

The Impact of Stretching on Sports–Injury Risk and Performance

Alison R. Snyder, PhD, ATC, and Tamara Valovich McLeod, PhD, ATC, CSCS • A.T. Still University
 Anna J. Hartman, MS, ATC, CSCS • Athletes’ Performance

STRETCHING IS OFTEN included in the prevention and rehabilitation of athletic injuries. A popular belief is that stretching decreases the risk of injury, or reinjury, while also improving performance. Research to date, however, has not provided any strong evidence supporting the effectiveness of stretching for these purposes.

Thacker et al.’s Review on Stretching and Sport–Injury Risk

A systematic review by Thacker et al.¹ addressed the question of whether or not stretching is an effective tool to decrease the risk of sports injuries and improve performance. The authors searched OVID version 2, MEDLINE (1966–2002), Current Contents (1997–2002), Biomedical Collection (1993–1999), Dissertation Abstracts through MDConsult, Cochrane Library, and SPORTDiscus databases without language limitations.¹ Search terms included *stretching*, *flexibility*, *injury*, and *sports injury*, and the terms *epidemiology* and *injury prevention* were used to limit the search. Additional articles and unpublished investigations were identified in the reference sections of the articles retrieved and from experts in the field,

respectively. Specific inclusion and exclusion criteria are presented in Figure 1 for the studies included in the meta-analysis.

Articles were screened by one author and reviewed independently by three other authors, who assessed the methodological quality of the selected studies via the use of a modified scoring system. Each study was awarded a quality score, ranging from 0 (*low*) to 100 (*high*), which allotted points for variables such as experimental design, data presentation, and statistical analysis.

A meta-analysis was performed on the six randomized controlled trials or cohort studies that included stretching as the intervention. Pooled odds ratios were calculated based on an intention-to-treat analysis, and both crude and adjusted odds ratios were determined. Sample size was used to weight the magnitude of treatment effect demonstrated by the individual studies. Subgroup analyses of quality score (low vs. high),

Study Inclusion Criterion	Study Exclusion Criteria
Stretching intervention	No control group.
	Stretching combined with other interventions.
	Participants did not take part in sporting or fitness activities.

Figure 1 Study inclusion and exclusion criteria for meta-analysis.

nature of intervention (single vs. multiple muscles stretched), and study design (randomized controlled trials vs. other) were performed, and a 95 % confidence interval was calculated for each subgroup. The Q statistic was used to determine heterogeneity.

The search identified 361 articles that addressed flexibility, injury-risk factors and prevention methods, alternative interventions to stretching, relationship of stretching to performance and injury prevention, and negative reactions to stretching and flexibility. Twenty-seven studies since 1962 have reported that stretching, regardless of method, increased flexibility in various joints of the body, including the knee, hip, trunk, shoulder, and ankle. Uncertainties regarding the most effective methods of stretching remain—some studies suggest that proprioceptive neuromuscular facilitation results in greater flexibility gains than other stretching techniques, but this finding is inconclusive. Passive stretches lasting 15–30 s improved flexibility as much as longer duration stretches and more than shorter duration stretches. There appears to be no difference between flexibility gains resulting from passive or active stretching, but both methods appear superior to dynamic stretching. Gains in flexibility typically remain for 6–90 min, although a more extensive stretching program might produce longer improvements. Some reports indicated that stretching and increased flexibility decreased grip strength, jump height, and running economy, but some indicated improved performance after stretching activities.

Combining warm-up and stretching exercise is effective in enhancing flexibility for up to 15 min, although there is no indication that, together, these activities will prevent injuries. There is, however, research indicating that the combination of stretching, warm-up, and strength and balance training might prevent injuries of the knee and ankle. A summary of 22 studies addressing the influence of warm-up on performance indicates that warm-ups consisting of vigorous stretching motions similar to the activity to be performed improve performance, although other passive methods of increasing body temperature increase performance, as does a positive attitude toward warm-up activities. Surveys and personal-report data show no relationship between stretching and injury, protection from injury, and risk of injury, and it remains unclear whether stretching before or after exercise limits pain postexercise. Research is also inconclusive as to whether joint laxity or tightness is

associated with injury, although it has suggested that injury risk increases with extreme flexibility or extreme inflexibility.

Of the six studies that involved controls and specifically addressed whether stretching prevents injury, it was determined, through pooled analysis of five of the articles, that stretching did not reduce injury incidence (Table 1). Further review of these articles also showed that there were no significant differences among homogeneous subgroups for quality score, nature of intervention, and study design (Table 1). Of the six studies, quality ranged from 26 to 65 out of 100. These data suggest that there is insufficient evidence to promote or discourage the use of stretching before or after exercise as a means of injury prevention in competitive and recreational athletes. Because of the paucity of literature regarding stretching and injury prevention, additional high-quality randomized controlled trials are necessary to determine the role, if any, of stretching in injury prevention, especially in athletes.

TABLE 1. POOLED ANALYSES OF FIVE STUDIES

Category	OR	95% CI	Outcome
Injury reduction	.93	0.78–1.11	Stretching did not reduce injury occurrence.
Quality score			No difference.
low quality	.88	0.67–1.15	
high quality	.97	0.77–1.22	
Nature of intervention			No difference.
specific muscles	.80	0.54–1.14	
multiple muscle groups	.96	0.71–1.28	
Study design			No difference.
RCT	1.00	0.81–1.25	
non-RCT	.81	0.61–1.09	

Note. OR = odds ratio, a way of comparing whether the probability of a certain event is the same for two groups; CI = confidence interval, the estimated range of values within which a particular population parameter is believed to fall, with a specific level of confidence; RCT = randomized controlled trial.