

IMPORTANCE OF THE PHYSICAL FITNESS OF EMERGENCY PROFESSIONALS

Senka Bajić,¹ Borko Bulajić,² Dragoljub Veljović³

Abstract: It is very vital to underline the importance of the physical fitness of the emergency professionals in disaster response as an emergency response performance is crucial in limiting mortality, injuries, property loss, and environmental harm. Personnel in special weapons and tactics (SWAT), special operations forces, conventional military forces, law enforcement, firefighters and different emergency response teams are all examples of tactical athletes. Emergency personnel may be required to carry heavy loads, move through hazardous terrain and environments, run, engage in self-defense, perform manual handling tasks, engage in search and rescue operations, safeguard community property, and engage in other near-maximum heart rate activities for extended periods. All of those physically demanding job duties necessitate a high level of physical fitness. Fitness improvements enhance tactical athlete's performance on duty with superior precision and efficiency, therefore mitigating consequences of different emergency events.

Key words: Disaster response, Emergency situations, Physical fitness, Tactical professionals, Occupational fitness, Occupational safety and health, Protection and rescue system

1. INTRODUCTION

Disaster risk management cycles are a complex system with interconnected stages that are usually referred to as mitigation, preparedness, response, and recovery [1] and cover the time before the hazardous event, during the event, and afterward. The effectiveness of each of these stages directly affects the next one and the severity of the effects of the disaster. Actions made during the emergency preparedness stage can be used to assess how effective the emergency response stage can be. Planning, training, and exercise are seen as the three main components of preparation, with exercise being viewed as an opportunity to put the protocols and tools listed in a plan and taught during the training phase to the test [2], [3]. Two well-known types of emergency preparedness exercises are discussion-based exercises and operation-based exercises [2]

Many different researches suggest that there is a strong correlation between actions taken during the emergency reaction phase and physical activity. The term "physical activity" refers to any skeletal muscle-driven motion that involves some kind of energy expenditure. These movements include leisure-time activities, travel to go anyplace, and movements made at a job or school [4]. It is very vital to underline the importance of the physical fitness of residents as well as the emergency professionals in disaster response as an emergency response performance is crucial in limiting mortality, injuries, property loss, and environmental harm [5]. According to [6], some persons are more at risk of harm in various situations before, during, and after a catastrophic event. Emergency personnel are regarded as tactical athletes since every emergency requires them to perform at their very best. Personnel in special weapons and tactics (SWAT), special operations forces, conventional military forces, law enforcement, firefighters and different emergency response teams are all examples of tactical athletes [7].

2. PHYSICAL FITNESS OF EMERGENCY PERSONNEL

In order to describe physical performance in such occupational duties there are two main approaches. The first one defines the physical requirements of job-specific tasks. The second one is the

¹ Assistant Professor, PhD, Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia, senka.bajic@uns.ac.rs

² Associate Professor, PhD, Faculty of Technical Sciences, University of Novi Sad, Trg Dositeja Obradovića 6, 21000 Novi Sad, Serbia, borkobulajic@uns.ac.rs

³ PhD student, Faculty of Sport and Physical Education, University of Novi Sad, Lovčenska 16, 21000 Novi Sad, Serbia, dragoljub.veljovic@gmail.com

design of physical performance tests that are used to forecast occupational performance [8], [9]. It is very important to analyze the occupational task of interest in detail with special attention on needs analysis of every tactical occupation and organization. Observing a job task can give insight into the physical demands, skills required, key movements, energy system usage, and comprehensive examination of injury and disease [7]. Emergency personnel may be required to carry heavy loads, move through hazardous terrain and environments, run, engage in self-defense, perform manual handling tasks, engage in search and rescue operations, safeguard community property, and engage in other near-maximum heart rate activities for extended periods [7], [10]. All of those physically demanding job duties necessitate a high level of physical fitness [10]. Strength, endurance, and cardiovascular fitness represent the most important physical prerequisites for occupational performance [11]. Muscular strength is defined as the maximum force that a muscle or muscle group can produce at a given velocity [7], [12]. Aerobic endurance, or the ability to perform aerobically at a high level, depends on the heart and lungs' capacity to carry oxygen to the muscles and their capacity to use that oxygen to make ATP (Adenosine Triphosphate). Muscular endurance, on the other hand, is the capacity of a muscle to contract repeatedly against a submaximal load in a specific amount of time or to maintain a specific submaximal force for a protracted period of time [7].

In determining pre-employment selection, recruit training, in-service physical fitness testing, and occupational workforce shortfalls, physical analysis of characteristics like gender, age, body mass, percent body fat, fat mass, lean mass, bench press strength, etc. is useful [13]. Better performances in the field of physical fitness can hasten the process of minimizing the effects of disasters, such as lowering the risk of injury and loss of life [14], [15]. Lower levels of cardiovascular fitness have been linked to an increased risk of injury during emergency missions or high-demand work environments, according to certain studies [16]. The use of other fitness metrics, including power, strength, and muscle endurance, has also led to the same results [17], [18]. The relationship between emergency tasks and fitness level is clear, and numerous studies have been conducted and found to be reliable regarding the high level of strength and aerobic performance required by specialist police jobs like carrying loads, performing repetitive lifts, and performing a variety of carrying tasks [19], [20]. Performance in all tactical occupational tasks can be improved with participation in a specific training program, depending on which fitness factors are examined [20]. Therefore, fitness level directly affects how well emergency workers function in any given threat circumstance. Different physical performance tests are carried out before the composition of emergency teams in order to understand the significance of fitness being associated with occupational task performance and injury risk [21], [22]. It is also important to take into account additional equipment for emergency personnel which may be carried on job demands [10], [23]. To safeguard the body and still be certain that different forms of diseases won't arise in firefighting scenarios, more research and investigation must be conducted, taking into account the physiological stress that personal protection equipment causes on the human body [24].

A structured training program with the primary objective of achieving and maintaining a higher level of personal fitness is considered to be very beneficial for emergency teams [25]. Different simulated fire suppression tasks are the greatest way to show the importance of this relationship. However, realistic scenarios must be modeled to get precise answers [26]. For instance, while testing firefighting duties, work in the heat and other stressful conditions should be included (Trondheim test). The Trondheim exam is regarded as being quite physically demanding. Physically fit people finished the test more quickly than less fit participants, according to [27]. Although emergency responders work as a team, the majority of study focuses solely on examining individual physical fitness. Moreover, developing more effective teamwork mechanisms is not a common component of training for enhancing emergency planning and responses [28]. Further research is necessary to determine how physical fitness affects team performance as a whole, rather than just individual performance [29]. Emergency teams must collaborate to reduce disaster effects and enhance emergency response [5]. Additionally, fire protection systems should put more of an emphasis on team member interactions and strategic and tactical considerations, to improve risk management in future emergencies of any kind [30].

Emergency exercises are included in emergency preparedness activities with the primary aim of raising the overall competence and confidence of the participants, and studies are showing improved perceptions of preparedness and comprehension of individual roles [31]. On whether these exercises can result in better emergency response from all individuals, more research has to be done. Physical activity exercises are not formally and directly regarded as emergency exercises for enhancing the emergency response and preparedness phases, although it can be claimed that the initial phase of disaster response is influenced by an individual's level of physical fitness (Figure 1). There is a study [29] showing that emergency responders' physical abilities are even more important than their intellectual abilities, as the speed of responding to an emergency scenario can be critical in saving lives.



Figure 1 - Firefighters require high levels of physical fitness

Furthermore, in order to perform their mission efficiently, emergency personnel (tactical population) should have physical fitness on high level. Recent research suggest that physical fitness of the tactical population are below the general population and health recommendations. That cognition could be of great importance while decline in exercise and health can directly impact organizations with lower productivity levels which is the main asset for every emergency team [32].

3. CONCLUSION

Tactical occupations are physically very demanding. Improvements in health and job-related components of fitness through different training programs can improve emergency personnel ability and performance in very stressful conditions which are inevitable part of their jobs. Training programs prepare the individual for prescreening fitness testing, basic training and occupational tasks [7]. Fitness improvements enhance tactical athlete's performance on duty with superior precision and efficiency, therefore mitigating consequences of different emergency events. Proper prescription of training programs is the most effective way to improve performance and reduce the risk of injury in all tactical athletes, which will directly lead to better security and safety of citizens.

4. ACKNOWLEDGMENT

This research (paper) work of the first and second authors has been supported by the Ministry of Science, Technological Development and Innovation through project no. 451-03-47/2023-01/200156 “Innovative scientific and artistic research from the FTS (activity) domain”.

5. REFERENCES

- [1] T. Schneid and L. Collins, Disaster management and preparedness. Boca Raton, Florida 33431: CRC Press LLC, 2001.
- [2] D. M. Peterson and R. W. Perry, “The impacts of disaster exercises on participants,” *Disaster Prev. Manag. An Int. J.*, vol. 8, no. 4, pp. 241–254, 1999.
- [3] E. A. Skryabina, N. Betts, G. Reedy, P. Riley, and R. Amlôt, “The role of emergency preparedness exercises in the response to a mass casualty terrorist incident: A mixed methods study,” *Int. J. Disaster Risk Reduct.*, vol. 46, no. February, p. 101503, 2020.
- [4] World Health Organisation (WHO), “Physical activity,” *World Heal. Organ.*, no. November 2020, pp. 1–9, 2021.
- [5] J. C. Doyle, “Improving performance in emergency management,” *Disaster Prev. Manag.*, vol. 5, pp. 33–46, 1996.
- [6] L. Gray, C. MacDonald, J. S. Becker, and D. Johnston, “A qualitative study of emergency management considerations for big-bodied people in Aotearoa New Zealand,” *Int. J. Disaster Risk Reduct.*, vol. 67, p. 2021, 2022.
- [7] B. A. Alvar, K. Sell, and P. A. Deuster, *NSCA’s Essentials of Tactical Strength and Conditioning. Human Kinetics*, 2017.
- [8] J. Hogan, “Structure of Physical Performance in Occupational Tasks,” *J. Appl. Psychol.*, vol. 76, no. 4, pp. 495–507, 1991.
- [9] American Psychological Association, “Structure of physical performance in occupational tasks,” 2020. .
- [10] R. Orr et al., “The use of fitness testing to predict occupational performance in tactical personnel: A critical review,” *Int. J. Environ. Res. Public Health*, vol. 18, no. 14, 2021.
- [11] D. MacDonald, R. Pope, and R. M Orr, “Differences in physical characteristics and performance measures of part-time and full-time tactical personnel: A critical narrative review,” *J. Mil. Veterans. Health*, vol. 24, no. 45, 2106.
- [12] H. G. Knuttgen and W. J. Kraemer, “Terminology and Measurement in Exercise Performance,” *The Journal of Strength and Conditioning Research*, vol. 1, no. 1, p. 1, 1987.
- [13] R. W. Boyce, S. Ciulla, G. R. Jones, L. Edward, S. M. Elliott, and C. S. Combs, “Muscular Strength and Body Composition Comparison Between the Charlotte - Mecklenburg Fire and Police Departments,” *Int. J. Exerc. Sci.*, vol. 1, no. 3, 2008.
- [14] D. Maupin, T. Wills, R. Orr, and B. Schram, “Fitness Profiles in Elite Tactical Units: A Critical Review,” *Int. J. Exerc. Sci.*, vol. 11, no. 3, pp. 1041–1062, 2018.
- [15] A. Joseph, A. Wiley, R. Orr, B. Schram, and J. J. Dawes, “The Impact of Load Carriage on Measures of Power and Agility in Tactical Occupations: A Critical Review,” *Int. J. Environ. Res. Public Health*, vol. 15, 2018.
- [16] R. P. Pope, R. Herbert, J. D. Kirwan, and B. J. Graham, “Predicting attrition in basic military training,” *Mil. Med.*, vol. 164, pp. 710–4, 1999.
- [17] R. Orr, R. Pope, S. Peterson, B. Hinton, and M. Stierli, “Leg power as an indicator of risk of injury or illness in police recruits,” *Int. J. Environ. Res. Public Health*, vol. 13, no. 2, 2016.

ENGINEERING CONFERENCE,
Bečići, Crna Gora, 28 – 30.8.2023.

- [18] T. L. Grier, M. Canham-Chervak, T. T. Bushman, M. K. Anderson, W. J. North, and B. H. Jones, "Evaluating Injury Risk and Gender Performance on Health- And Skill-Related Fitness Assessments," *J. Strength Cond. Res.*, vol. 31, no. 4, pp. 971–980, 2017.
- [19] J. Robinson, A. Roberts, S. Irving, and R. Orr, "Aerobic Fitness is of Greater Importance than Strength and Power in the Load Carriage Performance of Specialist Police.," *Int. J. Exerc. Sci.*, vol. 11, no. 4, pp. 987–998, 2018.
- [20] N. R. Hendrickson et al., "Combined resistance and endurance training improves physical capacity and performance on tactical occupational tasks," *Eur. J. Appl. Physiol.*, vol. 109, no. 6, pp. 1197–1208, 2010.
- [21] R. G. Lockie, J. J. Dawes, R. M. Orr, M. Stierli, J. M. Dulla, and A. J. Orjalo, "Analysis of the effects of sex and age on upper- and lower-body power for law enforcement agency recruits before academy training," *J. Strength Cond. Res.*, vol. 32, no. 7, pp. 1968–1974, 2018.
- [22] C. Rappole, T. Grier, M. K. Anderson, V. Hauschild, and B. H. Jones, "Associations of age, aerobic fitness, and body mass index with injury in an operational Army brigade," *J. Sci. Med. Sport*, vol. 20, pp. S45–S50, 2017.
- [23] S. D. Blacker, "Physical employment standards developed for the Armed Forces – A summary of the international status," *J. Sci. Med. Sport*, vol. 20, p. S8, 2017.
- [24] C. E. Morris and H. Chander, "The impact of firefighter physical fitness on job performance: A review of the factors that influence fire suppression safety and success," *Safety*, vol. 4, no. 4, 2018.
- [25] P. W. Lemon and R. T. Hermiston, "Physiological profile of professional fire fighters," *J. Occup. Med.*, vol. 19, no. 5, pp. 337–340, 1977.
- [26] P. O. Davis and C. O. Dotson, "Physiological aspects of fire fighting," *Fire Technol.*, vol. 23, no. 4, pp. 280–291, 1987.
- [27] E. von Heimburg and J. Ingulf Medbø, "Energy cost of the trondheim firefighter test for experienced firefighters," *Int. J. Occup. Saf. Ergon.*, vol. 19, no. 2, pp. 211–225, 2013.
- [28] J. K. Ford and A. M. Schmidt, "Emergency response training: Strategies for enhancing real-world performance," *J. Hazard. Mater.*, vol. 75, no. 2–3, pp. 195–215, 2000.
- [29] C. Subramaniam, H. Ali, and F. M. Shamsudin, "Influence of physical ability on initial emergency response performance," *Disaster Prev. Manag. An Int. J.*, vol. 21, no. 5, pp. 556–571, 2012.
- [30] R. Klinoff, *Introduction to Fire Protection and Emergency Services*, 5th ed. Jones & Bartlett Learning, 2015.
- [31] E. Skryabina, G. Reedy, R. Amlôt, P. Jaye, and P. Riley, "What is the value of health emergency preparedness exercises? A scoping review study," *Int. J. Disaster Risk Reduct.*, vol. 21, no. December 2016, pp. 274–283, 2017.
- [32] Rasteiro, A.; Santos, V.; Massuça, L.M. Physical Training Programs for Tactical Populations: Brief Systematic Review. *Healthcare* 2023,11,967. <https://doi.org/10.3390/healthcare11070967>