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LETTER TO THE EDITOR / EDİTÖRE MEKTUP

Does Pre-Exercise Stretching Prevent Injuries?

Egzersiz Öncesi Germe Yaralanmaları Önler mi?

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Introduction

We recently read with interest the work "Effectiveness of active stretching during training for injury prevention and performance enhancement in sports: A systematic review and meta-analysis" and appreciate the authors' efforts and dedication [1]. However, we were surprised at the title as most of the manuscript did not focus on injury prevention. In fact, only one study included presented injury data [2]. Moreover, in this study there were no differences in injury rate after the 12-week intervention, only after a 40-week follow-up period where there is no information about what types of interventions (if any) the participants performed [2]. In addition, the conclusion from the meta-analysis opens with a sentence confirming pre-exercise stretching was demonstrated to be effective in decreasing injuries, despite having only included a single study with injury data. Furthermore, many of the references seem to be misrepresented. Our objective is to demonstrate the conclusions of this review are not supported by the data presented, as well as to identify additional relevant methodological flaws that undermine the interpretation of the dataset.

Injury risk was not actually assessed

Injury risk is typically assessed in the form of odds ratios, risk ratios, or similar measures [3-6], and was used in the largest review on stretching and injury risk to date [7]. Incidentally, the aforementioned review included 19 studies with injury data, unlike the single study included in Weerasinghe et al 2026 [1]. The methods reported for the meta-analysis only mention statistics for continuous/interval data, but not for event data and, as expected, no meta-analysis was performed for injury risk (given that only one study had relevant data). In addition, Table 1 from the results only reports "significant" results, representing a severe problem due to selective reporting. In research, all relevant results must be reported, regardless of significance [8-10]. Importantly, there are no actual injury outcomes in this table, despite this being a core tenet of the review and the first sentence of the conclusions focusing on injury risk.

The results do not present any meta-analysis regarding injury risk, and in the one study that was narratively presented on the topic [2], the description is very poor. For instance, what are "routine exercises", what is being compared, and how did the authors define "tight musc-

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les"? This is not addressed in the review. Moreover, if the conclusion applies only to individuals with "tight muscles" (notwithstanding its imprecise definition), then why did the authors generalize the conclusions to the population at large? In addition, the study compared stretching to "routine exercises". What are "routine exercises"? What precisely is stretching being compared to? Based on a single study reporting actual injury data (and without being clear what the comparator group was doing), the authors manage to somehow state that active stretching can reduce injury risk. This is indeed the first statement of the conclusions. Worryingly, the authors refer to this study after stating "among the significant outcomes" (1, p. 53), meaning it is possible that other studies included in the review had injury data but failed to reach significance. This suggests that the authors of this review may have performed selective reporting.

Problems with eligibility criteria and search strategy

Eligibility criteria and search strategy are two key methodological steps in any systematic review. If not performed well, they may negate the validity of the results entirely. In the authors' meta-analysis [1], many questions arise from the inclusion criteria: (**P**articipants) athletes had to be involved in competitive sports. Were all studies included indeed from competitive settings? This is not entirely clear. (**I**nterventions) The active stretching definition is never defined within the body of the paper, but the one provided by the authors in the abstract appears to be circular: "stretching techniques involving active muscle engagement by the individual, defined as stretching techniques involving voluntary muscle engagement by the individual, including both dynamic and active static stretching" (1, p. 47). Regardless, PNF has a very important active component. Why was it not considered, since the authors wanted to focus on the "active" modalities of stretching? (**O**utcomes) What do the authors mean by "injury-related outcomes"? Either collect/report direct injury data, or perhaps there should have been a refrain from any injury-related claims. Surrogate or proxy outcomes are often not consensual, are sample- and or sport-specific, and tend to be a very poor measure of actual risk injury. The phrasing of this specific eligibility criterion does not make it clear whether direct injury data had to be collected. Although the authors hint at that in the second part of the definition, the articulation with the first part leaves room for doubt.

Further methodological problems

The authors mention PRISMA, but they clearly did not appear to follow it. It is worth noting PRISMA has been discontinued, hence, the authors perhaps meant PRISMA 2020 [11]. Regardless, these guidelines were not followed. For example, the eligibility criteria must be defined prior to establishing the search strategy, not the reverse, as the eligibility criteria will likely determine the search strategy. There is no justification provided for limiting to between 2015 and 2024. Why exclude papers published before 2015? This raises a serious concern, as it disregards all the research performed prior, and provides a biased understanding of the topic.

Misrepresentation of references

Finally, the authors appear to make several misrepresentations of the published literature. For instance, Chaabene et al. 2019 did not report that active stretching alone reduces injury (it actually increased the risk) [12]. Costa et al. 2014 did not demonstrate dynamic stretching enhances performance; in fact, the authors reported precisely the opposite [13]. In Koźlenia et al. 2021, the authors imply a study revealed that a decrease in flexibility increased the risk of injury [14]. However, this study simply reported that low Functional Movement Screen (FMS) and sit-and-reach scores were associated with a higher injury risk [14]. The authors state that their findings on injury risk reduction align with those reported by Amako et al. 2003 [15]. However, if stretching interventions reduce muscle injury risk but no effect is found on overall injury risk, there may be relevant compromises. For example, in the aforementioned study, the stretching group had a smaller lower incidence for muscle/tendon injury, but similar total injury rate [15]. In that study, the stretching group had a higher incidence of bone injury, ligament injury, and joint injury [15]. Because the authors only considered

muscle and/or tendon injuries, one cannot conclude that stretching caused an overall reduction in injuries. More importantly, that study was not randomized [15]. Although the participants were randomly allocated to battalions, the companies within the battalions were then allocated to intervention or control in a non-random manner [15]. In fact, the authors of the meta-analysis point out that the rationale of injury reduction has not been fully explored, and it does not extend to other types of injuries, contradicting their own more general conclusion.

The authors of the meta-analysis cite Hadala et al. 2009 [16], and mentioned a stretching intervention reduced injuries in sailors. However, that trial also involved taping, physiotherapy, ice baths, kinesiotaping therapy, as well as core stability and balance exercises [16]. It is difficult to claim stretching alone led to injury reduction, especially without a control group for comparison. In addition, the authors cite Behm et al. 2016 [17]to state incorporating pre-exercise static stretching into warm-up routines may reduce injury risk. However, that particular systematic review reported pre-exercise static (and PNF) stretching alone had no clear effects on all-cause injury risk [17]. Furthermore, the authors state that "no studies explored its effects on injuries beyond musculotendinous strains, such as ligament tears or overuse injuries" (1, p. 55), which is untrue [15, 18-27].

In conclusion, we thank the authors for their work, but there are some concerns not only with the meta-analysis, but also the interpretations of references used. Nevertheless, we agree that more randomized controlled trials are needed to properly investigate whether pre-exercise stretching can indeed lead to overall injury reduction in competitive settings. The fact remains that the current review does not support a preventive role for stretching, despite the authors' claims in the conclusions.

Conflict of Interest / Çıkar Çatışması

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Author Contributions / Yazar Katkıları

Concept: PC; design: PC, JA, KW; supervision: PC; analysis and interpretation: PC, JA, KW; literature review: PC, JA, KW; drafting of the manuscript: PC, JA, KW; critical reviews: PC, JA, KW. All authors contributed to the final version of the manuscript and discussed the results and contributed to the final manuscript.

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