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# Lactate dynamics of mountain bikers in a laboratory performance diagnostic

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## Abstract

**Background:** Caused by a multitude of climbs and downhill sections, as well as overtaking manoeuvres, intense intermittent physiological demands are characteristic for mountain bike marathon and cross country competitions. Consequently, aerobic and anaerobic parameters are of importance for the individual's race performance (Impellizzeri and Marcora, 2007: Sports medicine 37(1), 59--71). Considering that only 40% of the variance in performance are explained by aerobic fitness in high-level mountain bikers, anaerobic parameters are rarely analysed (Impellizzeri and Marcora, 2007) and athletes have high blood lactate concentrations during a mountain bike race (Prins et al., 2007: J Sports Sci., 25(8), 927--35), tolerance of high lactate accumulation and faster lactate elimination could be an important factor of performance.

**Purpose:** to analyse lactate dynamics during repeated recuperative and intense intervals using a specific test that was designed to simulate the physiological anaerobic demands of mountain bike competitions.

**Methods:** 10 ambitious mountain bike cyclists (age  $34 \pm 8.7$  years;  $VO_{2peak}$ :  $66 \pm 11.3$  ml/min/kg) rode an all-out-time-trial which consisted of different all-out interval (AO) durations (4x 10 s, 2x 1 min and 1x 5 min) which are based on findings of Stapelfeldt et al. (2004: Int J Sports Med. 25(4), 294--300). Cyclists were instructed to ride each AO with maximum effort. Between AO, cyclists could recover at an individual power output of 1.5 W/kg bodyweight. After the 10s-AO and between 1min-AOs the recovery period was 5 min, respectively; after the second 1min-AO 7 min. Before and after the AO, blood lactate concentrations were analyzed. The entire all-out-time-trial, including time durations and lactate analysis, is shown in figure 1. For external validation of laboratory parameters cyclists performed an outdoor race simulation test trial (laps: 6, total distance: 26.8 km) within a maximum period of 4 weeks. The average afforded power output during the race was monitored by CycleOps-powermeters (PowerTab PRO MTB Disc Hub, CycleOps, Madison, USA) and scaled by body mass. It was used to validate laboratory parameters. Correlations between lactate accumulation and power output of AO scaled by body mass and correlations between lactate change during recovery and power output during the outdoor test trial were calculated.

**Results:** The blood lactate dynamic (figure 1) shows large between-subject variation and rises during the all-out-time trial in average over all athletes to a maximum of  $14.5 \pm 3.1$  mmol/l. Blood lactate accumulation and power output during the all-outs show moderate to large correlation: 10s-AO ( $r=0.58$ ), 1min-AO ( $r=0.65$ ) and 5min-AO ( $r=0.47$ ). Lactate change during the 5-minute recovery periods after the 10s-AO ( $r=0.20$ ) and after the first 1min-AO ( $r=0.41$ ) correlation is only small with race performance. However, blood lactate elimination after the second 1min-AO (7 min regeneration period) shows very large correlation ( $r=0.80$ ) (figure 2).

**Discussion:** This is the first study which shows that cyclists with a better race performance have a higher lactate elimination during regeneration periods. However, the strength of correlation is dependent on the duration of the regeneration. Moreover our results support the findings of Zarzeczny et al. (2013: Biol Sport, 30(3), 189--94), that mountain bike cyclists who can afford larger power output in high intense intervals have also higher blood lactate accumulation. It indicates that cyclists with higher power outputs might have a better tolerance of lactate concentration. Further research is needed to analyse the regeneration process on enzymatic level. Our findings could be used for an optimized prediction of race performance and are therefore considered in a follow-up study with a larger sample size.

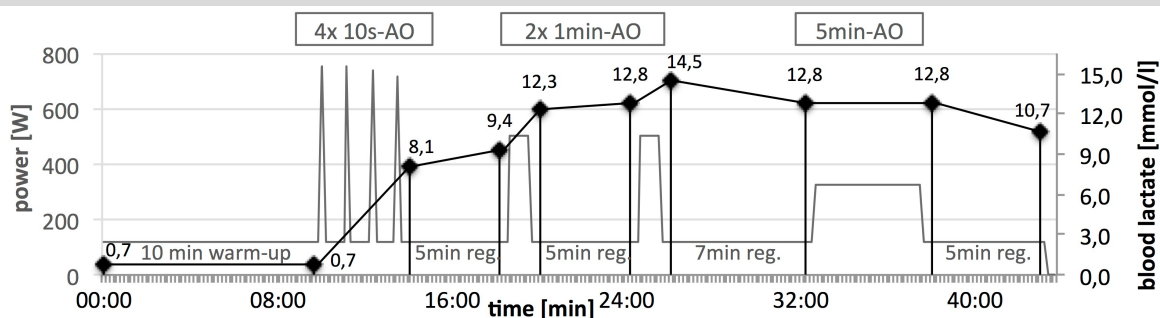


Figure 1. All-out-time-trial with average lactate dynamic over all ten cyclists

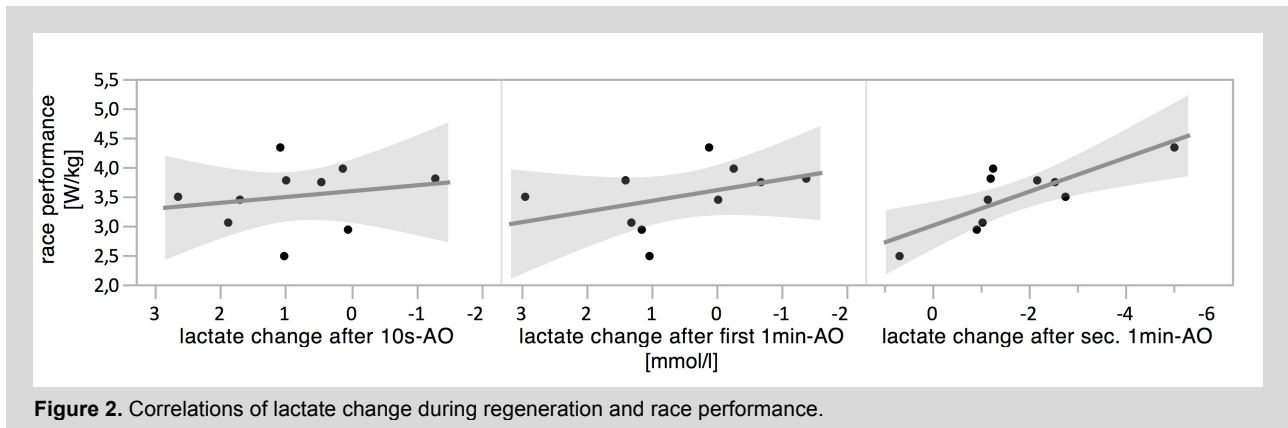


Figure 2. Correlations of lactate change during regeneration and race performance.

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