

The Influence of movement velocity on the maximal lactate formation rate in isokinetic cycle ergometer sprint

Haase, R.¹, Nitzsche, N.¹

¹Department of Sports Medicine/ Sports Biology, University of Technology Chemnitz, Germany

ABSTRACT:

Introduction: The maximal lactate formation rate (vLa_{max}) is used to estimate the lactic capacity and is measured using a short maximal exercise. Nitzsche et al. (2017) showed an increased vLa_{max} with higher movement velocity by resistance loads. Whether this effect is also evident in maximal isokinetic cycle ergometer sprint is unknown. Therefore, the aim of this study was to investigate the effect of the movement velocity during an isokinetic cycle sprint on vLa_{max} .

Methods: Six male participants (24.8 ± 2.9 years, 178 ± 8.7 cm, 79.0 ± 14.4 kg) completed three 10 second isokinetic sprints on a cycle ergometer with different movement velocities (110 revolutions per minute (rpm), 130 rpm and 150 rpm). Capillary blood samples were collected at rest, after the warm up/before the sprint, immediately after cessation of the test and until the 9th minute every 30s and further samples until the 15th minute every 60s after completion of the sprint. vLa_{max} was estimated using the equation: $(La_{max} - La_{pre}) \cdot (t_{sprint} - t_{alac})^{-1}$ (La_{max} = lactate maximum, La_{pre} = pre-sprint lactate, t_{sprint} = sprint duration, t_{alac} = fictional alactic time interval) (Mader, 1994). t_{alac} was defined as the time from beginning of the test until the maximum load decreased by 3.5%. A repeated measures ANOVA was used to analyze the effect of the different movement velocities on the vLa_{max} .

Results: The vLa_{max} were 0.79 ± 0.08 mmol·L⁻¹·s⁻¹, 1.09 ± 0.24 mmol·L⁻¹·s⁻¹ and 1.36 ± 0.35 mmol·L⁻¹·s⁻¹ for 110 rpm, 130 rpm and 150 rpm, respectively. The repeated measures ANOVA showed a statistically significant difference in vLa_{max} ($F = 19.77$, $p < 0.001$, partial $\eta^2 = 0.80$) and t_{alac} ($F = 13.87$, $p < 0.01$, partial $\eta^2 = 0.74$) between the different movement velocities. There was no significant difference in La_{pre} ($F = 1.46$, $p > 0.05$) between the different conditions. Bonferroni adjusted post-hoc tests revealed a significant difference in vLa_{max} between 110 rpm vs. 130 rpm ($p < 0.05$, $M_{diff} = -0.30$), 110 rpm vs. 150 rpm ($p < 0.05$, $M_{diff} = -0.57$) and 130 rpm vs. 150 rpm ($p < 0.05$, $M_{diff} = -0.27$).

Conclusion: The results indicate that a higher movement velocity results in a higher vLa_{max} . Therefore, it seems that the highest possible movement velocity should be used to determine the maximal lactate formation rate.

KEY WORDS: maximal lactate formation rate, cycle ergometer sprint, glycolysis

Reference:

1. Mader A. (1994). Energiestoffwechselregulation, Erweiterungen des theoretischen Konzepts und seiner Begründungen - Nachweis der praktischen Nützlichkeit der Simulation des Energiestoffwechsels. In: Mader A, Allmer H, eds.: Brennpunktthema: Computersimulation: Möglichkeiten zur Theoriebildung und Ergebnisinterpretation. Academia-Verl.: Sankt Augustin.
2. Nitzsche N, Zschäbitz D., Baumgärtel L, Schulz H. (2017). The effect of isokinetic resistance load on glycolysis rate. European College of Sport Science: Book of Abstracts of the 22nd Annual Congress of the European College of Sport Science – 5th - 8th July 2017, p.558.