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Research for New Physical Ability Testing Method for Firefighters in the V4 Countries

A tűzoltók új fizikai állapotfelmérésének módszereinek kutatása a V4 országokban

An analysis and precise identification of rescue operations by firemen are only possible under extreme and realistic conditions using special instruments. Monitoring of firemen's physical preparedness for rescue actions is indispensable for efficient interventions and for preserving the health of firemen. We have elaborated complex physical aptitude testing that may be introduced in the V4 countries upon completion of a standardisation process.

Keywords: *physical ability test, firefighter, method*

A tűzoltók mentési tevékenységének elemzése, a munkatevékenység pontos meghatározása kizárólag extrém, a valós körülmények között, speciális műszerekkel lehetséges. A tűzoltók fizikai felkészültségének monitorozása elengedhetetlenül szükséges a hatékony beavatkozáshoz és a tűzoltó egészségének megőrzése szempontjából. A fizikai képességek mérésére egy komplex tesztet dolgoztunk ki, amely a szabványosítási eljárás után bevezetésre kerülhet a visegrádi négyek országaiban.

Kulcsszavak: *fizikai állapotfelmérés, tűzoltó, módszer*

Introduction

The aim of this research is to implement the V4 test battery, in close international collaboration with selected Visegrad Four organisations, which will be used to assess the suitability of new recruits for work in the fire service.

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A modified version of this diagnostic tool will also be developed for the purposes of testing the physical performance of serving firefighters for readiness for action.

Within the framework of the scientific research, we have also carried out an assessment of the physical capability of firefighters in Hungary with the new procedure [1] [2].

Why Is It Necessary to Measure the Physical Performance of Firefighters?

Firemen rescue activities in built-up areas, especially in high-rise buildings require a special focus on the firemen's motor skills. Among the negative factors that may pose a threat, the negative influence of single rescue in a long time of salvage is associated with the fire's high temperature, high humidity due to water by steam, dark environs, possible presence of toxic compounds and heavy technical resources used in action [3].

In such a way, we could detail other working activities in the area. Those threats have negative influence on the process of salvage. All activities, except firemen's high growth performance, may pose a danger, because no rescue situation itself can be planned forward. Something dangerous can always occur suddenly and unexpectedly.

Contemporary legislative conditions for fire rescue staff force firemen to verify, yearly, their growth performance through motor-operated testing. Motor tests reveal the condition of firemen's growth performance in the field of conditional and coordinative preparedness (velocity, endurance, kick and rush, motional accomplishment coordination) [4].

Firemen jobs can be considered as special from the point of performance growth. Rescue activities are also characterized by a high psychological load on firemen. The mentioned activities put special demand on the body strengths of firemen. Our aim was to design a test, a kind of motor chain, by which we can test firemen's preparedness for rescue.

In connection with building complexity of contemporary high-rise buildings, we can assume, that firemen rescue activity in case of various accidents in the presence of fire in the subject environment, demands a high level of firemen's preparedness.

The solution of the problem is a research grant task VEGA MS SR No. 1/0713/08 under the cooperation of the Board of Fire and Rescue Service of the Department of Home Affairs in SR, Technical University of Mine – Faculty of Safety Engineering Ostrava, Fire Rescue Service Moravsko-Sliezsky Region, Szkoła Główna Służby Pożarniczej Warsaw, Technical University in Zvolen and the Fire Department of Budapest [1].

Aim, Tasks of Work

The research work was based on the theoretic analysis of specific firemen activities in rescue, to propose and then to verify a specific motor-operated test for gaining the firemen preparedness in high-rise building rescue:

- to perform standardization;
- to apply it in firemen training of the V4 countries;

Tasks:

- to identify the most characteristic job activities that firemen perform during rescue operations;
- to assign representation motional conditional and coordinational accomplishment in individual working activities, with assignment of dominance of growth accomplishment;
- to create from the most characteristic activities motional chain, that will duplicate sequence of working activities in rescue;
- to create files of firemen in individual V4 countries preparing conditions for testing;
- to improve outfit of firemen;
- to perform exact description of activities in test which are familiar with all testing files of firemen;
- to perform skill session of coordinators in V4 countries who participate on problem solution;
- to create timeframe testing file in individual V4 countries (Hungary, Poland, Czech Republic and Slovakia in the years 2018–2019).

Method:

Characteristics and description of the test. This test models disturbances in high-rise buildings, where people are rescued during fire-fighting [5] [6]. The rescue phases below were joined in the test:

- research – places of rescue (walk – inspection of an object – preparation hose transport system) – exercise 1 from the test;
- military development – exercise 2 (ascent up the stairs, bring out technical resources and hose forwarding rail);
- rescue – (exercise 3) – rescue of persons;
- secondary research (exercise 4) – research space.

Description of the test:

As it has already been described in the previous sections, the test consists of firemen working activities, in preparation and during the rescue. It is designed into four sections or exercises. Firemen realize the mentioned test in full PPE (personal protective equipment) as they do in rescue operations, the full weight of which is 22 kg.

Besides exercise No. 1, in the next three, firemen perform their activity in breathing masks and use their breathing apparatuses (BA). After every exercise, their achievements are recorded while firemen have a 1-minute break during which they progress to the subsequent exercise. Measuring of achieved times is done in individual exercises.

Doing motional growth activities in mask in the above mentioned test (besides exercise 1) is from the case of smoke-quarts or toxic cloth presence.

The arrangement of the locations of individual exercises must be minimised so that the distance between these places should not exceed 10 m, to minimise walking between exercises. Intensity of growth activities of firemen in applying the provision test is submaximal [1].

The duration of rescue activities can last from several minutes even up to a few days. We have decided to join the testing of job activities, which are expected from firemen, so they do them with high intensity. It is about activities (object inspection, hose system generation, rescue of persons, secondary research) that firemen do in mixed anaerobic-aerobical energetic regime covering energetic pretensions for the mentioned job activities.

Description of individual exercises:

Exercise 1

- introduces actual inspection of an object in which firemen have to do rescue preparation for development and connection of hose transport system.

Activity: fireman starts at command, on a path of 25 m from one end to another and individually transfers 1 hose C, 1 hose B, 1 distributor, 1 nozzle. At the end of the last sector, after the transfer of all 4 sections of hose system are coupled:

- distributor with hose B.

Standardization of new motor-operated test

- nozzle with hose C (together completes $8 \times 20 \text{ m} = 160 \text{ m}$). After the first exercise, fireman in motion puts on mask within 1 minute because he completes other three exercises with mask on breathing air from breathing apparatus.

Exercise 2

- introduce actual additional bringing out bins with hoses and technical means up the stairs in high-rise buildings.

Activity: at command's start, fireman goes up and down on a 0.25-meter high, 0.40-meter wide, and 1-meter long tepper (stair) which introduces simulation activity in stairway building. In both arms he carries 2 canisters filled with sand, both weighing 20 kg.

Timekeeper counts the fireman's achieved repeated ascents and descents on stepper. In this exercise the fireman ascents and descents 40 times on stepper with mentioned load (1 repetition – ascent by both legs from the ground on stepper and descent by both legs from stepper to ground on his feet). After the last repetition he puts off the canisters on the marked place.

Exercise 3

- introduces rescue and evacuation of injured persons from the place of fire to safe-depot.

Activity: fireman at his command starts to transfer 4 single sacks, each filled with sand weighing 40 kg. He must carry the sacks and not drag them. He transfers sacks at a distance of 10 m from one end to the other.

Exercise 4

- introduces research of searching for injured persons.

Activity: fireman at command starts to seize canister weighing 5 kg in his hands, which in fact represents a thermo-camera and overcomes barriers (small gates in height of 0.6 m, width of 1 m). There are 3 barriers and they are arranged every 2 m. So the path has the following form (from the starting position): the first obstacle is placed at 2 meters, then comes the second obstacle in another 2 meters, after that the third in another 2 meters, and lastly, 2 meters from the third obstacle, the goal.

The first obstacle toadies down, the second obstacle transgresses, the third obstacle toadies, rounds the goal and he performs equal activity backward. He puts down canister on the level of startup goal and runs a distance of 25 m, where he uncouples forwarding hose system. Here a timekeeper terminates (measures) closing activity in test.

Test measures following kinetic accomplishment and motional skills:

- Exercise 1: velocity kinetic accomplishment and motional skill (connection of hose system).
- Exercise 2: velocity accomplishment, endurance in power.
- Exercise 3: velocity accomplishment, endurance in power.
- Exercise 4: velocity accomplishment, growth skilfulness (motion under difficult conditions with thermo-camera – simulated by canister weighing 5 kg), motional coordination and flexibility [6] [7].

Results of the test:

Testing was done from April to June 2018 at the Fire Station of the Budapest Fire Brigade. Under natural conditions of fire stations in the place of mobile technique with concrete floor, from where after sliding (space in space barn into place of garage) they go into rescue activities. Firemen were informed about taking the test and about individual parts of the test. Firemen were tested in full PPE as they are in rescue activities.

As for the valuation of firemen file (Polish Republic, Czech Republic, Hungarian Republic), the average age of firemen from Poland was 34.2 years, Hungary 27.4, the youngest file was from the Czech Republic – 26.6. From the point of growth building of individual exercises of the test, the most difficult were the second and the third exercises.

In the aforementioned activities, the average attributes of heart rates were 192 bpm in Hungarian firemen, 180 bpm in Polish firemen and 177 bpm in Czech firemen. The best average results in values of lactate time in individual exercises, but also in the whole evaluation of the entire test the Czech firemen came out first, followed by the Polish firemen and the weakest were the file of Hungarian firemen. Exact results of all measured values are shown in the tables.

Conclusions

In order to achieve positive change in firefighter recruitment in the V4 countries, higher demands must be made of recruits given the increasingly difficult nature of rescue operations. To help achieving positive change we wish to include a new V4 test battery as part of the physical performance diagnostics, which will require recruits to cope with greater, and especially, more specific demands that reflect the reality of firefighting duties.

The goal for recruits is to be able to cope with the activities in the diagnostic battery. The specific aim of the diagnostic tool is to test the recruit's ability to perform rescue activities with a load. The results of the research are aimed at the needs of the Fire Brigades in the V4 countries.

References

- [1] KANYÓ Ferenc – BAUER Márton (2009): A tűzoltók fizikai állapotfelmérésének új alapjai. (New bases for physical aptitude testing of firefighters). *Védelem Online*. Source: www.vedelem.hu/letoltes/anyagok/206-a-tuzoltok-fizikai-allapotfelmeresek-uj-alapjai.pdf (Accessed: 05. 11. 2018.)
- [2] KANYÓ Ferenc – CZIVA Oszkár (2008): Different international methods for testing the ability of firefighters. *Hadmérnök*, Vol. 3, No. 3.
- [3] KANYÓ Ferenc (2008): *A tűzoltók fizikai alkalmasságának felmérése az új évezredben. Laboratóriumi és pályavizsgáló teljesítménydiagnosztikai eljárások alkalmazási lehetőségei a tűzoltók teljesítménymérésében. (Physical aptitude testing of firefighters in the new millennium. Applicability of laboratory and drill course performance testing in testing the performance of firefighters)*. Budapest, Zrínyi Miklós Nemzetvédelmi Egyetem, Hadtudományi Doktori Iskola.
- [4] KANYÓ Ferenc (2007): Special physical examination for firefighters using Draeger fire simulation containers. *AARMS*, Vol. 6, No. 4. 637–645.
- [5] KANYÓ Ferenc (2007): A fizikai állapotfelmérés új módszerei a Fővárosi Tűzoltóparancsnokságon. (New methods of physical aptitude testing at the Fire Department of Budapest). *Védelem*, Vol. 14, No. 5. 19–20.
- [6] EGERMAN, Monte (2011): Flexibility & Firefighting. *Fire Rescue Magazine*, Vol. 7, No. 1. Source: www.firerescuemagazine.com/articles/print/volume-6/issue-8/firefighter-fitness-and-health/flexibility-firefighting.html (Accessed: 05. 11. 2018.)
- [7] VÁSÁRHELYI-NAGY Ildikó (2018): A beavatkozó állomány kondicionális képességei fejlesztésének új irányai, különös tekintettel a proprioceptív módszerek alkalmazására. (New directions of improving physical conditioning capabilities of intervening strength with a particular view to the applicability of proprioceptive methods). *Hadmérnök*, Vol. 13, No. 4. 408–422.