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The Validation of Physiological Field Testing
in Elite Orienteers

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ABSTRACT

The complex physiology of orienteering performance is not well understood but recent advances in technology allow for more in-depth investigation. The purpose of this study was to develop and validate physiological field tests for elite orienteers in Australia.

Seven male and three female elite orienteers volunteered to take part in the study. Subjects completed an incremental fixed-distance (803m) trial in Australian forest terrain, paced by a bicycle equipped with a speedometer. This was replicated in the laboratory using a 4.5% grade for treadmill running. Subjects also completed four (males) or three (females) laps of a 1340m terrain loop incorporating uphill, track and downhill sections. Subjects then repeated this test in the laboratory, with treadmill grade manipulated to replicate the gradient profile of each section. Heart rate (HR) and oxygen uptake ($\dot{V}O_2$) were recorded continuously with telemetry during each stage/lap. Blood [La] and RPE were recorded after each stage/lap.

In the incremental tests, no significant differences ($p=0.05$ level) were observed in HR, $\dot{V}O_2$, blood [La] or RPE between the Field test, and its Laboratory replication over the entire range of speeds tested. The actual speeds run during the Field tests were significantly faster than the Laboratory test at the slowest speed ($8 \text{ km}\cdot\text{h}^{-1}$) attempted, and slower at the fastest speed ($18 \text{ km}\cdot\text{h}^{-1}$) attempted. In the time-trial tests, no significant differences were observed in HR, $\dot{V}O_2$, blood [La] or RPE between the Field test and its Laboratory replication. The running speeds in the Field tests were significantly slower than the Laboratory tests. Running speed appeared inversely related to the course profile and the terrain also affected the speeds that could be achieved. Despite the changes in the course profile, the physiological responses to the course were maintained within a narrow range at a high level ($\sim 95\%$ of maximal heart rate, 80-90% of $\dot{V}O_{2\text{max}}$, blood [La] $\sim 10 \text{ mM}$) for the duration of the 20-25 minute test.

The Field tests that were developed in this study for elite orienteers in Australian forest terrain were successfully validated by replicating the protocols in a Laboratory setting.

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Abbreviations

Selected abbreviations used throughout the text

Blood [La]: blood lactate concentration

bpm: beats per minute

cm: centimetres

°C: degrees Centigrade

kg: kilograms

km: kilometres

km·h⁻¹: kilometres per hour

m: metres

ml·kg⁻¹·km⁻¹: millilitres per kilogram of body weight per kilometre

ml·kg⁻¹·min⁻¹: millilitres per kilogram of body weight per minute

mm: millimetres

mM: millimoles per litre

m·min⁻¹: metres per minute

OBLA: onset of blood lactate accumulation (4mM)

RPE: rating of perceived exertion

SD: standard deviation

sec: seconds

$\dot{V}O_2$: oxygen uptake

$\dot{V}O_{2max}$: maximal oxygen uptake

VO2000: Aerosport VO2000 portable gas analysis system

vOBLA: running speed at the onset of blood lactate accumulation (4mM)

W·kg⁻¹: Watts per kilogram