

The selected morphofunctional indicators and the effectiveness of water towing

Abstract

Drowning accidents are a serious problem on an international scale. Taking appropriate measures to support suitable behaviour by the water areas, such as promotion of swimming classes as well as creating proper conditions for safe bathing under the care of well-trained lifeguard staff, are an essential element in drownings prevention (Kula i in., 2016; Ostrowski i in., 2013; Skalski i in., 2015; Telak, 2017; World Health Organization, 2021). Drownings are unfortunately quite a common social phenomenon occurring all over the world, thus it is critical to develop uniform training methods for lifeguard staff; this aim can be achieved, among other things, by conducting continuous scientific research focused on the analysis of every individual rescue operation stage.

The main research objective in this study was to assess the effectiveness of towing a dummy by a lifeguard, taking into account towing without any equipment (using one hand by the jaw, with both hands by the armpits, sailing method) as well as with the use of the rescue tube. The purpose of this composition was to conduct an in-depth study of the most effective and safest methods of towing practices used in water rescue operations (taking into account various drowning scenarios) as well as recommend such practices to all institutions in charge of organising and conducting rescue training programmes.

A selected group of 18 male lifeguards participated in the study. The average age of the participants was $16,8 \pm 1,29$ years, weight and body height of the subjects were $73,2 \pm 13,19$ kg and $177,7 \pm 9,57$ cm respectively. The research was carried out in two stages. During the first stage, the maximum oxygen threshold (VO_{2max}) was determined by conducting 7x200 meter swim test, using gas analysis system. The average VO_{2max} for all lifeguards was $56,1 \pm 4,96$ ml \times kg⁻¹ \times min⁻¹. In addition to that, on the basis of video footage recorded with cameras placed both, above and below the water surface, a number of kinematic indicators of the towing techniques were distinguished. The towing speed was recorded in the five-meter measurement zone on the first and second length of 25 meter swimming pool (V1 and V2); the results for various techniques were the following:

- both hands by the armpits: 0.68 ± 0.06 and 0.56 ± 0.04 m \times s⁻¹
- one-hand by the jaw: 0.68 ± 0.12 and 0.58 ± 0.1 m \times s⁻¹
- sailing method: 0.66 ± 0.08 and 0.58 ± 0.06 m \times s⁻¹
- rescue tube 0.77 ± 0.05 and 0.67 ± 0.06 m \times s⁻¹

Additional assessed parameters during the exercise were: number of arm movements (nRR1 and nRR2), number of leg movements (nNN1 and nNN2), lunge angle (K_{at}Nat1 and K_{at}Nat2), deceleration index (FI). During towing examination, gas exchange measurements were also registered, which enabled determination of physiological indicators such as heart rate (HR), minute oxygen uptake (VO₂), blood saturation (SpO₂), energy expenditure (EE) as well as the fatigue index in accordance with 10-point Borg scale.

The results of the research confirmed that there is a significant positive impact the use of equipment (rescue tube) has on the time as well as the speed of lifeguards' towing. Out of all analyzed methods of towing, the conducted research shows that the method of towing with both hands by the armpits puts the least strain on the cardiorespiratory systems; in contrast, the towing method using the equipment (rescue tube), turned out to be one of the most physiologically demanding method of towing. Despite the smallest physical load generated by towing method with both hands by the armpits, it should be emphasized that it is also the slowest of all the analyzed methods.

To conclude, should there be no equipment available to the rescuer, it is recommended to tow a drowning person with both hands by the armpits, as it is the least physically exacting method. Finally, it is highly recommended to use available equipment, as it offers the highest rescue success ratio, even in the light of unforeseen negative circumstances.