HEART RATE AND OXYGEN UPTAKE RECOVERY AND THE LEVEL OF AEROBIC CAPACITY IN MOUNTAIN BIKERS

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Abstract
Introduction. Since mountain biking involves exercise of varying intensity, competitive performance may be affected by the rate of recovery. The aim of the current study was to determine whether maximal oxygen uptake is associated with the rate of heart rate and oxygen uptake recovery in mountain bike athletes. Material and methods. The study examined 29 mountain bikers, including members of the Polish National Team. These athletes specialised in cross-country Olympic (XCO) racing. After undergoing a graded stress test on a cycle ergometer, the subjects were divided into two groups: G1, consisting of athletes with higher aerobic capacity (n = 12; VO₂max > 60 ml·kg⁻¹·min⁻¹) and G2, comprising athletes with lower aerobic capacity (n = 17; VO₂max < 55 ml·kg⁻¹·min⁻¹). Heart rate and oxygen uptake recovery was measured after the graded stress test in a sitting position.

Results. HRmax values did not differ significantly between the two groups. HR₁', HR₂', and HR₄' values recorded for G1 were statistically significantly lower compared to those achieved by G2. %HR₁, %HR₂, and %HR₄ values were also significantly lower in G1 than in G2. No significant differences were found in oxygen uptake during recovery (VO₂⁻¹', ₂', ₃', ₄', ₅') between the two groups. Significantly lower %VO₂₋₁', %VO₂₋₂', and %VO₂₋₅' values were observed in G1 compared to those in G2. No significant correlations were found between VO₂max per kilogram of body mass and the recovery efficiency index in either group. There was, however, a statistically significant correlation between VO₂max and the recovery efficiency index (R = 0.52) in the entire group of athletes (n = 29). Conclusion. The study showed that the work capacity of mountain bike athletes was associated with the rate of heart rate and oxygen uptake recovery.

Key words: maximal oxygen uptake, recovery, heart rate recovery, mountain biking

Introduction

Mountain biking is characterised by the performance of exercise of varying intensity. This is due to the fact that mountain bikers need to complete uphill sections, requiring high-intensity effort, and downhill sections, during which the power generated by the lower limb muscles decreases. The key parameters which are deemed to determine successful performance in mountain biking include maximal oxygen uptake (VO₂max), maximal aerobic power [1], power at anaerobic threshold, and work efficiency [2]. Of major importance is also the level of anaerobic capacity [2, 3].

The parameter which is examined the most frequently among the ones mentioned above is maximal oxygen uptake [4]. The VO₂max value is additionally significant for the effective repayment of the oxygen debt during recovery [5, 6]. A relationship between oxidative capacity and the rate of recovery after glycolytic exercise was observed by Thomas et al. [7]. A high level of VO₂max is associated with features of the muscles that impact lactate metabolism, namely higher levels of myoglobin and enzymes involved in aerobic metabolism as well as a greater number, size, and surface of mitochondria [8, 9]. Furthermore, aerobic training increases, among others, stroke volume, muscle capillarity, blood volume, and hemoglobin concentration [10, 11], which facilitates transporting metabolites produced during intense exercise [6, 12, 13].

As mountain biking involves exercise of higher and lower intensity, performance in biking competitions may be affected by the rate of recovery. Effective recovery can be determined by examining the rate of the decrease in HR values (heart rate recovery, HRR) or VO₂ values after the performance of exercise [14]. The faster the recovery is, the sooner the body is ready to undertake high-intensity exercise. An important role is played here by the recovery of phosphocreatine. As observed by Hase- ler et al. [15], the time of the recovery of this substance depends on the availability of oxygen. Post-exercise recovery consists of two phases [16]. The initial fast phase lasts from a dozen or so seconds to a few minutes and is characterised by a rapid decrease in heart rate and in the amount of oxygen consumed. This is followed by the slow phase, which can last from a few to a dozen or so minutes. Increased post-exercise metabolism is due to the clearance of lactate and hydrogen ions, increased body temperature, the activity of catecholamines, the resynthesis of muscle glycogen, and the resynthesis of proteins [6]. Heart rate recovery is mainly dependent on the activity of the autonomic nervous system [17, 18]. Moreover, it is affected, among