



## Re: The Integration of Internal and External Training Load Metrics in Hurling – interpretation beyond a significant relationship required

by

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Dear Editor,

We write to you in regard to the recently published manuscript '*The Integration of Internal and External Training Load Metrics in Hurling*'. The authors, Malone, Doran, Akubat and Collins conducted a study to investigate whether the ratio between external and internal training load measures accrued during a hurling simulation protocol, related with measures of aerobic fitness established via laboratory based methods. Malone and colleagues were therefore considering the physiological response (i.e., internal load) to the specific stimulus. The authors should be commended on undertaking a study of this nature, which is applied and highly translational for the practitioner. Such an approach can help the practitioner to determine an athletes state of 'fitness', depending on their response to a given load (e.g., reduced internal load to an external load would suggest the athlete has become more efficient [or *fitter*]).

While the above appears a strength of the study, the relationships presented and the interpretation beyond statistical significance warrant further consideration, especially if this study can be useful for those in practice. For example, a positive relationship between external: internal load and markers of aerobic fitness appears logical, but our interpretation of the figures presented does not support this. We have added gridlines and arrows on the figures presented by Malone and colleagues (their Figure 1a and Figure 2a) to depict our concerns with their interpretation and recommendations for practice. Figure 1 presents the relationship between total distance (TD): iTRIMP and vOBLA. While a positive (significant;  $p = 0.003$ ) relationship is reported and discussed, we find it hard to see how practitioners can meaningfully and confidently use these data. Our scatter plot presented highlights the two players with the greatest TD: iTRIMP score (Figure 1; solid line) achieved onset of blood lactate accumulation (OBLA) at 12.0 km·hr<sup>-1</sup> (the second lowest in the squad) and approximately 15.8 km·hr<sup>-1</sup> (the highest in the squad). Similarly, the player with the lowest OBLA velocity (approximately 12.8 km·hr<sup>-1</sup>) had the same TD: iTRIMP score (Figure 1; broken line) as a player who achieved OBLA at approximately 15.0 km·hr<sup>-1</sup>.

Similarly, when interpreting data from Figure 2a presented by Malone and colleagues, from our Figure 2, players with a high-speed distance (HSD): iTRIMP of approximately 2.00, achieved OBLA at approximately 11.4 and 15.6 km·hr<sup>-1</sup> (our Figure 2; broken line), and players with similar vOBLA achieved HSD: iTRIMP of approximately 2.00 and 3.30. As such, despite the significant relationship ( $p = 0.039$ ) the application of these data to practice is limited, when practitioners are attempting to interpret individual

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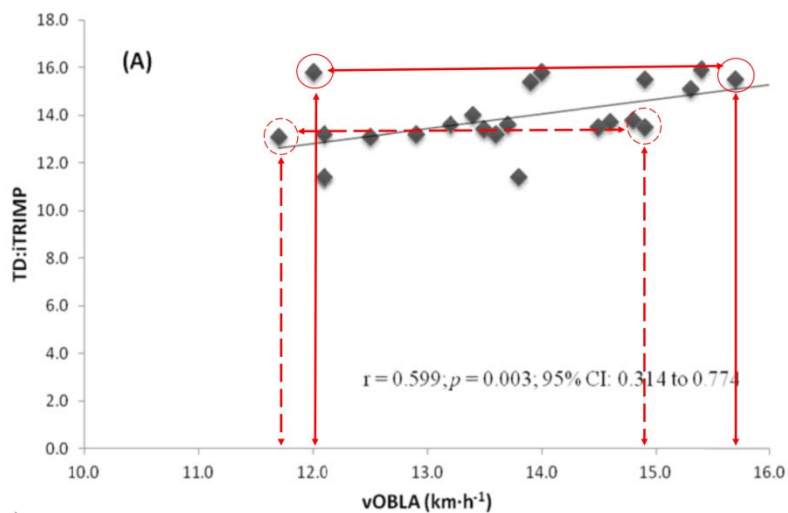
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responses within a team environment.

The lack of apparent relationships could be explained by a number of factors, including but not limited to, the possible incapability of training load ratios to appropriately scale at the lower and higher ends of the range (Atkinson and Batterham, 2012), the use of a global high-speed threshold for each player (underestimating the physiological cost for some players; Abt and Lovell, 2009), the likely insensitivity of 2 km·hr<sup>-1</sup> treadmill test increments to establish an individual's velocity at 2 and 4 mmol·L<sup>-1</sup> of blood lactate concentration and the questionable validity and reliability of 4 Hz global positioning devices to measure high-speed-distance. Another unconsidered limitation, both within the study design and subsequent analyses, is that the highly repeatable (Coefficient of Variation of 1.9%) hurling simulation resulted in a homogenous accumulation of total distance (7604 ± 510 m) and HSD (1623 ± 149 m). As such, it appears that the external load is effectively controlled for within the study design, and consequently, its use as an independent variable seems redundant.



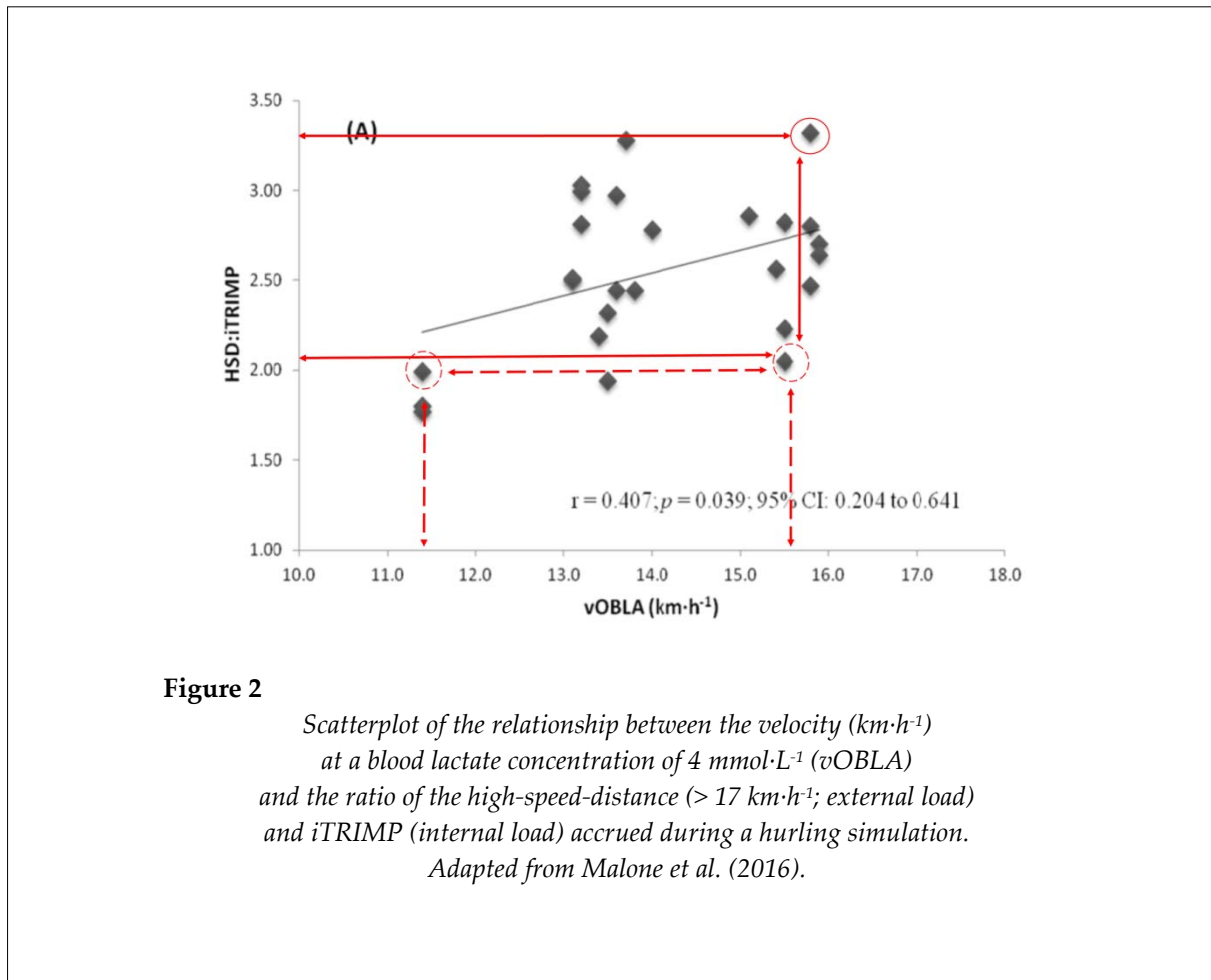
**Figure 1**

*Scatterplot of the relationship between the velocity (km·h<sup>-1</sup>) at a blood lactate concentration of 4 mmol·L<sup>-1</sup> (vOBLA) and the ratio of the total distance (external load) and iTRIMP (internal load) accrued during a hurling simulation.*

*Adapted from Malone et al. (2016).*

Therefore, the use of a correlation analysis could be inappropriate to answer this particular research question, as there is likely to be limited variance in  $y$  (i.e. external load), yet greater variability in  $x$  (i.e. fitness measures). As a result, the presence or lack of any relationships observed between the external load and 'fitness' is likely to be statistical artefacts, limiting appropriate inference. This subsequently impacts the relationships investigated between external: internal load ratios and 'fitness' due to the redundancy of the external load as an independent variable within this study design. As a result, the reported variance in 'fitness' is likely explained solely by the between-subject variance in the internal load (iTRIMP) only. Therefore, the research design fails to appropriately test the 'integration' of training loads. For the reasons stated, we believe that the evidence presented by Malone et al. does not support their conclusions. As such, further research is warranted surrounding the appropriateness of external: internal load ratios in team-

sports and we recommend that findings from the current study are interpreted with notable caution by practitioners.



## References

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