

# The Limitations of Systematic Reviews With Meta-Analyses in Sport Science

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In a previous editorial,<sup>1</sup> I (the first author) briefly introduced some limitations of systematic reviews with meta-analysis (SRwMs) based on my own experiences. For instance, the conclusions from an SRwM can change significantly after the inclusion or exclusion of a few studies. Moreover, the discussions in some SRwMs were perplexing. Some of the confounding interpretations might be attributed to the lack of experience of authors who could not profoundly elaborate on the factors and potential moderators behind the discrepancies between (apparently) similar studies. While these limitations may be overcome with more refined inclusion and exclusion criteria and the participation of more experienced authors during the elaboration of the SRwM, in this editorial we briefly elaborate how sport scientists and practitioners may embrace the results from systematic reviews.

It is generally argued that systematic reviews are necessary because of the possibility of some subjective bias in narrative reviews. Thus, SRwMs are considered the gold standard of scientific evidence. However, “all that glitters is not gold,”<sup>2</sup> as SRwMs are only as good as the articles they contain, not only from a risk-of-bias perspective<sup>2</sup> but also when considering the characteristics of the samples, protocols, and outcomes included. Generalizations may erroneously pretend to be a one-size-fits-all solution for complex biological phenomena. When considering the factors and potential moderators of training interventions and subsequent performance and physiological adaptations, a suite of population characteristics (eg, training background, age, sex), training-regimen characteristics (eg, exercise type and mode, loading, timing), testing protocols and selected outcomes (eg, exercise type, performance parameter, timing), and other contextual factors should be included. Consideration of all these factors is important for a better characterization of any (acute or chronic) training effect on an individual athlete basis, as previously exemplified for postactivation performance-enhancement strategies.<sup>3</sup> However, this approach is not always possible for most SRwMs and the included studies. This shortcoming means that any analysis from an SRwM may be limited because of the infinite combinations of all those potential factors and their moderators, which may result in suboptimal combinations.

The “best” randomized controlled trial with the “best” training protocol in the “best” setting may promote suboptimal adaptations simply because, for example, the nutritional status of the athletes was not appropriate, there was an excess of daily life stress, there were different eccentric-contraction velocities during stretch-shortening exercises, or because the athletes’ adaptations were not evaluated in a true rested state, among a myriad of possibilities. In this regard, it is noteworthy that many times the published studies are not describing all the potential moderators and contextual factors associated with the training interventions. Moreover, a universal classification of these factors is often impossible, partly related to conflicting terminologies. Therefore, there is a risk of bias when trying to elaborate on the moderators associated with the outcomes included in an SRwM. For this reason, we recommend that research teams and authors of SRwMs be composed of scientists and practitioners with different views and experiences to better identify those factors, thus minimizing the effect of any uncontrolled or unknown moderator on the outcomes. In this context, examination of the individual responses from studies, when reported, may also be informative, as the characteristics and contextual factors associated with individual responses may be better identified rather than just group responses that do not fully account for biological variability.

Another critical limitation of SRwMs in sport science is that we mostly deal with a very small (ie, <5%) influence or effect of any training strategy (ie, acute effect) or intervention (ie, chronic effect). For this reason, correct identification of the error of the outcome measures obtained with valid and specific evaluation protocols is mandatory. For instance, if we evaluate the influence of strength-training protocols on endurance performance, we should differentiate between time trials, distance trials, or incremental or ramp protocols with different profiles, durations, signal-to-noise ratios, and physiological determinants. However, this type of differentiation is frequently absent when defining the outcome measures in SRwMs, possibly to maximize the sample size. Inclusion of different outcome measures leads to heightened heterogeneity because of the incorporation of diverse error-contributing variables. The presence of such heterogeneity implies, in turn, the absence of a true single intervention effect but, rather, a spectrum of intervention effects included into a single artificial metric (ie, “endurance performance” in the previous example).


We consider that the conclusions from SRwMs may sometimes encourage practitioners to conduct inappropriate practices. This especially applies if they are not appropriately contextualized with a holistic perspective. The inclusion of studies with significant contradictory results in the same SRwM should be a red flag for

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authors and readers to look for the individual biological factors behind those discrepancies. The expected objectivity of SRwMs can be improved when adding the refined knowledge of true experts participating in the whole process. Meanwhile, use of different formats such as scoping reviews, living SRwMs, and umbrella reviews can be encouraged while keeping in mind that evidence in sport science should account for the inherently biological variability and complexity that are far away from the mechanistic relationships of any treatment or intervention in simplistic research paradigms. If you are willing to submit an SRwM to *IJSP*, please consider these reflections while following the *IJSP* Mission and Author Guidelines.

## References

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