EFFECT OF ENVIRONMENTAL TEMPERATURE ON HIGH INTENSITY INTERVALS IN WELL-TRAINED CYCLISTS

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Introduction

Performance of steady-state endurance exercise close to lactate threshold is reduced in substantially hot and cold environmental temperatures (T_A), demonstrating an inverse U-shaped relationship between T_A and endurance performance (Galloway and Maughan, 1997; Peiffer and Abbiss, 2011). Paradoxically, endurance athletes train a small duration at threshold intensity while maximal high-intensity aerobic intervals (interval training) are an important component of endurance training (Stöggl and Sperlich, 2015). This study examined the influence of a range of T_A on performance and physiological responses (e.g. body temperature and cardiopulmonary measures) during interval training. Similar to the findings of previous research (Galloway and Maughan, 1997; Peiffer and Abbiss, 2011), it was hypothesized that power output and oxygen consumption (VO_2) would be highest in the 13°C condition and lower in the 5°C, 22°C, and 35°C conditions.

Methods

Eleven well-trained cyclists completed four interval sessions at 5°C, 13°C, 22°C, and 35°C (55% RH) in a randomized order. Interval sessions involved a standardized warm-up at a neutral T_A (22°C) and five self paced 4-minute high intensity intervals interspersed with five minutes of recovery. Power output, VO_2, core temperature (T_C), and heart rate (HR) were recorded during the sessions.

Results

Mean session power output for 13°C (366 ± 32 W) was not markedly higher than 5°C (365 ± 35 W, P= 1.00, ES= .030), 22°C (364 ± 36 W, P= 1.00, ES= 0.061), or 35°C (351 ± 31 W, P= .129, ES= 0.441). Power output was lower in the 5th interval of the 35°C condition compared with all other T_A, yet no significant interactions were observed between 5°C, 13°C, and 22°C conditions. VO_2 was not significantly different across T_A (P= .187). T_C was higher in 22°C compared with both 5°C and 13°C (P= .001). HR in the 4th and 5th intervals were higher in 35°C compared with 5°C and 13°C.

Conclusions

This study demonstrates that whilst mean power outputs for intervals are similar across T_A, hot T_A (≥35°C) had a negative effect on interval power output later in a training session (> 20 min). This study also shows power output for intervals in a T_A as low as 5°C is not affected when performed by well-trained cyclists. In conclusion, well-trained cyclists performing maximal high-intensity aerobic intervals after a standardized warm-up can achieve near optimal power output over a broader range of T_A than previous literature has indicated.

References

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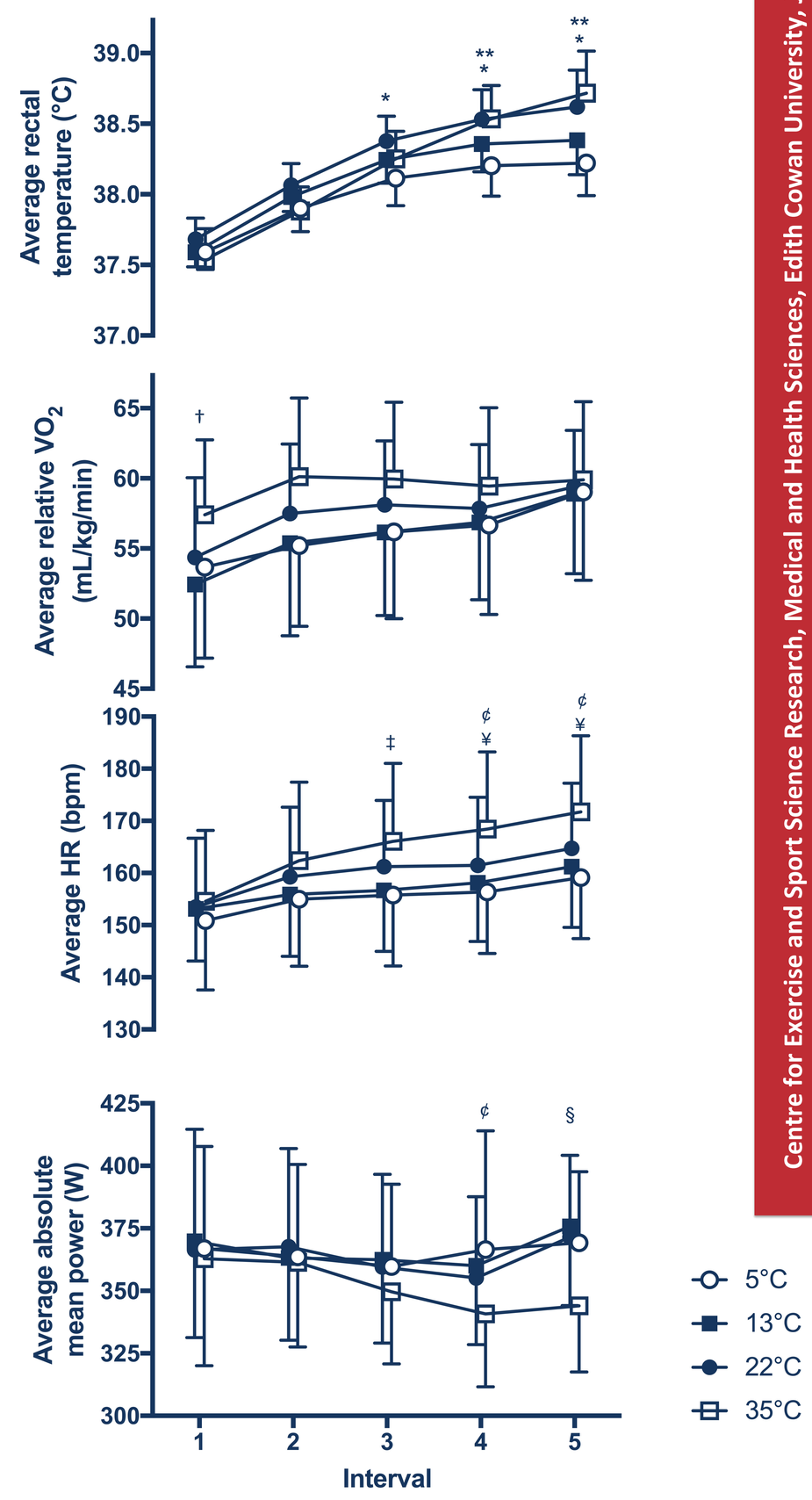

Figure significant differences (p< .05):

*22°C vs 5°C & 13°C; **5°C vs 13°C & 35°C; †13°C vs 22°C; ‡22°C vs 35°C; ¥5°C vs 22°C & 35°C; ¢13°C vs 35°C; §35°C vs 5°C, 13°C, & 22°C

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