BOOK OF ABSTRACTS Open Access

Physiological characteristics of elite vs non-elite enduro mountain bike cyclists

Kirkwood [1] ✉

Abstract

Introduction: Enduro mountain bike racing debuted internationally in 2013 as the Enduro World Series (EWS). Riders compete individually on multiple timed predominantly downhill stages and travel generally uphill between stages either by riding or mechanical uplift. Terrain covered in enduro race stages is similar to downhill racing (DH) though climbing sections similar to cross country Olympic (XCO) are often included. The overall event distance and duration is reciprocal with cross country marathon (XCM) racing. Previous research in XCO, XCM and DH indicates successful athletes from each discipline show specific physiological characteristics, particularly the importance of increased power to weight ratio and measures of maximal aerobic capacity (VO_{2max}) (Novak and Dascombe, 2014). However, the rapid growth of enduro racing means there is a dearth of literature on the demands of enduro racing. The aim of this study was to identify the physiological characteristics of successful enduro mountain bike racers.

Methodology: Eleven (n=11) male enduro mountain bike riders (age= 25 ± 6 years, height=181 ± 5cm, mass=72 ± 6kg) volunteered for the laboratory study. Athletes were assigned to the 'elite' group (n=5) based on a top 40 finishing position at a EWS event; otherwise assigned 'non-elite' (n=6). All tests were performed using a cycle ergometer (Velotron, Racer Mate Pro, USA) set up to the dimensions of the participants race bike. During the ramp (VO_{2peak}) protocol online gas analysis was used to measure oxygen uptake (Jaeger Masterscreen CPX, Germany; Hans Rudolph V2, Germany). The workload started at 160W increasing 20W min-1 until volitional exhaustion. Blood lactate response to an increasing workload was investigated using a starting workload of 110W increasing 40W every three minutes until blood lactate concentration exceeded 2mmol/l (OBLA2) and 4mmol/l (OBLA4). The enduro specific power test featured two sets of sprint intervals (overall duration 3 and 5 minutes) with individual sprint duration varying from 2-45 seconds. Interval sets were separated by 15 minutes (80% power at OBLA4) to replicate stage transition. Body composition was assessed using an International Society for the Advancement of Kinanthropometry (ISAK) restricted profile with the addition of thigh girth 1cm distal of gluteal fold and grip strength in both hands. An equation using height and skinfold-corrected upperarm, thigh and calf girth was used to predict skeletal muscle mass (Doupe et al., 1997).

Nine (n=9) male enduro mountain bike riders volunteered for the field study at a National level enduro mountain bike race. Athletes were assigned to an elite (n=5) or non-elite (n=4) groups by the same means of previous top 40 EWS finishing position. A 10Hz global positioning system (GPS) and 100Hz triaxial accelerometer unit (Catapult Minimax S4, Catapult Innovations, Melbourne, Australia) was fitted to participants' bicycles to assess player load (g), velocity (ms-1) and acceleration (ms-2).

Results – Laboratory: In comparison to non-elite riders, elite enduro riders produced greater absolute power at VO_{2peak} (417 ± 29W vs. 363 ± 30W p<0.05), OBLA4 (318 ± 31W vs 263 ± 25W; p<0.05), OBLA2 (267 ± 39W vs 198 ± 36W) and RER = 1 (343 ± 25W vs 282 ± 27W; p<0.05). Elites riders also demonstrated significantly greater relative power at OBLA4 (4.3 ± 0.3W/kg vs 3.8 ± 0.3W/kg) and OBLA2 (3.6 ± 0.4W/kg vs 2.9 ± 0.5W/kg). Absolute peak power during sprints (658 ± 57W vs 541 ±66W; p<0.05), mean power over 3 minute sprint set (absolute = 475 ± 15W vs 390 ± 31W; relative = 6.3 ± 0.1 W/kg vs 5.6 ± 0.1 W/kg: p<0.05) and 5 minute sprint set (absolute =469 ± 12W vs 387 ± 30W; relative = 6.3 ± 0.4W/kg vs 5.6 ± 0.1W/kg, p<0.05) was significantly higher in the elite riders. No significant differences existed in VO_{2peak}, power to weight ratio at VO_{2peak}, muscle mass, percentage muscle mass, grip strength or thigh girth between elite and non-elite riders.

Results – Field: Overall race time was significantly correlated with less time spent in player load band 1 (r=.906, p<0.05) and more time spent in player load band 3 (r=-.798, p<0.05), band 4 (r=-.731, p<0.05) and band 5 (r=-710, p<0.05) suggesting faster riders experience less low intensity loading but greater high intensity loading. Overall race time was also significantly correlated with distance covered in velocity band 1 (r=.883, p<0.05) with elite riders spending less time in this zone, but more in velocity band 6 (r=-.814, p<0.05) when compared to non-elite riders – suggesting that elite riders were able to travel greater distances at higher velocities.

Discussion/conclusion: Enduro riders display a well-developed aerobic capacity comparable to that of XCO and elite DH riders (Novak and Dascombe, 2014; Macdermid and Stannard, 2012). Elite riders produce greater power at submaximal intensities suggesting a reduced lactate accumulation and utilisation of carbohydrate as a fuel source between stages. During the race analysis elite riders demonstrated an ability to travel at faster velocities whilst withstanding the subsequent increases in player load associated with such speed. Enduro mountain biking is defined as requiring a high aerobic capacity with the ability to produce repetitive high intensity efforts across a period of sustained aerobic demand, in tandem with the appropriate skill and technique to pilot the bicycle over challenging terrain.

References

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✉ **Contact email:** (Kirkwood)

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