BOOK OF ABSTRACTS Open Access

Joint specific power production in cycling: the effect of cadence and athlete level

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Introduction

When increasing cadence, there is increasing knee joint contribution and decreasing hip contribution to external power [1, 2]. Increasing power output leads to a decrease in knee contribution and an increase in hip contribution [2, 3]. Low cadence (<60 rpm) interval training is a widely used training method, but previous studies have primarily focused on cadences ranging from 60 to 180 rpm, without examining the effect of low cadence on joint contribution. The present study investigates joint-specific power production in recreational and elite cyclists during cycling at a range of different cadences.

Methods

Ten recreational cyclists and nine elite cyclists (Continental and ProTour-level) performed cycling bouts at seven different pedaling rates (40 to 100 and freely chosen) and four intensities. Intensities were set at 55 (Int55), 85 (Int85) and 100 % (IntLT) of predetermined lactate threshold (LT) in addition to average 20 min all out power (Int20min). All tests were performed on an indoor cycle trainer with the participants' private road bike. Joint specific power was calculated from kinematic measurements and pedal forces using inverse dynamics

Results

Mean work rate at the four different intensities were 154 W (Int55), 240 W (Int85), 282 W (IntLT) and 322 W (Int20min). The elite group had an average of 32.6 % higher LT and 38.4 % higher 20 min all out power than the recreational group. The knee joint was the major power producer at all cadences, with the exception of low cadence (<60 rpm) where the hip joint were the major power producer (fig. 1.). There was a significant main effect of cadence and intensity on the relative contribution of the hip, knee and ankle joints. At cadences above 60 rpm, increasing cadence led to a significant decrease in relative hip joint power and an increase in relative knee joint power. However, there was no effect of cadence on the relative joint contribution at cadences below 60 rpm. Relative knee joint power increased with increasing intensity, however the relative hip joint power only increased from low to moderate intensity. The elite group had significantly higher relative hip joint power and lower relative knee joint power compared to the recreational group.

Discussion and Conclusions

The present study demonstrates that increasing cadence leads to a decrease in relative hip joint power and an increase in relative knee joint power, however, the effect of cadence only occurred above 60 rpm. Elite cyclists have higher relative hip joint contribution, and lower relative knee joint contribution at all cadences and intensities compared to recreational cyclists. This is to the author's knowledge the first study to report an effect of athlete level on relative joint specific power in cycling. The findings related to the effect of cadence on joint specific power complies with earlier research [1, 2] with the exception of the effect at low cadence (<60 rpm). The lack of an effect of reducing cadence below 60 rpm may have implications for how low cadence training is carried out.

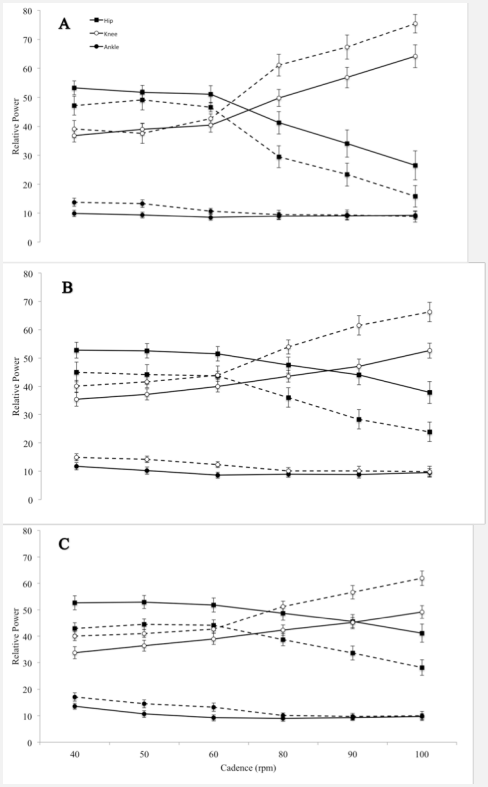

Fig 1. Group mean and standard error for relative joint power in hip (square), knee (open circle) and ankle joint (filled circle) at int55 (A), int85 (B) and intLT (C) for Elite n=9 (line) and Recreational n=10 (dashed line) cyclists.

References

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