Exercise-based intervention for prevention of sports injuries (PEDro synthesis)

BACKGROUND
Exercise-based intervention has been shown effective in treating and preventing many health conditions.1 Sporting activities are one way that people can engage in physical activity; however, injuries can be a negative consequence of engaging in sport.2 Along with providing a disincentive to participation, studies have shown high costs associated with the management of sports injuries.3 There is evidence, however, that specific injury prevention programmes can be accessible and are potentially effective for all kinds of athletes.1 In order to make recommendations regarding injury prevention, it is important to understand the effectiveness of different types of injury prevention programmes.1

AIM
The primary aim of this systematic review was to estimate the effectiveness of physical activity-based interventions for prevention of sports injuries in adults and/or adolescents. Second, to determine whether strength training, stretching, proprioception and combinations of these have different effects on injury prevention. The final aim was to determine whether effects are different for acute and overuse injuries.

SEARCHES AND INCLUSION CRITERIA
PubMed, EMBASE, Web of Science and SPORTDiscus were searched up to October 2012. Searches used words related to prevention, injury, specific injury diagnoses and sports. Randomised controlled trials (RCTs), reported in English and conducted in humans, with appropriate intervention and control arms were included. Exclusion criteria were specific pathology potentially responsible for injury, surrogate measures of injury, use of devices (kinesiotape, insoles, etc), sport that involved some type of transportation (bicycles, motor vehicles, skis, equestrian, etc) and inadequate follow-up. Studies included adolescents and/or adults of either gender involved in any organised sport.

INTERVENTIONS
Most interventions included strengthening programmes for the thigh and calf muscles (dynamic and eccentric training), and proprioceptive training (coordination, dynamic stabilisation and balance). Prevention programmes that included multiple exercises, such as core stability, plyometrics and stretching, in addition to strength and proprioceptive training were also included.

MAIN OUTCOMES
The primary outcomes were injuries that resulted from sports-related physical activity, defined as ‘any physical complaint sustained by a player from a match or training session’.4 Lower limb injuries were further classified as acute or overuse.

STATISTICAL METHODS
Meta-analyses were conducted using random-effects models. Many of the included studies were cluster RCTs, and clustering effects were calculated by the review authors or estimated if the primary studies did not report them. All analyses were adjusted for clustering effects. Stratified analyses were performed for type of programme (strength training, stretching, proprioception training) and outcome (acute vs overuse).

RESULTS
Estimated effects were based on 25 included studies with 26610 individuals and 3464 injuries. Thirteen studies were undertaken with adults, 11 with adolescents and one study included both. The control group interventions were usual warm-up, stretches or exercises for the upper body. The meta-analyses showed large and robust effects of the programmes on injury prevention; risk was reduced by close to 40% in the groups that undertook the prevention programmes. The effects were somewhat larger for strengthening programmes, although the difference in effects was not formally tested or assessed via meta-regression. Interventions that include combinations of exercises and those that include proprioceptive training alone appear similarly effective. Most strength training interventions involved exercises for the quadriceps/hamstrings and the gastrocnemius/soleus. Risk ratios for primary, secondary and subgroup analyses are summarised in table 1.

LIMITATIONS
There was substantial heterogeneity in effect estimates between studies, possibly due to different types of prevention programmes and populations. Some of the included studies in the systematic review did not conduct an intention-to-treat analysis, which can introduce bias and overestimation of the effect size. Effect sizes were generally larger in the smaller studies, which means that preventive effects of these programmes may not be as large as the pooled estimate when implemented on a large scale.
According with the results of this systematic review, physical activity-based programmes are highly effective in reducing sporting injuries. The effect sizes are large; these programmes can reduce injury risk by 35%–50% compared with stretching or usual warm-up. Programmes that include combinations of different types of exercises are more effective than proprioception training only. Strength exercises should include concentric/eccentric training of the thighs (hamstring and quadriceps) and gastrocnemius/soleus. Stretching exercises do not add any protective effect against sports injuries. Finally, both overuse and acute injuries could be reduced with preventive programmes.

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