Individual deceleration-speed profile in-situ: A proof of concept in professional rugby union players

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Résumé

Introduction: Deceleration can be mechanically defined as "the decreasing velocity with respect to time" (Winter et al., 2016). In team sports, deceleration events often occur during intense game situations such as defensive transitions, sudden stops before contact, or rapid changes of direction (Dalen et al., 2016; Harper & Kiely, 2018). Testing deceleration is possible using specific tests like the Horizontal Deceleration Ability, but these require isolated efforts, and the movement assessed is not specific to rugby union tasks (Dos Santos et al., 2019). While specific laboratory-based tests do exist to assess deceleration capacity, typically involving force plates or motion capture systems, they are resource-intensive, time-consuming, and not easily applicable in real training (Harper et al., 2021). **Method:** This proof-of-concept short communication presents a method to derive player's individual deceleration-speed profiles (DSP) in situ, i.e., from global positioning system (GPS) data collected over several rugby sessions. Briefly, raw speed data collected from 30 professional male rugby union players during multiple training sessions were plotted. For each 0.2 m/s increment in speed, starting at 3 m/s and up to each player's top speed, the maximal deceleration output was retained to generate a linear DS profile. **Results:** The main finding of this study is that all individual DS profiles displayed strong linear trends (mean $R^2 > 0.80$), confirming that in-situ deceleration profiling is feasible using passively collected GPS data. This supports the concept that athletes consistently produce their highest deceleration efforts relative to running speed, and that this relationship remains stable across sessions. Descriptive statistics and reliability analyses reinforced the model's robustness. No significant effect of time was observed, indicating the absence of systematic bias across repeated measures. Relative reliability was excellent for theoretical maximal speed (S0; ICC = 0.95), and high for maximal deceleration capacity (D0), DSslope, and R^2 (ICC = 0.76–0.89), suggesting strong test-retest reliability. In terms of absolute reliability, S and R^2 were associated with SEM < 5% (2.6% and 4.9%, respectively), indicating excellent measurement precision. SEM values for D and DSslope ranged between 5.3% and 6.3%, which remains acceptable for field-based assessments. **Discussion:** These findings have relevant practical implications. High-intensity decelerations impose substantial mechanical and metabolic loads, particularly eccentric muscle stress, which can elevate injury risk and impact recovery. Therefore,

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tracking individual DS profiles may help practitioners tailor neuromuscular load, optimize training loads, and monitor fatigue or readiness. Additionally, deviations from an athlete's typical profile could flag early signs of maladaptation or potential injury risk, making DS profiling a valuable component of return-to-play decisions. Another key advantage of this approach is its alignment with the principle of "invisible monitoring." Instead of relying on dedicated and potentially fatiguing tests, practitioners can extract meaningful data directly from sport-specific efforts performed in training contexts. **Conclusion:** In rugby union, where movement demands are complex and not purely linear, this method enhances ecological validity while reducing the burden of testing. It allows for frequent and non-intrusive performance assessments without disrupting the training cycle. Future research should aim to investigate the sensitivity of DS profiles to physical status changes over time, including fatigue or injury recovery.

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