University of Essex

Department of Biological Sciences

MYOCARDIAL STRESS AFTER ULTRA-ENDURANCE RUNNING IN EXTREME HEAT

R.M. Leithäuser, H. Doppelmayr, M. Doppelmayr, H. Finkernagel, S.P. von Duvillard, FACSM, L. Golding, FACSM, H.J. Roth, R. Beneke, FACSM

Centre for Sports and Exercise Science, Department of Biological Sciences, University of Essex, UK, e-mail: rleith@essex.ac.uk

Introduction

The effects of prolonged exercise on cardiac muscle integrity and function are still more controversial and less well investigated than skeletal muscle damage.

The "Badwaterultra", a 216 km race through Death Valley, CA, USA, might serve as an excellent model to further investigate cardiac muscle integrity and function (Figure 1). The combination of extreme temperatures of up to 54°C and a demanding course profile consisting of 110.4 flat km, 73.6 uphill km (approx. 4000 m total) and 32 downhill km (approx. 1400 m total) makes it to one of the world toughest Ultramarathons.

The **purpose** of this study was to investigate possible negative effects of prolonged, exhaustive exercise in extreme heat on the heart based upon humoral markers of cardiac damage and dysfunction in experienced ultra-endurance runners.

Methods

Venous blood samples were obtained from eight highly-trained male endurance athletes (median (p25 / p75 percentile): 54.5 (44.0 / 59.25) yrs, 176 (170 / 181) cm, 74.8 (69.8 / 80.9) kg) before and after termination of the race.

As humoral markers reflecting myocardial damage Creatine kinase (CK), creatine kinase MB (CKMB) and cardiac Troponin T (cTnT) were measured.

Additionally, the nt-fragment of pro-B-type natriuretic peptide (nt-proBNP) indicating cardiac dysfunction was analysed.

Results I

Six runners finished the race within the time limit of 60 hours. One runner dropped out after approx. 85 km (16 h) and the other after approx. 194km (57 h).

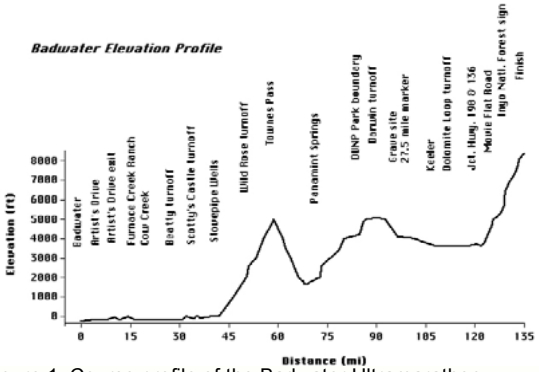

Figure 1: Course profile of the Badwater Ultramarathon (www.badwaterultra.com)

Photos 1 and 2: Start and on the way.

Photos 3 and 4: Finished! Done!

Results II

Baseline values of CK (136 (97.25 / 215.25) U L^{-1}) and CKMB (11.5 (10.0 / 12.75) U L^{-1}) were unsuspicious. Due to the exercise both CK (2868 (531.0 / 6883.5) U L^{-1}) and CKMB (66.0 (22.75 / 109.5) U L^{-1}) showed a clear increase ($p = 0.012$). The percentage of CKMB on total CK after the Ultramarathon was 3.0 (1.7 / 5.2) %. The cTnT remained below detectable level.

Baseline values of nt-proBNP (17.49 (12.39 / 30.48) ng L^{-1}) were in the reference range of healthy subjects. Following the exercise nt-proBNP was significantly increased (317.95 (79.23 / 339.35) ng/l, $p = 0.012$) immediately after the race.

Conclusion

Since cTnT remained unchanged following the ultra-endurance exercise in extreme heat the clear increase in both CK and CKMB seems to be mainly attributed to skeletal muscle damage. However, the rise in nt-proBNP may reflect a temporary, reversible left ventricular dysfunction.

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