

Heat acclimation: practical and efficient in the laboratory

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Purpose:

In order to be able to perform optimally in endurance competitions in hot and humid climates - such as the 2017 Mountain Bike World Championships in Cairns (AUS) - it is recommended that the athletes acclimatize to heat for about two weeks at the competition venue (Périard et al., 2015). With a short, "artificial" pre-acclimatization (acclimation) in the heat laboratory, the necessary acclimatization time at the competition venue could be shortened and the athletes thus offered valuable planning scope.

The aim of this study was to quantify the psycho-physiological acclimation effects during a week-long laboratory acclimation in elite mountain bikers.

Methods:

Six participants of the Mountain Bike World Championships 2017 (4 f, 2 m; 3 U23, 3 Elite) trained for 6.7±1.6 days in the heat laboratory (67±12 min per day at ~31°C and ~78% rel. humidity). During the heat trainings heart rate, thermal stress sensation and sweat rate were recorded and acclimation effects were quantified using mixed linear models.

Results:

Per acclimation day, a decrease in heart rate of 0.92 bpm (95%-CI: [0.34 bpm, 1.57 bpm]), a decrease in thermal stress sensation of 0.14 points (95%-CI: [0.11 points, 0.18 points]) and an increase in sweat rate of 31.4 ml/h (95%-CI: [-20.9 ml/h, 84.5 ml/h]) were observed with the same performance.

We used the experimental data of the first subject to optimize the different parameters of the simulation and calibrate our method, while the data of the 3 others subjects were used to evaluate the performance of the method. Figure 2 depicts the forces simulated by our method versus the forces computed from ground-truth data. It shows that there is a good correlation between the two sets of data. However, this correlation is limited probably because of the weak repeatability of the experimental data. We can indeed note that almost all points are contained in the space defined by 2 times the standard deviation of the experimental data (depicted as bars in the figure).

Conclusion:

The observed psycho-physiological effects of the one-week laboratory acclimation correspond to the expected effects of an equally long on-site acclimation (Périard, Racinais, & Sawka, 2015). This indicates that previous laboratory acclimatization can effectively shorten the necessary on-site acclimatization time and thus be used to individualize the acclimatization process.

References:

1. Périard, J. D., Racinais, S., & Sawka, M. N. (2015). Adaptations and mechanisms of human heat acclimation: Applications for competitive athletes and sports: Adaptations and mechanisms of heat acclimation. *Scandinavian Journal of Medicine & Science in Sports*, 25, 20–38. <https://doi.org/10.1111/sms.12408>

