

論文の欧文要旨

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(Title)

A biomechanical study on the bicycle pedaling skill.

(Abstract)

The pedaling exercise is widely used in various research fields, including physical fitness evaluation. Studies have utilized the mechanical crank power ($P_{\text{Mechanical}}$) to quantify the power exerted by the rider. However, it cannot accurately reflect the power exerted by the rider, potentially leading to the misunderstanding of the data analysis and evaluation. Additionally, even a minor variation in the pedaling skill reportedly influences the crank power and physiological variables. While emphasizing the pulling of the lower limb during the pulling phase of the pedaling cycle has been shown to improve the mechanical efficiency and not the physiological efficiency, the overall pedaling skill and its effect throughout a crank pedaling cycle remains unknown. Hence, this study aimed to examine the pedaling skill from a biomechanical perspective to accurately estimate physical fitness and provide insight into analytical methods that take the pedaling skill into account.

The summary of the results was as follows. First, the endurance capacity indices were determined using $P_{\text{Mechanical}}$ and P_{Net} (sum of the positive power of both side cranks). P_{Net} values were higher than those of $P_{\text{Mechanical}}$. Furthermore, the relative difference between these indices (termed P_{Excess}) varied between participants, implying that the P_{Excess} , which is an indirect indicator of negative crank power, may be related to the pedaling skill. Second, the skillful pedaling exercise were reflected in the behavior of the hip extension and knee flexion moments during the pushing phase. This suggests that the production of these moments during pushing is important in improving the pedaling skill. Third, the pedaling skill can be evaluated by measuring the ability to perform steady-state pedaling at a supramaximal cadence.

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In conclusion, the $P_{\text{Mechanical}}$ may underestimate the power exerted by a rider, and the relative difference could be related to the pedaling skill. Additionally, cyclists with better pedaling skills show characteristic moments at the hip and knee joints during the pushing phase. Moreover, the pedaling skill can be estimated by measuring the highest cadence possible for performing pedaling in the steady-state, which is an effective longitudinal evaluation method of the pedaling skill.