Abstract

Title: Identification and Comparison of Selected Physical Fitness Parameters in Members of the Integrated Rescue System

Aims of the thesis: The main aim of this thesis was to identify the level of selected indicators of physical performance or physical fitness in members of selected Integrated Rescue System (IRS) units. Another aim is to objectify the determinants in order to clarify the achieved performance with subsequent comparison between selected IRS units. Within the Fire and Rescue Service (FRS) component to identify and highlight the type of physical training with the greatest effect on the level of selected physical fitness parameters.

Methods: In the present study, selected parameters of body composition (Tanita MC-980MA), postural stability (RS Footscan), flexibility (Sed and reach), isometric muscle strength of upper and lower limbs (Groinbar), isokinetic strength of knee flexors and extensors (Cybex Humac Norm), dynamic strength of lower limbs (Kistler) and selected parameters of aerobic fitness (Cortex Metalyzer 3B) were evaluated. The body composition parameters assessed were: body fat (%), fat mass (kg), muscle mass (kg), muscle mass distribution (kg) and BMI (kg-m-2); postural stability: total center of compressive force (mm); flexibility: reach (cm); isometric strength: maximum force produced (N); isokinetic muscle strength: maximum torque force (N. m); dynamic forces: jump height (cm), maximum force (N-kg-1), impulse force (N-s-kg-1); aerobic capacity: maximum oxygen consumption (ml-kg-min-1), minute ventilation (l-min-1), respiratory quotient and maximum heart rate (heart-min-1).

Results: We observed statistically ($p < 0.001$) and substantively ($\eta p2 > 0.06$) significant differences between members of the selected IZS units in terms of body composition diagnostics, namely body height and weight, fat mass, muscle and fat mass, as well as in the distribution of muscle mass on the limbs. The police officers of the intervention unit of the Czech Police achieved significantly higher ($p < 0.05$) upper and lower limb strength compared to the Fire Brigade and the ACR. When assessing hand grip strength, flexors and extensors of the elbow joint, we observed ($p < 0.001$) higher performances in the police officers of the intervention unit compared to the Fire Brigade and the ACR. These officers also achieved the highest ($p < 0.001$) performances in the assessment of maximal strength and trunk muscle work. In tests aimed at assessing the lower extremities, these officers were also found to have higher force production in both adductor ($p < 0.029$) and abductor ($p < 0.001$) hips. When isokinetic muscle force was subsequently assessed, the officers showed significantly higher maximum

torque force values at the extensors ($p < 0.004$) of the knee joint. For dynamic strength, we found higher performances in favour of SWAT officers during countermovement jump with and without upper limb involvement ($p < 0.025$). Significant statistical ($p < 0.001$) and substantive ($\eta p2 > 0.06$) differences were found among professional firefighters for selected body composition parameters. Also, within the strength analysis, we found significantly higher ($p < 0.001$) force production in firefighters preferring special physical training. There is a significant difference in the evaluation of dynamic strength, where firefighters using fire sport disciplines achieve ($p < 0.001$) better performance than other professional firefighters and the rest of the members of the IZS. For firefighters preferring disciplines simulating common firefighting activities, we found a ($p < 0.001$) value of maximum oxygen consumption than that produced by firefighters preparing using general training.

Conclusion: Based on these results, it can be concluded that members of the different branches of the IRS achieve different levels of physical fitness, specifically firefighters competing in fire disciplines and members of the elite unit of the emergency response unit achieved better performances. In terms of strength abilities, the PČR achieved better results. In contrast, in terms of aerobic capacity, firefighters preferring the Toughest Firefighter Alive disciplines performed best. Then, for dynamic strength parameters, firefighters preferring fire sport excelled. The diagnostic methods used were able to reveal specific differences between the different components of the IZS. These differences may have an impact on their work performance when performing specific tasks. Therefore, it is important to adapt the training programs and preparation of the individual IZS units to better prepare the members for physically demanding tasks. This work can provide normative values for other researchers or practitioners in the field of physical training of the IZS components, useful both in the actual selection of future officers, control and their physical fitness development.

Keywords: Muscle strength, performance, tactical population, physical training, laboratory tests, work capacity