and the currently adopted position was established worldwide.
- Today, in accordance with WHO recommendations, one should exercise five times a week for at least 30 minutes with moderate (3–6 MET) intensity.[22] For ages 18–64, 150 minutes of moderate-intensity aerobic exercise or at least 75 minutes of high-intensity aerobic exercise, their combination, and the strengthening of major muscle groups at least twice a week are recommended. To intensify efficiency, it is advisable to increase medium intensity aerobic physical activity to 300 minutes or high intensity aerobic activity to 150 minutes.[23]

Maintaining the physical condition of soldiers

Meeting the requirements stipulated in Decree 10/2015 of the Ministry of Defence of Hungary is the starting point of a military career. Physical performance is measured by performing three tests of motor skills. These forms of movement include push-ups, pull-ups, sit-ups, running/dashing for 2,000 m and 3,200 m, and walking for 1,600 m. In terms of

[18] Koltai and Nádori. *Sportképességek fejlesztése.* 9.

[19] Cooper, K. H. *A tökéletes közérzet programja.* Budapest: Sport, 1987. 108.

[20] "Benefits and Risks Associated with Physical Activity". In *Guidelines for Exercise Testing.* 10th ed. Philadelphia: Wolters Kluwer, 2018. 1–21.

[21] Physical Activity Guidelines for Americans: 2008. US Department of Health and Human Services. October 2008. https://health.gov/sites/default/files/2019-09/paguide.pdf, Accessed on 5 June 2020.

[22] *Global Strategy on Diet, Physical Activity and Health.* Geneva: WHO, 2004.

[23] *Global Strategy on Diet, Physical Activity and Health.*

abilities, the latter few forms of activity portray the state of the circulatory system, meaning they are suitable for measuring endurance in the simplest forms of movement. The other exercises measure the strength and endurance of a certain muscle or group of muscles. The technical requirements specified during the execution of the exercises must be met, as they ensure the reliability and objectivity of the measurements.

The score required to be qualified as 'fit for service' is 220 points, as mentioned earlier, which is 60% of the maximum obtainable score. In the case of strength endurance elements and exercises the average of optimal value is 60-60, and in the case of endurance (running, walking) it is 100 points. The total value earned thus also grants statutory qualification. That is, if the three results of 60-60-100 are what is considered optimal, then the number of repetitions and time intervals associated with this value can be defined as a target for performance. Naturally, this poses different results in performances among individuals across age cohorts. For example, the specifics of the youngest age group (<25 years) are: 30 push-ups or 12 pull-ups (60 points), 50 sit-ups (60 points), while 100 points are awarded for the completion of the 3,200-metre run if men complete it within 17'30", and if women complete it within 19'00".

Neither the basic requirement set for soldiers in Decree 10/2015, nor the attainment of reaching maximum scores do not actually require an outstandingly high physical performance. It merely sets a goal that is achievable for healthy, regularly training soldiers. Therefore, the proposed training methods are the same as those recommended for preserving health.

If the desired results – which are in line with circumstances – are compared with standards, the means and mode of training begin to be outlined. The three-tiered desired result (decelerating deterioration of performance, maintaining performance, developing/increasing performance) and its specific conditions (quarantine, gilded cage, mission) determine the entirety of the training. In essence, the availability of equipment, infrastructure and time are what need to be taken into account primarily. As conditions improve, the range of opportunities for training increases. Under normal living conditions, there are countless opportunities to be exploited for individuals when it comes to exercising. The 21st century brought along an inexhaustible pool of fitness opportunities. Indoor and outdoor gyms pop up around almost every corner. If not a fan of public options, the opportunity to work out at the comforts of one's home, and practice callisthenics is also dominant. Based on the specifications discussed in practice materials, there is no need for serious material-centred conditions (equipment), especially when it comes to fitness. It is the load on the circulatory system that is more exposed to a decline of circumstances. However, despite an increase in the vulnerability of the physical conditions, it remains possible to train.

Maintaining the proper physical conditions of soldiers is essential in preserving combat readiness, in successfully fighting a battle, in bearing the burdens of service, regardless of the fact that soldiers in different roles are exposed to different loads. All soldiers have to be able to carry out their duties in a tactical situation, to overcome obstacles in full combat equipment/gear, and to perform individual and group engagements over long distances, even in extreme conditions. Therefore, they need a minimum of 150 minutes of moderate or 75 minutes of vigorous (or a combination of these) aerobic activity, and two-three sessions of strength training per week. The recommendations are, ideally, a combination of 300 minutes of moderate and intense aerobic activity and 30–60 minutes of strength training three times a week.[24]

[24] "Army Physical Fitness". Army Public Health Center. 1 June 2020. https://phc.amedd.army.mil/topics/healthyliving/al/Pages/ArmyPhysicalFitness.aspx, Accessed on 5 June 2020.

Even in limited circumstances, continuous and regular training three to five times a week for a duration of at least 30–60 minutes is recommended, with an intensity corresponding to 65–85% of the maximum heart rate. A positive impact only takes effect when the training is performed with adequate loading and at a frequency of three-five times a week. If the number of workouts falls below three per week, or is abandoned for a longer period of time, the impact of the workout will deteriorate.[25] It is important to follow a gradual approach in terms of adjusting the intensity, weekly frequency, and duration of training.

When commencing a workout, it is most appropriate to
– do it three times a week;
– with an intensity corresponding to 60% of the maximum heart rate at load;
– for a duration of ten-twenty minutes per workout.

It is then necessary to increase the training load in the following order:
– first, increase the weekly frequency to at least four, but if possible, to five workouts;
– secondly, the duration of a workout can be slowly be increased to 60 minutes;
– finally, the training intensity can be increased to 85% of the maximum heart rate at load.[26]

In limited circumstances, it is advisable to seize every opportunity to lead an active lifestyle. The most obvious solution at hand is performing and varying those exercises, which are part of the military physical fitness assessment – the callisthenic exercises of push-ups, pull-ups, or sit-ups. Starting position, range of motion, rhythm and more can be varied by preference. In hopes of increasing intensity, the use of dumbbells and rubber bands is suggested. However, store-bought equipment is but one option. Everyday objects can also be used. Dumbbells can be replaced with water bottles, loaded backpacks or handbags, or books. To increase the effectiveness of the physical activity, it is advisable to perform exercises that require the simultaneous use of several muscle groups. Suspended devices (TRX), unstable support surfaces (bosu, fitball, balance board, stability air pad) can be used for this. Treadmills, stationary exercise bicycles, oars, elliptical trainers and stair machines are recommended for indoors aerobic training, or there is always the option to run, walk, jump, and climb stairs, or dance. During quarantine, let us involve our family and children. During a mission, or in the gilded cage, it is advised to find training partners. The overarching aim is to enjoy the physical activity we partake in, so as to help us relieve tension and stress, and to aid us in finding our physical and mental balance.

We must not forget about warming up for and cooling down after training, or to incorporate stretching into our workouts. In this case, the stretching-relaxing breathing exercises of autogenous training, such as yoga or Pilates – prove to be useful.

In order to avoid accidents, the location, means, and method of training must be carefully chosen according to our circumstances.

SUMMARY

Sometimes, life forces people into difficult situations; however, it is in their interest to consciously put effort into reducing consequent negative effects and their impacts. Sustaining soldiers' physical fitness, decelerating their deterioration, or perhaps even attaining

[25] Fritz P. „A rekreációs edzés az egészségtudatos életmód építőköve". In Szatmári Z. (ed.), *Sport, Életmód, Egészség.* Budapest: Akadémiai Kiadó, 2009. 896.

[26] Fritz. „A rekreációs edzés az egészségtudatos életmód építőköve". 899.

some degree of development is possible, too, within limited circumstances. Analysing the possibilities of these circumstances, using mathematical tools it was found that there is no such setting, where efforts could not be made to maintain physical performance. By setting realisable goals, and through consistent and conscious behaviour, desired results can be achieved in all circumstances. In this paper, I have outlined the key principles that can turn our efforts successful.

Despite the fact that this study is designed to analyse the sustainability of soldiers' physical fitness, it may also be useful in a civil setting for those whose jobs pose similar working circumstances.

Last but not least, advice drawn from the objective analysis of facts is, that if our health allows it, we should not abandon leading an active lifestyle! It is important to partake in physical activities that are in agreement with our age and circumstances, as this plays a key role in sustaining our physical and mental health for as long as possible.

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