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Stretching before or after exercise does not reduce delayed-onset muscle soreness

► **Herbert RD**, de Noronha M, Kamper SJ. Stretching to prevent or reduce muscle soreness after exercise *Cochrane Database Syst Rev* 2011;**7**:CD004577.

BACKGROUND

One reason for stretching before or after exercise is to reduce the risk of soreness after exercise.¹ Delayed-onset muscle soreness (DOMS) typically arises within the first day after exercise and peaks in intensity at around 48 h.² This review is an update of a Cochrane review first published in 2007.³ A large randomised trial (2377 participants) of both pre and postexercise stretching has been published since then.⁴

AIM

Our aim was to determine the effect of stretching before or after exercise on the development of postexercise muscle soreness.

SEARCHES AND INCLUSION CRITERIA

The methodology followed those recommended by the Cochrane Collaboration. Electronic databases (the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register, the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, CINAHL, SPORTDiscus and PEDro), the WHO clinical trials registry and reference lists were searched from the earliest dates until February 2010. The search terms consisted of variations of the terms 'stretch' or 'warm-up' combined with variations of the phrase 'muscle soreness' and the terms 'pain' or 'DOMS'. Studies could include participants of any age and sex but had to be a randomised or quasi-randomised trial of any pre or postexercise stretching technique designed to prevent DOMS. There was no restriction based on language studies or publication status.

INTERVENTIONS

Of the 12 included studies, all but two were carried out in laboratory settings and involved standardised exercise. Three studies examined the effect of stretching before exercise, seven studies investigated the effect of stretching after exercise and two investigated the effect of stretching both before and after exercise. The studies varied in the muscle group stretched (knee extensors, hamstrings, ankle plantar flexors, wrist extensors, elbow flexors or lower limb and trunk muscles) and the duration of the stretch (ranging from 40 s to 900 s). All but one of the studies examined the effects of static stretching; one study examined the effects of a ('hold-relax') proprioceptive neuromuscular facilitation (PNF) technique.

MAIN OUTCOME MEASURES

The main (and only) outcome measure was self-reported muscle soreness (pain). Pain data were typically reported on 100 mm visual analogue scales or 10-point scales. To facilitate pooling, data were converted to a common 100-point scale.

STATISTICAL METHODS

The effect of stretching was estimated from each study using the difference between mean pain levels in the stretching and comparison groups (mean difference). Effects of pre-exercise and postexercise stretching were initially estimated separately but, as there was no evidence of heterogeneity, they were combined in a secondary analysis. Post-hoc analyses were conducted to obtain separate estimates from laboratory-based studies and the two community-based studies and to obtain separate estimates from studies of static stretch and the one study that used PNF stretching.

RESULTS

The search retrieved 43 potentially eligible studies of which 12 were eligible for inclusion in the review. Two of these studies (including one study involving 2377 participants) were added to the previous version of the review. The overall quality of evidence was low to moderate.

The pooled estimates indicated that pre-exercise and postexercise stretching reduces soreness, on average, by one point on a 100-point scale at one day (mean difference (MD) -0.9, 95% CI -6.1 to 4.2; seven studies; figure 1), increases soreness by one point on a 100-point scale at 2 days (MD 1.0, 95% CI -4.1 to 6.2; seven studies) and has no effect on soreness at 3 days (MD -0.3; 95% CI -6.8 to 6.2; five studies). None of these findings were statistically significant. The only large study⁴ found that stretching reduced the intensity of the worst soreness experienced over a week by, on average, four points on a 100-point scale (MD -3.8; 95% CI -5.2 to -2.4). Although this result is statistically significant, the size of the treatment effect is small (ie, 3.8/100) and is unlikely to be clinically worthwhile. Hence, this review found that stretching pre or postexercise did not have important effects on muscle soreness.

LIMITATIONS/CONSIDERATIONS

The overall methodology of this review was sound. In this updated review, the addition of two new studies (including a very large one) did not change the conclusion that the available evidence from randomised studies indicates stretching does not

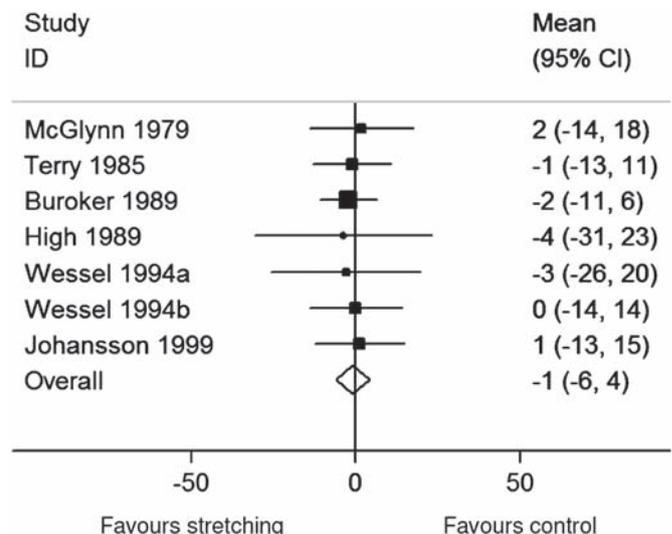


Figure 1 Effects of pre or postexercise stretching on pain intensity (/100) measured one day postexercise (re-drawn from Herbert RD, de Noronha M, Kamper SJ. *Cochrane Database Syst Rev* 2011;**7**:CD004577).

produce important reductions in muscle soreness in the days following exercise. The findings appear conclusive because when the results across 12 studies of 2597 participants were pooled together, the differences between stretching and no stretching were small, precise (ie, tight CI) and not clinically worthwhile.

The conclusions of the review are based on studies that rate poorly or moderately on conventional scales of study quality. Only one of the reviewed studies explicitly concealed allocation, none were blinded, few reported low rates of loss to follow-up and only one explicitly analysed by intention to treat. Nonetheless, there is a high degree of consistency in estimates of the effect of stretching, both across studies and across comparisons. Typically, these biases in randomised trials produce exaggerated intervention effects,⁵ yet, this review found consistent evidence of near-zero effects.

The best available evidence indicates that stretching does not reduce muscle soreness. These findings were consistent across settings (laboratory vs field studies), types and intensity of stretching, populations (athletic or untrained adults of both genders) and study quality. As such, they are unlikely to be changed by further studies.

CLINICAL IMPLICATIONS

The available evidence from randomised trials suggests that stretching before or after exercise does not produce important reductions in postexercise soreness in healthy adults.

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