

Open Letter to the Editor: “Playerload™ and accelerometer based metrics: scientific evaluation and implications for athlete monitoring”

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**Open Letter to the Editor:
“Playerload™ and accelerometer
based metrics: scientific
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athlete monitoring”**

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This article is an open letter to the Editor of *Frontiers in Sport and Active Living*. This journal does not accept Letters to the Editor, so the authors of this letter decided to post this as a pre-print to enable this discussion to be published in an accessible way and to rebut a range of inaccurate statements and claims made in an article recently published in that journal.

To the Editor of *Frontiers in Sport and Active Living*,

We read with interest the recent article from Staunton et al. (2026) detailing a critique of the use of the Catapult Playerload (PLd) variable in research and applied practice. The article provides a relevant and welcome review of the different accelerometry equations that are available, as well as outlining the very real issues with proprietary algorithms and opaque signal processing that are common to commercial accelerometers. In this it provides a timely update and expansion of the discussions from

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Bredt et al. (2020), further reminding users to be aware of the limitations that do exist with this equipment. Significant portions of the article, however, make inaccurate statements about the purpose of accelerometry measurements in sports performance and research, how these are interpreted, and which comparisons may be used to draw inferences about validity. The inaccuracies of the arguments made stem from an apparent misunderstanding of the training load construct and its components (Jeffries et al. 2021). The authors' argument rests on a logical fallacy of *Petitio Principii* (begging the question), in which the conclusion is embedded in the initial premise. Their claim that PLd is "invalid" because it lacks mechanical precision assumes that training load is strictly a Newtonian construct. This perspective is grounded in a mechanistic reductionism and has been previously rebutted (Impellizzeri et al. 2022): training load is the label assigned to a construct deliberately conceptualised and operationalised to quantify the amount of training performed by athletes, rather than a direct measure of mechanical forces.

The authors claim that *"An increase in PlayerLoad with greater movement does not inherently justify its use as a proxy for external intensity or training volume."* This statement cannot be justified as increased movement is, by definition, increased external training load. If that movement is done with greater intensity (i.e. more movement per unit of time) then this will be directly reflected in by increased PLd per minute ($\text{PLd}\cdot\text{min}^{-1}$) as a direct marker of external intensity. This is evidenced in the range of studies from multiple sports showing large to near perfect relationships between PLd variables and other measurements of external training load such as: time motion analysis of total movement time (Kirk, Atkins, and Hurst 2020); total running distance (Casamichana et al. 2013; Oliva-Lozano et al. 2023); running distance at low intensity (Maughan, MacFarlane, and Swinton 2021); number of sprints and sprint distance (Prudholme et al. 2023); number of jumps and changes of direction (Askow et al. 2023). None of these papers are cited by the authors who instead focus their discussion of validity predominantly on articles published in 2014 or earlier.

Of the PLd related studies that are referenced by the authors, none make the claim that a relationship between PLd and an internal training load measurement was evidence of PLd's validity. Indeed, several of the papers listed by Staunton and colleagues recommend that further studies exploring

PLd's validity would be required. As for the claim that it cannot be used as a proxy for training volume (i.e., the amount or duration of training completed) — we agree, but equally we know of no authors who have claimed that it could or should be used for this purpose. As such, based on the up-to-date literature on this topic, PLd does provide a direct measurement of external training load and external intensity, per its constitutional and operational definitions (Jeffries et al. 2021).

The authors also state that the lack of studies comparing PLd to “... *indirect calorimetry or whole-body energy expenditure*” also prevents PLd from being classified as valid. These variables are, however, either internal training load or internal training intensity measurements. Claiming that a comparison of PLd to calorimetry provides a marker of validity would be just as incorrect as comparing PLd to heart rate (HR) and claiming construct validity.

The authors point out that PLd and other measurable variables such as HR and ratings of perceived exertion (RPE) may increase or decrease independently of each other, with this indicating that PLd may therefore not be valid. This ignores that external training load variables (e.g. PLd) and internal training load variables (e.g., HR and RPE) *can* increase or decrease *independently*, because they are measures of two different constructs that are causally related (Jeffries et al. 2021). A person's internal training load can, and often should, display different responses to the same external training load, particularly when that external training load is expressed in absolute terms such as PLd, with this depending on multiple psycho-biological factors such as fatigue, changes in efficiency and/or economy, and sub-optimal hydration and/or macronutrient intake (Shushan et al. 2022). Indeed, a person showing decreased internal load for the same external load can be used as an indirect proxy for fitness and fatigue (Barnes and Kilding 2015). Similarly, the authors state that “...*when team sport athletes performed the same incremental running protocol to exhaustion, PlayerLoad values differed substantially between individuals*” and “...*athletes with different movement strategies ...may generate different PlayerLoad values despite performing identical work*”. Such inter-individual variability is to be expected precisely because of differences in limb stiffness, gait, movement economy, etc. Each of these are specific and measurable training effects in addition to being key determinants of performance (Barnes and Kilding 2015). Understanding these differences plays a key role in the

training-recovery-adaptation cycle, as well as prescribing individual training targets and needs. This is why monitoring both internal and external intensities/training loads is seen as an essential part of programming, so that adjustments can be made to external training load to enable the required internal training load (and therefore performance outcome) to be attained (Jeffries et al. 2021).

The authors discuss inherent 'noise' between units with the statements *"...identical activity measured using two devices placed at the same location but operating at a different sampling rate will produce PlayerLoad values that cannot be meaningfully compared."* and *"...its use across athletes is problematic due to individual differences in movement mechanics and sensor placements..."*. This has been highlighted previously in PLd related research, with independent guidelines being published for practitioners and researchers to ensure that the units are always worn in a tightly fitted, manufacturer provided harness, and that the same unit is used by the same athlete/participant across all sessions (McLean et al. 2018). Accordingly, following of these guidelines enables the noise between units to be accounted for and avoided as much as possible. Whilst it cannot be guaranteed that all practitioners/researchers follow these guidelines all the time, this is no reason to reject the use of the PLd variable itself.

In conclusion, the author's critiques of the proprietary algorithms that are central to the PLd family of variables are warranted and are absolutely worth reminding sport scientists about. The claims of PLd not being a valid marker of external training load/intensity are, however, unfounded. Much of the author's misgivings about the use of PLd are rebutted by the training process framework that comprehensively defines, describes and operationalises training load, its sub-dimensions and causally related components (Jeffries et al. 2021). The evidence as it exists strongly supports PLd being a valid and valuable marker of external training load/intensity when used under the recommended guidelines.

Contributions

Drafted and/or revised the article: CK, SM

Approved the submitted version for publication: CK, SM

REFERENCES

Askow, Andrew T., Will Jennings, Andrew R. Jagim, Jennifer B. Fields, Remington G. Beaudoin, Giuliano M. Sanchez, Jeremy E. Weeks, Jonathan M. Oliver, and Margaret T. Jones. 2023. 'Athlete External Load Measures Across a Competitive Season in High School Basketball'. *Journal of Strength & Conditioning Research* 37(11):2206–12. doi:10.1519/JSC.0000000000004552.

Barnes, Kyle, and Andrew Kilding. 2015. 'Running Economy: Measurement, Norms, and Determining Factors'. *Sports Medicine-Open* 1(1):1–15.

Bredt, Sarah da Glória Teles, Mauro Heleno Chagas, Gustavo Henrique Peixoto, Hans Joachim Menzel, and André Gustavo Pereira de Andrade. 2020. 'Understanding Player Load: Meanings and Limitations'. *Journal of Human Kinetics* 71(1):5–9.

Casamichana, David, Julen Castellano, Julio Calleja-Gonzalez, Jaime San Román, and Carlo Castagna. 2013. 'Relationship between Indicators of Training Load in Soccer Players'. *The Journal of Strength & Conditioning Research* 27(2):369–74.

Impellizzeri, Franco, Annie Jeffries, Asaf Weisman, Aaron Coutts, Alan McCall, Shaun McLaren, and Judd Kalkhoven. 2022. 'The "Training Load" Construct: Why It Is Appropriate and Scientific'. *Journal of Science and Medicine in Sport* 25(5):445–48.

Jeffries, Annie C., Samuele M. Marcora, Aaron J. Coutts, Lee Wallace, Alan McCall, and Franco Impellizzeri. 2021. 'Development of a Revised Conceptual Framework of Physical Training for Use in Research and Practice'. *Sports Medicine* 1–16.

Kirk, Christopher, Stephen Atkins, and Howard T. Hurst. 2020. 'The Pacing of Mixed Martial Arts Sparring Bouts: A Secondary Investigation with New Analyses of Previous Data to Support Accelerometry as a Potential Method of Monitoring Pacing'. *Human Movement* 21(4):88–96.

Maughan, Patrick C., Niall G. MacFarlane, and Paul A. Swinton. 2021. 'Relationship Between Subjective and External Training Load Variables in Youth Soccer Players'. *International Journal of Sports Physiology and Performance* 1(aop):1–7.

McLean, Blake D., Cloe Cummins, Greta Conlan, Grant Duthie, and Aaron J. Coutts. 2018. 'The Fit Matters: Influence of Accelerometer Fitting and Training Drill Demands on Load Measures in Rugby League Players'. *International Journal of Sports Physiology and Performance* 13(8):1083–89.

Oliva-Lozano, José M., Daniele Conte, Víctor Fortes, and José M. Muyor. 2023. 'Exploring the Use of Player Load in Elite Soccer Players'. *Sports Health: A Multidisciplinary Approach* 15(1):61–66. doi:10.1177/194173812111065768.

Prudholme, Dieanna C., Jared W. Coburn, Scott K. Lynn, and Robert G. Lockie. 2023. 'Relationships between Sprint, Acceleration, and Deceleration Metrics with Training Load in Division I Collegiate Women's Soccer Players'. *Journal of Human Kinetics* 85(1):53–62. doi:10.2478/hukin-2022-0109.

Shushan, Tzlil, Shaun J. McLaren, Martin Buchheit, Tannath J. Scott, Steve Barrett, and Ric Lovell. 2022. 'Submaximal Fitness Tests in Team Sports: A Theoretical Framework for Evaluating Physiological State'. *Sports Medicine* 52(11):2605–26. doi:10.1007/s40279-022-01712-0.

Staunton, Craig A., Peter Edholm, Bernardo N. Ide, Massimiliano Ditroilo, and Daniel Wundersitz. 2026. 'Playerload™ and Accelerometer-Based Metrics: Scientific Evaluation and Implications for Athlete Monitoring'. *Frontiers in Sports and Active Living* 7. doi:10.3389/fspor.2025.1710693.