Does the dynamic strength index, tethering force, and anaerobic critical velocity significantly influence front crawl and butterfly swimming performance?

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Summary

Evaluating and predicting the interaction of biomechanical and physiological variables to swimming performance is puzzling [1] since it can vary between swimming events [2]. This study presents a comprehensive approach, exploring the relationships between upper and lower limbs dynamic strength index, tethering force, and anaerobic critical velocity with front crawl and butterfly sprint swimming performance. Here the importance of targeted strength and conditioning programs focusing on explosive power and anaerobic capacity are underscored to enhance short-distance and high-intensity swimming events performances.

Introduction

A multivariate analysis approach in swimming performance can help to examine the complex interplay between multiple biomechanical and physiological factors, allowing to better understand how different variables contribute to sprint swimming success[3]. Particularly, analyzing neuromuscular performance using upper and lower dynamic strength index (DSI), tethered force and anaerobic critical velocity (AnCV) together could provide a comprehensive evaluation of an age-group swimmers' ability to generate speed in 50 m maximum exertion front crawl and butterfly events.

Methods

Fourteen regional age-group swimmers (age: 13.3 ± 0.1 years; height: 1.67 ± 0.1 m; mass 56.0 ± 9.4 kg; maturity offset: -1.82 ± 0.8 years; and 420 ± 88 *vs.* 388 ± 84 of front crawl and butterfly World Aquatics points) performed countermovement jumps and isometric mid-thigh pull (IMTP), as well as ballistic push-up and isometric grip strength, to determine lower and upper extremities DSI from K-deltas dual force platforms (Kinvent Physio, Montpellier, France) [4]. The 30 s tethered swimming test was employed to ascertain the mean force at each 10 s interval and the fatigue index (Swimforce V1.0.0, Germany). AnCV was obtained from 10, 15, and 25 m front crawl and butterfly distances at maximal intensities [5]. Additionally, 50 m front crawl and butterfly bouts were conducted to assess swimming performance (v) and stroke rate, stroke length and stroke index.

Results and Discussion

The association between the studied variables and front crawl and butterfly swimming performance are presented in Figure 1. A very large to nearly perfect positive correlation with AnCV, SI and 10-30 s mean force was observed in front crawl ($p<0.001$), while AnCV, SR and 10-30 s mean force ($p<0.01$) were the highest correlated variables with butterfly performance. The upper limbs DSI has a moderate negative correlation with swimming performance in both techniques ($p < 0.05$).

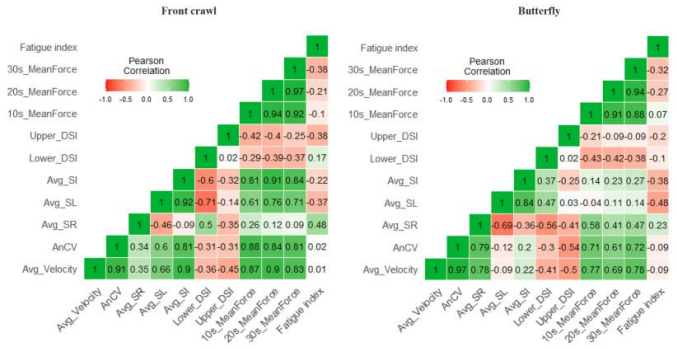

Figure 1. Correlation values among the upper and lower limbs DSI, tethering force, and AnCV with front crawl and butterfly sprint performance.

Conclusions

Data suggest that coaches should focus on implementing strength and conditioning programs aiming at developing explosive power and anaerobic capacity to enhance age-group sprint swimming performance. It seems to be important to balance anaerobic capacity, stroke efficiency and neuromuscular performance (especially the strength and power of the upper limbs) for optimal 50 m front crawl and butterfly swimming performance in a cohort of regional-level early adolescent swimmers.

References

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