Sports Medicine

Variability in the study quality appraisals reported in systematic reviews on the acute:chronic workload ratio and injury risk

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Author Comments:	My co-authors and I would like this letter to the editor be considered for publication in Sports Medicine. We feel as though it highlights the important issue of study quality appraisal amongst the four systematic reviews now published on the acute chronic workload ratio, two of which have been published in Sports Medicine
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Variability in the study quality appraisals reported in systematic reviews on the acute:chronic workload ratio and injury risk

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We welcome the recent systematic review by Andrade et al. [1], who explored in a detailed manner the question of whether the acute:chronic workload ratio (ACWR) is associated with risk of time-loss injury in professional team sports. Including their paper, there are now at least four systematic reviews published on this topic over the last two years [1-4]. Despite this number of evidence syntheses, we would like to highlight the worrying degree of inconsistency in conclusions between these reviews. While there are some differences between reviews in the selected study population, we question whether it is heterogeneity in the various appraisals of study quality that best explains the inconsistency in conclusions.

In Table 1, we present information on studied population, study quality appraisal details and the overall conclusions (derived primarily from the abstract and discussion sections) for each systematic review. Although a somewhat basic metric, we attempted to convert all the study quality ratings into percentage ratings, knowing the minimum and maximum number of items that were reported for each rating tool. In some reviews, quality scores were already reported as percentages. It can be seen that there is large variability between the average and range of percentage quality ratings in each review. Nevertheless, it can be seen that the review in which the most “negative” conclusion was arrived at [4] is also associated with the lowest average percentage rating across the studies. However, we also highlight that the quality tool employed by Wang et al. [4] also contained the least

number of items. It is, however, striking how different the conclusions of Wang et al. [4] are, compared with those in the other reviews.

Quality ratings for individual studies were not reported by Maupin et al. [3]. Nevertheless, in Table 2, we present the individual study quality ratings for four studies that were included in the other systematic reviews. Again, the variability in study quality rating is striking, ranging from all items being realised (100%) for one study [5] in one systematic review [2] to a very low quality rating for the same study in another systematic review [4]. It is also unclear in most systematic reviews whether a threshold quality rating was arrived at in an *a priori* manner to inform whether a particular study should be included or not. *A priori* decisions like this have been reported to be paramount for rating the stability and strength of evidence in systematic reviews [6].

In one review [3], an overall rating of 'fair' changed to 'good' when items deemed not to be relevant were removed from the quality tool that had already been modified. It can be seen that different study quality rating tools were used, as well as modified, by the various reviewers. Although the Downs and Black tool used in two reviews [1, 3] is designed to appraise the quality of randomised or non-randomised studies, the tool was designed specifically for intervention studies [7]. It is, therefore, not surprising that this tool needed to be modified by the researchers to appraise the quality of the various studies. The studies that have been reviewed are more akin to observational cohort studies rather than intervention studies, although there is also a within-subject change aspect to the ACWR exposure. Assuming that simple ratio assumptions are satisfied, the relevant question is whether a *change* (within players over time) in the ACWR is a useful predictive exposure for injury risk [8]. Validated tools for observational study designs are available, e.g., the National Institutes of Health Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies [9]. We, therefore, suggest that a substantial source of variability that may have influenced the conclusions of some of the systematic reviews is the choice of the most appropriate study quality tool, and the amount and nature of modification that was deemed necessary to apply it to the relevant study designs.

The replication of study findings is an increasingly important issue in research. From the evidence syntheses on the ACWR that have been published over the last two years, the conclusions seem to range from the ACWR metric being “valuable” to having serious “limitations” in terms of association to future injury risk. We congratulate Andrade and colleagues for appraising, in such a comprehensive manner, study quality, although their choice of measurement tool (designed for intervention studies) meant that substantial modifications were needed – as was the case for another review [3]. While several factors can influence discordance between systematic reviews [10], we maintain that variability between reviews in study quality tools, and how they are modified and interpreted are fundamental issues that may explain the variability in review conclusions on this particular topic. To arrive at a consistent and appropriate rating tool and threshold for acceptable study quality, we encourage researchers to collaborate on this matter.

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Table 1. Summary of the study appraisals reported in the various systematic reviews on the topic of the ACWR and injury risk. For the "Primary Conclusion" column, we inserted the concluding statement of the abstract or discussion section in each review.

Systematic Review	Population	Number of Reviewed Studies	Study Quality Tool (scale range)	Mean (range) study quality rating	Mean (range) study quality Rating (%)	Reported summary of study quality	Primary conclusion
Griffin et al., 2019	Team sports	22	Modified Newcastle-Ottawa Scale for cohort studies (0-9)	7.5 (5-8)	84% (56-100)	The quality of 21 studies was classified as 'good' and one study was classified as 'fair'. The quality was generally described as being "very high"	"*The findings of this review support the use of the ACWR as a valuable tool for monitoring training load as part of a larger scale multifaceted monitoring system that includes other proven methods*"
Maupin et al., 2020	General Sports	27	Modified Downs and Black checklist for randomised/non-randomised intervention studies (0-28)	Not reported	60% (48-64) After further modification: 76%* (61-82)	The mean study quality was first reported to be 'fair'. When the quality appraisal tool was further modified* to remove items relating to intervention studies, the average study quality was then reported as 'good'.	*"The findings of this review support the association between the ACWR and non-contact injuries and its use as a valuable tool for monitoring training load as part of a larger scale multifaceted monitoring system that includes other proven methods."*
Andrade et al., 2020	Elite team sports	20	Modified Downs and Black checklist for randomised/non-randomised intervention studies (0-16)	11 (9–12)	68% (56-81)	"Major methodological concerns" were reported. The majority of studies lacked information about players transferring between teams, missing data, adjustment of confounders and sample size.	*"The majority of studies suggest that athletes are at greater risk of sustaining a time-loss injury when the ACWR is higher relative to a lower or moderate ACWR. The heterogeneous methodological approaches not only reflect the wide range of sports studied and the differing demands of these activities, but also limit the strength of recommendations."*
Wang et al., 2020	Elite male footballers	12	Modified Newcastle-Ottawa Scale for non-randomised studies (0-7)	2.5 (2-4)	36% (29-57)	All studies were deemed to be of "poor" quality.	"*These findings fall in line with the growing evidence demonstrating the limitations of ACWR as a metric for determining injury risk"*

Table 2. Study quality ratings (%) reported in the various systematic reviews for the four studies that were included in all reviews

	Delecroix et al. [5]	Jaspers et al. [11]	McCall et al. [12]	Malone et al. [13]
Griffin et al. [2]	100	89	89	78
Andrade et al. [1]	75	75	81	69
Wang et al. [4]	43	29	57	29
Maupin et al. [3]	Quality appraisal for individual studies not reported			

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Manuscript title: Variability in the study quality appraisals reported in systematic reviews on the acute:chronic workload ratio and injury risk

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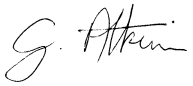
Signature (please **HAND-WRITE**): 

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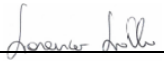
Signature (please **HAND-WRITE**): 

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