RELATIONSHIPS BETWEEN LOWER EXTREMITY STRENGTH AND MECHANICAL PERFORMANCE IN FORCE-VELOCITY TESTS AMONG AMATEUR CYCLISTS

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Introduction

Sprint performance in cycling depends on peak power output (PPO). In turn, PPO is determined by different factors, especially mechanical properties (Hill's force–velocity relationship) e.g., maximal torque [1]. Different sport-specific tests (conductedon on a cycle-ergometer) or non-specific tests are performed to assess the ability of the lower extremities to generate maximal strength (isokinetic torque) and power (countermovement jump) [2,3]. However, there is a lack of evidence regarding how different lower extremity muscle strength characteristics influence mechanical performance in amateur cyclists.

Aim

This study aimed to investigate the relationships between mechanical variables from the sprint cycling performance test (SCPT) and isokinetic peak torque of lower extremities muscle strength.

Material and methods

Twenty amateur male cyclists, age: 26.6 ± 6.2 (years), height: 1.78 ± 0.6 (m), body mass: 78.2 ± 8.7, training experience: 7 ± 5 (years) participated in this research and performed three tests. First, a sprint cycling performance test (using a Lode cycle-ergometer) was conducted to determine peak power output, maximal extrapolated torque (T0), optimal torque (TOPT), maximal extrapolated cadence (C0), and optimal cadence (COPT). The SCPT consisted of five 4-s all-out sprints with 115, 60, 135, 125, and 180 RPM with a 5-minute passive rest. Next, a countermovement jump test (CMJ) was performed using a Kistler dynamometric platform (three jumps). This was followed by measuring the peak torque of the knee and hip flexors and extensors on a Biodex isokinetic dynamometer at speeds 60, 90, 120, and 180 degrees · s-1. The highest peak torque values for each muscle group were selected for further analysis, and the Pearson correlation coefficient (r) was calculated.

Results

Maximal extrapolated torque was strongly correlated with peak power output ($r = 0.80$, $p < 0.001$). Strong relationships ($r = 0.74$, $p < 0.001$) were found between the PPO and hip and knee flexors, also slightly lower for knee extensors ($r = 0.71$, $p < 0.001$), while hip extensors were $r = 0.59$ ($p < 0.01$). T0 was correlated with knee extensors and flexors, $r = 0.63$ and $r = 0.61$ (both $p < 0.05$), respectively. Similarly, optimal torque was correlated with knee extensors ($r = 0.66$, $p < 0.01$) and flexors ($r = 0.65$, $p < 0.05$). Moreover, strong relationships were found between CMJ and PPO ($r = 0.85$, $p < 0.001$), as well as for CMJ and COPT ($r = 0.85$, $p < 0.001$).

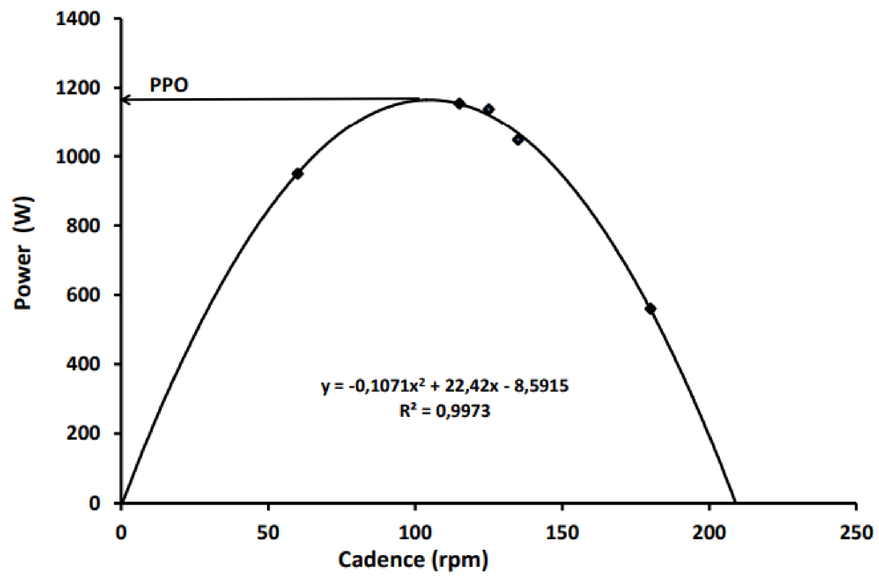

Fig. 1. Power-cadence relationship derrived from sprint cycling performance test. Peak power output was found by interpolation the apex.

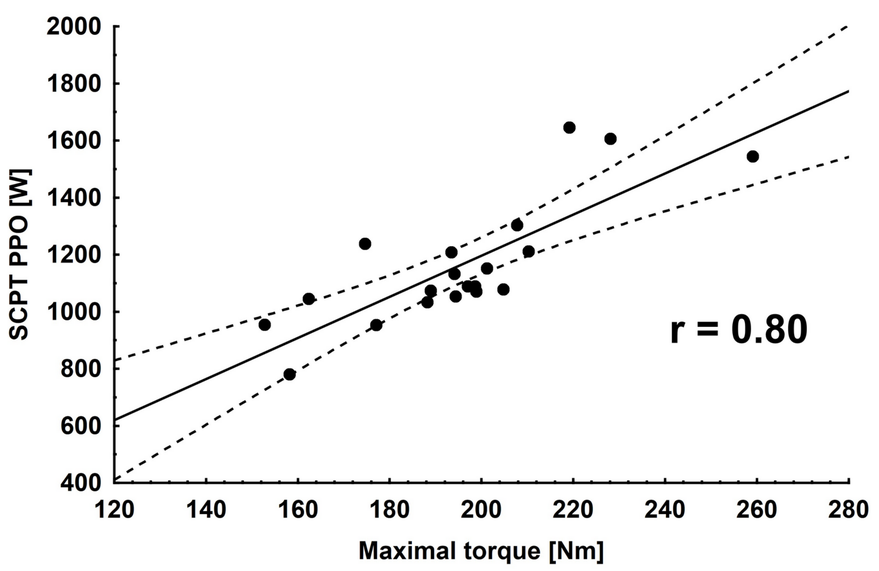

Fig. 2. Relationship between sprint cycling performance test peak power output and maximal torque.

Conclusions

The evidence suggests that lower extremity strength has an important role in determining the mechanical sprint performance of amateur cyclists. Particularly, cyclists should focus on knee flexors and extensor training to improve their high-intensity effort performance. Our results indicate that a CMJ may be a great exercise to develop peak power output and optimal cadence.

References

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