THE RELATIONSHIP AMONG VERTICAL JUMP HEIGHT, SPRINT TIME, AND FATIGUE INDEX IN COLLEGE STUDENTS

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Introduction

Peak anaerobic power and anaerobic capacity are both important parameters in sports, especially those requiring short duration maximal efforts (5). Previous researchers have found a significant relationship between the vertical jump and sprint performance (3). However, there is limited research on the relationship between peak anaerobic performance and resistance to fatigue. The onset of fatigue can make muscles resistant to stretch and negatively influence force production (2), which may negatively impact anaerobic performance. As such, understanding the relationship between peak anaerobic power and anaerobic capacity may be beneficial to athletes.

Purpose

The purpose of this study was to compare peak jumping and sprinting performance to fatigue index (FI) during the running-based anaerobic sprint test (RAST).

Methods and Materials

- Eighteen apparently healthy, active college-aged males and females (X ± SD; age = 20.7 ± 1.1 yrs, height = 171.4 ± 7.8 cm, mass = 70.3 ± 15.4 kg) participated in this study.
- Participants completed three maximal countermovement jumps (CMJs) interspersed with 30-60 sec of rest.
- Reach and peak jump heights were measured with a Vertec with jump height (JH) calculated as the difference between standing reach height and peak jump reach height.
- A Tendo Weightlifting Analyzer recorded peak concentric jumping power (PPJ), velocity (PVJ), and force (PFJ) during the jumps. The Tendo was attached to the back of a vest in a position just superior to the waist. The jump with the greatest JH was used for analysis.
- Participants then completed the RAST, which involves 6 maximal 35-meter sprints with 10 seconds of recovery. Sprint time was used to calculate mean velocity (MVS), force (MFS), and power (MPS) for all sprints, with the fastest sprint used for analysis.
- FI was calculated as (max sprint power – minimum sprint power)/ total sprint time.
- Pearson product-moment correlations assessed the relationship between peak jump and sprint measures and FI ($p < 0.05$).

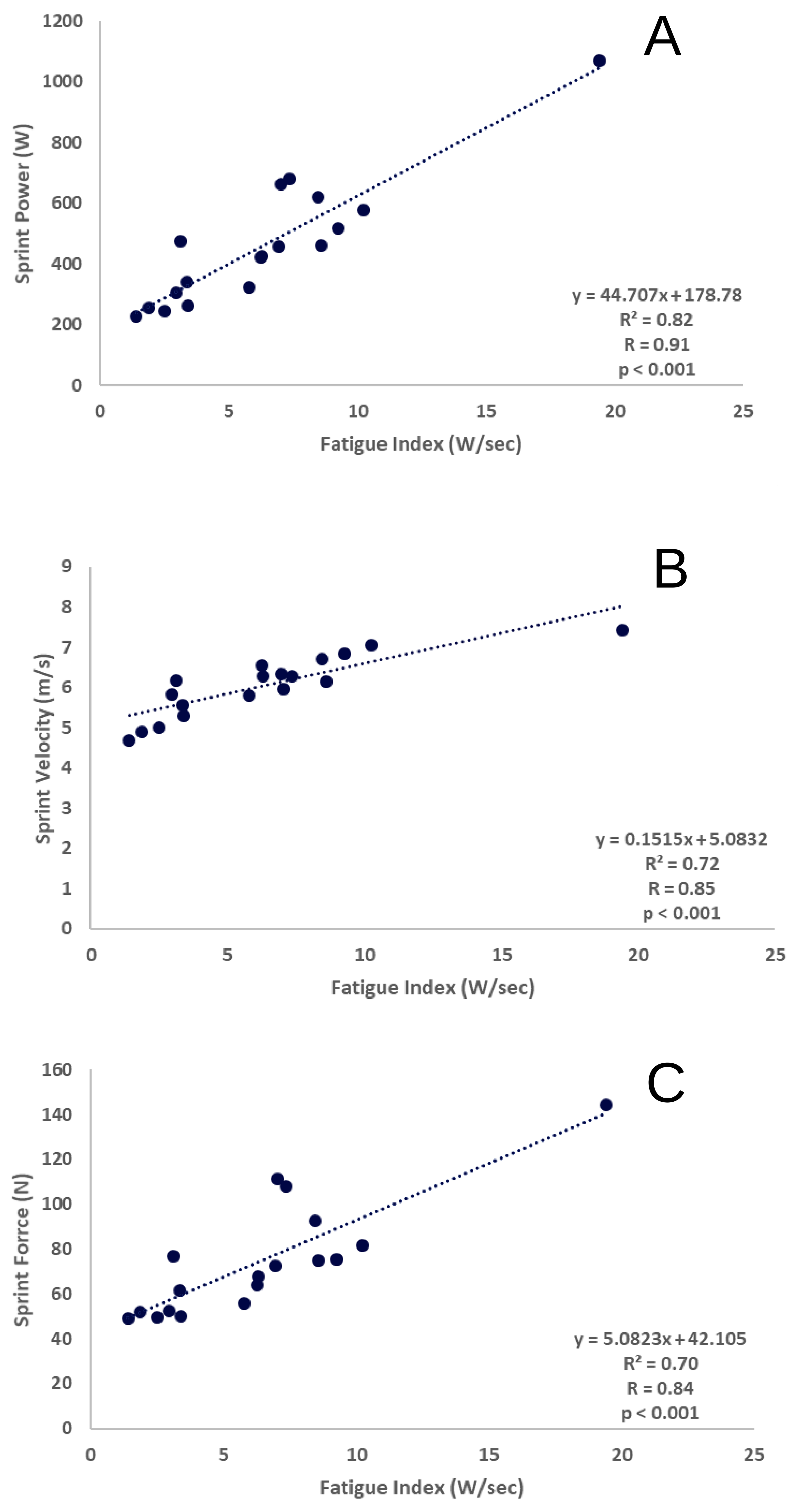

Figure 1. Scatterplots with linear lines of best fit, linear regression equations, r^2 values, and r values for fatigue index vs. sprint power (A), fatigue index vs. sprint velocity (B), and fatigue index vs. sprint force (C).

Results

- Strong linear relationships were noted between FI and the following sprint variables:
  - **FI and MPS ($r = 0.91$, $p < 0.001$)**
  - **FI and MVS ($r = 0.85$, $p < 0.001$)**
  - **FI and MFS ($r = 0.84$, $p < 0.001$)**
- Moderate correlations were found between FI and the following peak CMJ variables:
  - **FI and PVJ ($r = 0.54$, $p = 0.02$)**
  - **FI and JH ($r = 0.50$, $p = 0.036$)**
- Modest correlations were found between FI and PPJ ($r = 0.45$, $p = 0.062$) and FI and PFJ ($r = 0.32$, $p = 0.19$).
- **Body mass (BM) was not a significant predictor of FI ($r = 0.24$, $p = 0.34$).**

Conclusion

Participants with greater sprint force, velocity, and power also fatigued to a greater degree during the RAST. In addition, those with greater CMJ performance also fatigued to a greater extent. These findings of this study indicate that greater peak anaerobic performance and a greater rate of fatigue are positively correlated. However, previous research has shown peak power is strongly related to fatigue resistance (4). The recreational training status of our participants may have contributed to this discrepancy. Furthermore, the finding that BM is not related to fatigue is in contrast to previous work, with greater fat mass being associated with greater fatigue (1). Future work should compare body composition to fatigue index.

Practical Application

In the current study, participants with greater sprint force, velocity, and power as well as those with greater CMJ velocity and JH had a higher degree of fatigue during the RAST. BM did not appear to influence rate of fatigue. Therefore, greater peak anaerobic performance did not predict resistance to fatigue as they appear to be positively correlated. Training status and subject heterogeneity may have contributed to these data.

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