Stretching before exercise does not reduce the risk of local muscle injury: a critical review of the clinical and basic science literature

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Authors' objectives
To determine whether stretching immediately before exercise prevents injury.

Searching
MEDLINE was searched for articles published in either English or French using the following subject heading or textwords, either alone or in combination: 'stretch$', 'sprains and strains', 'strain', 'injur$', 'sport$', 'athlet$' and 'athletic injuries'. The bibliographies of identified studies were examined, and a citation search was performed on the bibliographies of pertinent articles. The full details of a second search of basic science research studies were presented.

Study selection
Study designs of evaluations included in the review
Controlled clinical trials were eligible, whereas clinical articles without a control group were excluded. Any articles discussing associated issues were also included.

Specific interventions included in the review
Stretching interventions were eligible. The actual interventions included half-time, pre-exercise and warm-up stretch. The cointerventions included leg guards, prophylactic ankle taping, controlled rehabilitation, information and supervision. More comprehensive details of the stretch interventions were not provided.

Participants included in the review
The inclusion criteria were not defined in terms of participants. The actual participants included elite male soccer players, high-school football teams, recreational cyclists, male recreational runners, habitual runners, community road race runners, elite women rowers, competitive runners, people buying running shoes, and 10 km race participants.

Outcomes assessed in the review
Assessments of injury rates were eligible. Actual injuries included quadriceps strain and groin or buttock conditions. The details of specific injuries were not provided for most of the studies.

How were decisions on the relevance of primary studies made?
The author does not state how the papers were selected for the review, or how many of the reviewers performed the selection. [A: The author included all studies with a control group]

Assessment of study quality
Validity was not formally assessed, although the author commented upon aspects of study design.

Data extraction
The author does not state how the data were extracted for the review, or how many of the reviewers performed the data extraction. The following information was reported in tabular format: author, sample size, characteristics of participants, study design and results.

Methods of synthesis
How were the studies combined?
The studies were grouped according to whether a positive, negative or equivocal result was reported, and were
combined in a narrative review. The relative risk or odds ratio were estimated for all prospective studies, and were presented separately for male and female participants where possible.

How were differences between studies investigated?
Differences between the odds ratio or relative risk of prospective studies were explored using a forest plot.

Results of the review
Twelve controlled studies were included: 3 randomised controlled trials (RCTs; 601 participants plus 5 football teams), 3 cohort studies (2,443 participants), and 6 cross-sectional surveys (3,469 participants).

The results were inconsistent. Overall, 4 studies suggested that stretching reduced injury rates and 8 studies reported no effect. Of the 3 RCTs, 2 suggested that stretching prevented injury whilst the remaining RCT reported no effect. Both RCTs reporting positive effects had methodological problems: stretching was part of a multiple component intervention in one RCT and risks of injury could not be calculated in the other positive RCT.

Prospective studies (6 studies): studies examining stretching as the sole intervention found no significant difference in injury rates. Statistical heterogeneity was shown in the forest plot.

Several methodological problems were evident. These included: lack of adequate description of intervention; multiple component interventions; lack of analysis; high rates of non-compliance; lack of control for previous injury and other factors; and cross-sectional study design. In addition, it was unclear whether people stretched before exercise before their injury, or as a result of the injury.

A summary was included of evidence from basic science literature on the pathophysiology of muscle injury.

Authors' conclusions
The basic science literature supports the epidemiologic evidence that stretching before exercise does not reduce the risk of injury.

CRD commentary
The aims were stated and the inclusion criteria were defined in terms of the study design, intervention and outcome. The literature search was limited to one database, and so other relevant studies may have been omitted, and there was no attempt to locate unpublished material, thus raising the possibility of publication bias. Details were given of the search strategy, although the methods used to select the studies were not described. [The author alone selected studies, assessed validity and extracted data]. Validity was not formally assessed but some aspects of study design were commented upon. Some relevant information on the primary studies was provided in tabular format, but the methods used to extract the data were not described. Given the heterogeneity among studies, a narrative review was appropriate. Statistical heterogeneity among prospective studies was illustrated using a forest plot. Studies were grouped according to outcome, and attention was not drawn to the better quality of evidence provided by the RCTs, compared with studies of less valid design. [A: Attention is drawn to the impossibility of evaluating stretching alone in studies employing multi-component interventions].

Given the considerable methodological flaws apparent in the primary studies and highlighted by the author, the evidence is too limited to make any comment on the effect of stretching upon injury rates.

Implications of the review for practice and research
Practice: The author states that current basic science and clinical evidence suggests that stretching before exercise is more likely to cause injury than to prevent it.

Research: The author states that more research is required into the long-term effects of stretching, whether stretching before or after exercise activity helps prevent injury, and the relative efficacy of beginning stretching versus strengthening exercises early in the rehabilitation period.
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Other publications of related interest

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This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.