Maximal Neuromuscular Function: The Effect of Temperature on Performance

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Purpose: The overall purpose of this study was to extend upon the work of previous investigators to gain a greater understanding of the effects of muscle temperature on maximal human performance. Specifically, to determine the effects of decreased and increased muscle temperature on maximum cycling power across a range of pedaling rates in a non-fatiguing test. Methods: Four cyclists (76 ± 5 kg) performed three maximal, isokinetic cycling trials, as described by Martin et al.; cold, hot, and control. Control trials were performed in ambient air (21 °C). After 12 minutes maximal cycling trial, participants were submerged in the iliac crest, for 30 minutes in hot (40°C), or cold (18°C) water. Subjects emerged from the bath and immediately performed 3 trials within 2 minutes. Pedal rates, power, and torque were recorded for each bout. Results: The parabolic relationship between maximal power and pedaling rate was seen in each bout. Results indicated a 9% increase in max power (p = .002) in hot versus control bouts, and an increase in optimal pedaling rates. Cooling the muscle decreased max power by 31% (p < .001) versus control bouts, and decreased optimal pedaling rates. Discussion: These data demonstrate the profound velocity dependent relationship of muscle temperature and maximal cycling. Peak torque is linearly related to pedaling rate. Following the cold water immersion, the relationship was shifted down suggesting that cold reduced muscle torque/power similarly at each pedaling rate. Heating the muscle, however, seemed to only alter muscle power and torque in the middle of the range of pedaling rates tested. The greatest effect is seen to occur at optimal pedaling rates. Our results suggest that increased muscle temperature increased muscular torque and power in the mid range.