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CHARACTERISING THE PHYSIOLOGICAL RESPONSES TO VERTICAL TREADMILL EXERCISE

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Introduction

A vertical treadmill (VerT) is being developed for the physical conditioning or rehabilitation of athletes. It requires a running action in a recumbent position on a vertically hung, non-motorised treadmill whilst the limbs are supported with overhanging resistance cables. To compare VerT exercise with horizontal treadmill running, a Rate of Perceived Exertion (RPE) of 15 was chosen as it approximates Maximum Lactate Steady State (MLSS) which is the highest steady state intensity without a continual blood lactate accumulation (Dekerle et al., 2003). The aim of this study was to determine the acute physiological responses to VT exercise at an RPE of 15.

Methods

With institutional ethics approval, five males aged 26 (2) years, height 181.2 (6.1) m, body mass 76.3 (6.8) kg were recruited. The participants' maximum oxygen consumption (51.7 (2.7) mL/kg/min) and Respiratory Compensation Point (RCP) were determined on a horizontal treadmill. MLSS was predicted from RCP minus 10% when expressed as percentage of maximum oxygen uptake (Dekerle et al., 2003). VertT exercise was performed for three minutes at an RPE of 15 during which treadmill belt speed and pulmonary gas exchange were continuously measured. Blood lactate was measured at rest and immediately after VerT exercise.

Results

Predicted MLSS during horizontal treadmill running elicited an oxygen uptake equivalent to 73.9 (2.9)% of the maximum oxygen uptake and a corresponding heart rate of 93.3 (8.4)% of the maximum. At an RPE of 15 on the VerT (equivalent to MLSS intensity), oxygen uptake was 58.7 (8.6)% of the horizontal maximum oxygen uptake, heart rate was 74.5 (5.7)% of the maximum, blood lactate rose from 1.41 (0.41) mmol/L rested to 3.67 (1.6) mmol/L and VerT belt speed was 1.60 (0.25) m/s.

Discussion

VerT exercise elicits lower cardiovascular stress (HR and oxygen uptake) than horizontal running at the same perceived intensity. This might be explained by the participants in the current study being accustomed to, but not conditioned for VerT exercise as well as the effects of load bearing. During VerT exercise muscular force is required to draw the leg downwards against the resistance cables which adds to the postural effort. This might result in a contribution of type II fibres during VerT as evidenced by the 2.26 (1.53) mmol/L increase in blood lactate. Further research should make direct comparisons with RPE-matched horizontal running as a framework for characterising VerT.

References

Dekerle J, Baron B, Dupont L Vanvelcenaher J, Pelayo P. (2003). Maximal lactate steady state, respiratory compensation threshold and critical power. Eur J Appl Physiol. 89, 281-288.

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