RELATIONSHIPS BETWEEN MECHANICAL PERFORMANCE AND LOWER EXTREMITY STRENGTH IN REPEATED CYCLING SPRINTS

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INTRODUCTION

Repeated sprint ability (RSA) depends on various factors, including maximal oxygen uptake, buffering capacity, and phosphocreatine resynthesis [1]. These factors are associated with the high demands of energy systems contribution and the ability to sustain maximal intensity during consecutive efforts. One crucial aspect of RSA is the quality of a single sprint [1], which indicates the role of mechanical peak power output (PPO) and its main determinants. Peak power output is influenced by various factors, especially mechanical properties such as Hill's force–velocity relationship, for example, maximal torque [2,3]. Therefore, it is intriguing to evaluate how different characteristics of lower extremity muscle strength influence repeated sprint cycling ability in amateur individuals.

Aim: This study aimed to investigate the relationships between performance in repeated sprint cycling conducted at optimal cadence and the isokinetic peak torque of lower extremity muscle strength.

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 following tests. First, a sprint cycling performance test (SCPT) (using a Lode cycle-ergometer) was conducted to determine peak power output, maximal extrapolated torque (T_0), optimal torque (T_{OPT}), maximal extrapolated cadence (C_0), and optimal cadence (C_{OPT}). 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 repeated sprint cycling (RSC) at optimal cadence, which included 15 x 4-s all-out iso-velocity bouts with 60 s passive rest, carried out on the same cycle-ergometer. This was followed by measuring the peak torque (PT) 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

Average power achieved in the RSC was strongly correlated with PPO ($r = 0.89$, $p < 0.001$), T_0 ($r = 0.76$, $p < 0.001$) and T_{OPT} ($r = 0.79$, $p < 0.001$) derived from the SCPT. Additionally, the correlation analysis revealed strong relationships between mechanical performance in the RSC and peak torque of the hip flexors ($r = 0.81$, $p < 0.001$), knee flexors ($r = 0.84$, $p < 0.001$) and knee extensors ($r = 0.85$, $p < 0.001$).

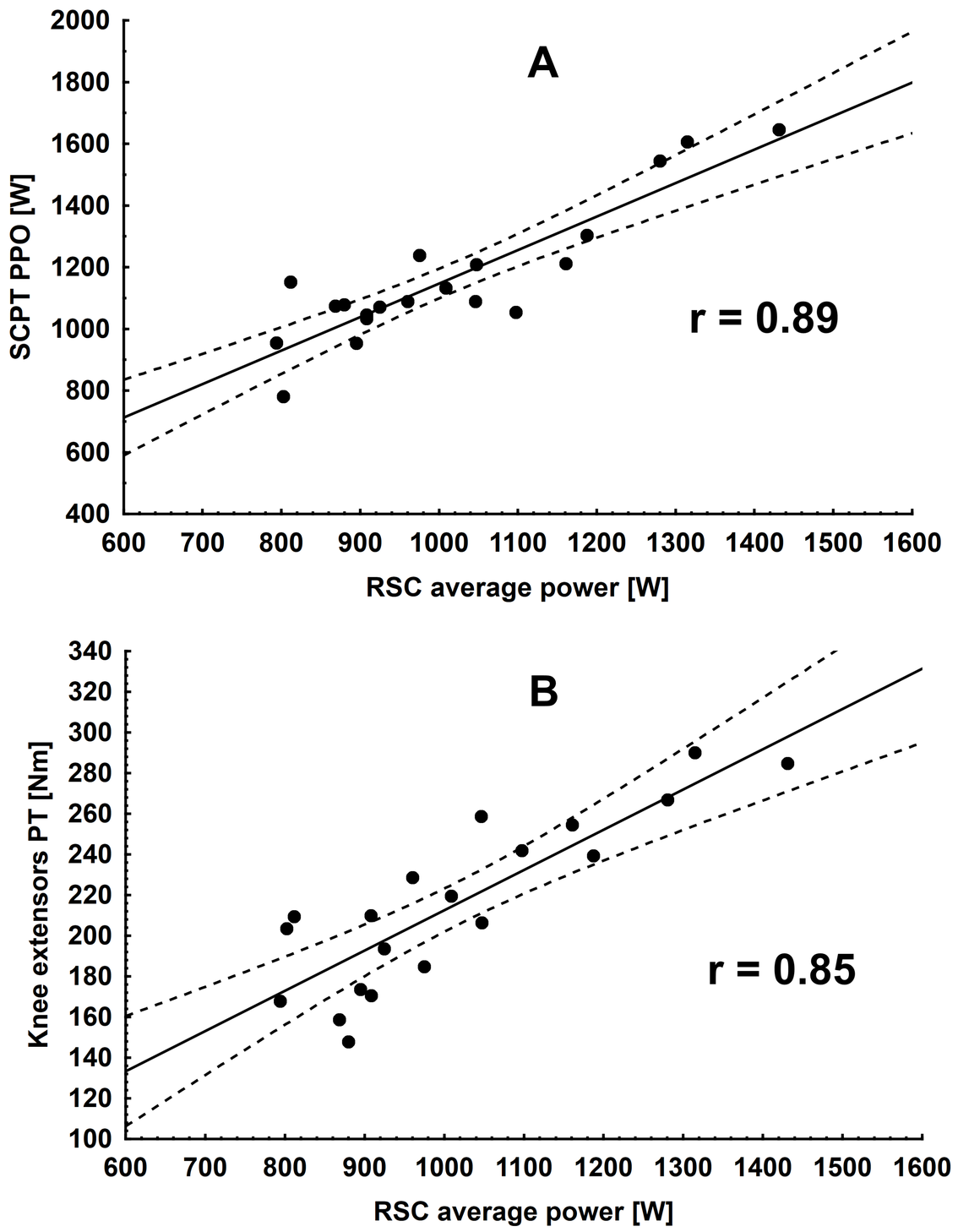

Figure 1. Pearson's correlation coefficient between average power in the RSC and peak power output (PPO) from SCPT (A) and knee extensors peak torque (PT) (B).

CONCLUSIONS

- These findings suggest that the performance in repeated sprint cycling is strongly related with different strength and power indices of lower limbs.
- Moreover, in order to improve the repeated sprint cycling ability amateur cyclists should include in their training program exercises which stimulate the peak power output in the single sprint and strength of knee flexors and extensor.

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