International Journal of Sports Physiology and Performance, 2020, 15, 600
https://doi.org/10.1123/ijspp.2019-0949

Human Kinetics
LETTER TO THE EDITOR

A Comment on "Does Mathematical Coupling Matter to the Acute to Chronic Workload Ratio? A Case Study From Elite Sport"

Lorenzo Lolli, Alan M. Batterham, Gregory MacMillan, Warren Gregson, and Greg Atkinson

In a recent article in this journal (the *International Journal of Sports Physiology and Performance*), Coyne et al[1] compared 2 different calculations of the acute-to-chronic workload ratio (ACWR) using a sample size of 17 basketball players and 28 weight lifters. The 2 different calculations were as follows:

- Coupled, whereby part of the calculation of chronic load (the denominator) involves the acute-load figure, which is also the numerator of the ratio
- Uncoupled, whereby the chronic-load denominator is mathematically distinct from the acute-load numerator, according to the concerns highlighted by Lolli et al[2]

We thank Coyne et al[1] for investigating the issue of coupled versus uncoupled ACWRs. Nevertheless, we wonder whether they have fallen foul of the analytical pitfall known as pseudoreplication.[3] It was this pitfall that encouraged Lolli et al[4] to adopt the correct within-subject correlation approach.[3,5,6]

Generally, the ACWR is calculated repeatedly from time-series data collected from each participant. This renders within-subject correlations as the important statistics, rather than between-subjects correlations[5] or, worse, a misleading melding of both within- and between-subjects correlations. It is a mistake to pool all such data within and across participants for the data analysis,[3,6] but, unfortunately, this is exactly what the figures presented by Coyne et al[1] indicate. There are literally hundreds of data points on the figures, which are supplemented by conventional Pearson correlation coefficients, despite there being fewer than 30 participants in each sample. This mismatch between sample size and the appropriate statistical model violates the assumption of independence of observations and leads to both biased and overly precise statistical estimates.[3]

More evidence for pseudoreplication in Coyne et al[1] comes from their R script. Using this R script, we reanalyzed our recently published data. Although Lolli et al[4] originally reported a trivial within-subject correlation of −.04 (95% confidence interval [CI], −.44 to .37), the approach used by Coyne et al[1] gives a correlation of .11 (95% CI, .04 to .19). Note that this latter correlation is biased by the pooling of within- and between-subjects data,[5] but it is also overprecise, illustrated by the spuriously narrow CI and spuriously inflated degrees of freedom of 663 players.[3,6]

A change in the ACWR is considered an exposure for injury risk on a within-subject basis. Therefore, all analyses should reflect accurately this within-subject basis.[6] It is an easy, yet potentially misleading, approach to pool data over time and then not model the within-subject nature of the data properly.[5,6] This pitfall seems to be present in the correlation coefficients for different calculations of the ACWR exposure reported by Coyne et al,[1] which leads us to wonder how prevalent pseudoreplication is in the analyses designed to quantify the prognostic value of the ACWR, or any relevant measure of load, for injury risk, given the within-subject nature of time-dependent observations as load data.[3]

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Lolli and Gregson are with the Football Exchange, Research Inst of Sport Sciences, Liverpool John Moores University, Liverpool, United Kingdom. Batterham, MacMillan, and Atkinson are with the School of Health and Life Sciences, Teesside University, Middlesbrough, United Kingdom. Lolli (lollilorenzo0@gmail.com) is corresponding author.