

## Pre-exercise stretching does not prevent lower limb running injuries.

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**CLINICAL SCENARIO:** Soft tissue running injuries are a common source of pain and disability among young adult runners. Injuries involving the lower limb can have a detrimental impact on the training schedule of runners and can reduce the overall level of sport performance. Traditionally, stretching has been performed as a component of a pre-exercise warm-up. Pre-exercise stretching may be effective in reducing the incidence of soft tissue injuries among runners. If this is the case, stretching should be widely and aggressively advocated for runners.

**CLINICAL QUESTION:**

Does pre-exercise stretching reduce the incidence of lower limb soft tissue injuries in young adult runners ( $\leq 35$  years old)?

**SUMMARY of Search, 'Best' Evidence' appraised, and Key Findings:**

Five studies were found meeting criteria for inclusion which examined the preventative effects of stretching on soft tissue injuries. Three prospective randomised controlled trials (RCT) were found that used military recruits as subjects. One study (Hartig et al.) found an overall reduction in incidence of lower limb injuries among army recruits who performed hamstring stretches. Two RCTs failed to find statistically significant results to indicate that stretching reduced injury risk. Two systematic reviews found that there was no overall evidence of significant protection against soft tissue injury from stretching exercises (this included exploratory analysis of the Hartig et al. study). No studies were found meeting inclusion criteria that examined competitive or recreational runners.

**CLINICAL BOTTOM LINE:**

Studies involving young, healthy, male military subjects have failed to demonstrate a preventative effect of pre-exercise stretching on lower limb soft tissue injuries. Future research involving recreational or competitive runners, female subjects, and longer follow-up to track injury recurrence are warranted to further examine the effects of stretching on injury prevention.

**Limitation of this CAT:** This summary of evidence has been prepared by a single reviewer and has not undergone the process of peer review.

**SEARCH STRATEGY:**

<b>Databases and sites searched</b>	<b>Search Terms</b>	<b>Limits used</b>
Cochrane Library EMBASE AMED PEDro	Running Soft-tissue injury Prevention Stretch	Years 1995-2005 English only Human
MEDLINE	Leg Injuries/pc Running/ij Soft Tissue Injuries/pc	Years 1995-2005 English only Human
CINAHL	Athletic Injuries/pc Running/ae Soft Tissue Injuries/pc Stretching	Years 1995-2005 English only

**INCLUSION and EXCLUSION CRITERIA**

**Inclusion:** Male or female runners  
 ≤35 years old, healthy  
 Studies published 1995-present, English only  
 Studies using number of soft tissue injuries as outcome  
 Studies that are randomized controlled trials, reviews, meta-analyses

**Exclusion:** Trials including changes to training schedules or use of splints/orthoses  
 Studies including bone injury in outcomes  
 Trials including subjects with pre-existing musculoskeletal injuries  
 Studies not found on-line or through Queen's or University of Western Ontario libraries

**RESULTS OF SEARCH**

A total of nine articles were found, five of which met the criteria set out above. These relevant studies were located and categorised as shown in Table 1 (based on Levels of Evidence, Centre for Evidence Based Medicine, 1998). Both systematic reviews were performed by Yeung & Yeung, with the Cochrane Review being a recently updated document comprised of their 2001 systematic review.

**Table 1:** Summary of Study Designs of Articles retrieved

<b>Level of Evidence</b>	<b>Study Design/ Methodology of Articles Retrieved</b>	<b>Number Located</b>	<b>Source(s)</b>
1a	Systematic Review of RCTs	2	MEDLINE, Cochrane Library, AMED, CINAHL
2b	Randomized controlled trials of lower methodological quality	3	MEDLINE, CINAHL, EMBASE

## BEST EVIDENCE

The following articles were identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting these papers were:

- Yeung & Yeung (2005): Level 1a evidence, Cochrane systematic review of RCTs (including previously published Level 1a review). This review included other trials identified while compiling this CAT and is an updated version of the authors' 2001 systematic review.
- Pope, Herbert, & Kirwan (2000): Highest quality RCT among those found. Not included in pooling of results in Cochrane review.

## SUMMARY OF BEST EVIDENCE

**Table 2:** Description and appraisal of RCT, Pope et al. 2000.

### **Purpose of the Study**

To determine the effect of pre-exercise stretching performed during warm-up on the risk of lower limb exercise-related injury

### **Intervention Investigated**

Performance of a single, supervised, self-administered stretch to each of the following muscle groups: hip flexor, hip adductor, quadriceps, hamstring, soleus, and gastrocnemius before basic training sessions. There were 735 recruits randomly assigned to the stretch group and 803 to the control group.

### **Outcome Measures**

Principle outcome measure was the incidence of lower limb injury. This was defined as an injury that prevented the subject from resuming full duties, free of signs or symptoms, within 3 days of onset. Injuries were classified by type (bony, soft tissue) and location by the blinded regimental medical officer, who assessed any injured subjects.

### **Results**

A total of 214 soft-tissue injuries were reported, 120 in the control group, 94 in the stretch group. Univariate Cox regression analysis demonstrated no significant effect of stretching on the risk of soft tissue injury. Hazard ratio was calculated as 0.83 with a 95% confidence interval of 0.63-1.09.

### **Authors' Conclusions**

Muscle stretching performed during pre-exercise warm-up does not produce clinically meaningful reductions in risk of exercise-related injury in army recruits.

### **Critical Appraisal:**

#### **Validity**

- Large sample size, random sampling, use of control group, and homogeneity of research subjects increase internal validity.
- Sampling procedure and training schedule/activities described in detail.
- Consistency of training, stretching supervision, and diagnosis improves validity.
- Use of male military subjects and intensity of military training reduces generalizability, especially as minimal demographic information was provided.
- Stretching regime of a single, 20-second stretch may not create a sufficient effect.
- Use of regression model eliminated a subject after an injury was reported, ignoring future injuries to different areas or recurrent injuries.
- Authors' analysis of 'hours needed to stretch' to reduce injury included training time of subjects who did not complete training (23% of recruits), possibly reducing the likelihood of developing overuse injuries.

#### **Importance of Results**

To determine stretching effect, the reviewer calculated a Relative Risk Reduction of 15.5% and an Absolute Risk Reduction of 2.8% (-1.3%-6.9% CI) for soft-tissue injuries. These calculations were based on an estimated 5% reduction in injury risk. This confirms the findings that stretching has a minimal/insignificant effect.

#### **Implications for Practice/ Applicability**

- Use of only male military subjects undergoing vigorous basic training reduces applicability to female runners, recreational athletes, or other runners with varying characteristics or training regimens.
- Exclusion of subjects after initial injury reduces applicability to runners with recurrent injuries or a history of lower-limb injury in different locations.

**Table 3:** Description and appraisal of SR, Yeung & Yeung, 2005.**Purpose of the Study**

To evaluate the evidence from randomized controlled trials on the prevention of lower limb soft tissue running injuries.

**Methods**

**Search Strategy:** An electronic database search of The Cochrane Library, MEDLINE, EMBASE, SPORT Discus, HERACLES, ATLANTES, BIOSIS, CINAHL, and SCISEARCH.

**Inclusion Criteria:** Any randomised or quasi-randomised trials evaluating interventions to prevent lower limb soft-tissue running injuries.

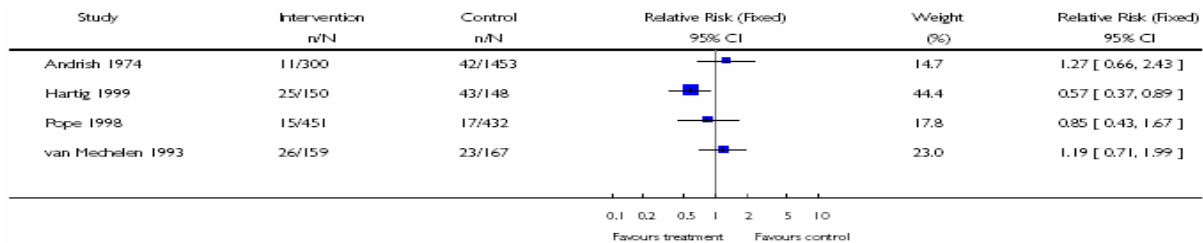
**Data Collection and Analysis:** Trials assessed by two reviewers independently. Data extracted independently by the two reviewers using a pre-derived data extraction form. Exploratory analyses, including pooling of results from groups of trials of similar designs were undertaken, using a fixed effects model. Results were reported as relative risks with 95 per cent confidence intervals.

**Outcome Measures**

Principle outcome sought was the reported incidence of injury (overall and by body location). Secondary outcomes included compliance with study intervention, severity of injury, and complications of interventions.

**Results**

Five trials exploring stretching were found which included 1944 participants in the intervention groups and 3159 controls. Pooling of results for four trials was possible.

**Authors' Conclusions**

There is insufficient evidence to determine the effectiveness of stretching exercises for major lower limb muscle groups in reducing lower limb soft-tissue running injuries.

**Critical Appraisal:****Validity**

- Focused clinical question addressed by appropriate study selection (RCT)
- Exhaustive systematic search and review process
- Use of two independent reviewers and pre-selected extraction form
- Large sample sizes among trials included
- All trials included male subjects only, four included military subjects only, improving homogeneity of subjects across trials, but reducing external validity.
- Trials found were of low to moderate quality, and utilized heterogenous methodology (muscles stretched, training regimen, definition of injury, outcome diagnosis).
- Trial characteristics did not allow for pooling and comparison of all results

**Importance of Results**

- Results did not favour the performance of pre-exercise stretching.
- Upper limits of confidence intervals of all but one study crossed the threshold favouring the control group.

**Implications for Practice/ Applicability**

- All trials involved young male subjects and four out of five involved military recruits.
- All subjects were young (17-35 y) and healthy, with no history of previous soft-tissue injury.
- Lack of demographic data in most studies makes generalization to other individuals difficult.
- Trials were of short duration, excluding the possibility that stretching may have long term effects on injury incidence or recurrence.
- Variability of training intensity, duration, running distance and stretching protocol make applicability to runners a challenge.

## REFERENCES

### Articles critically appraised:

1. Pope, R.P., Herbert, R.D., Kirwan, J.D., & Graham, B.J. (2000). A randomized trial of preexercise stretching for prevention of lower-limb injury. *Medicine & Science in Sports & Exercise*, 32, 271-277. (Level 2b)

2. Yeung, E.W. & Yeung, S.S.(2005). Interventions for preventing lower limb soft-tissue injuries in runners. *Cochrane Database of Systematic Reviews*, Issue 1, 2005. (Level 1a)

### Related Articles (not individually appraised)

#### *Level 1 Evidence*

Yeung, E.W. & Yeung, S.S.(2001). A systematic review of interventions to prevent lower limb soft tissue running injuries. *British Journal of Sports Medicine*,35,383-389.

#### *Level 2 Evidence*

Hartig, D.E. & Henderson, J.M. (1999) Increasing hamstring flexibility decreases lower extremity overuse injuries in military basic trainees. *American Journal of Sports Medicine*,27, 173-176.

Pope, R.P., Herbert, R.D., & Kirwan, J.D. (1998). Effects of ankle dorsiflexion range and pre-exercise calf muscle on injury risk in army recruits. *Australian Journal of Physiotherapy*,44,165-172.