This section features a recent systematic review that is indexed on PEDro, the Physiotherapy Evidence Database (http://www.pedro.org.au). PEDro is a free, web-based database of evidence relevant to physiotherapy.

Exercise-based programmes reduce sports injury in adolescents (PEDro synthesis)

▶ Rossler R, Donath L, Verhagen E, *et al*. Exercise-based injury prevention in child and adolescent sport: a systematic review and meta-analysis. *Sports Med* 2014;44:1733–48. http://dx.doi.org/10.1007/s40279-014–2

BACKGROUND

Participation in sport and other physical activity provides positive effects on children's and adolescents' physical and mental health, and these benefits track into adulthood.[1] However, injury during organised sport participation may result in reduced levels of engagement in physical activity.[2] The prevention of injury in sports is important to maximise the health benefits of sports participation.[3 4] Exercise-based interventions have historically been used for sports injury prevention; however, the effectiveness of these among children and adolescents is not known.

AIM

This systematic review and meta-analysis assessed the effectiveness of exercise-based injury prevention programmes for children and adolescents participating in organised sports.

SEARCHES AND INCLUSION CRITERIA

Studies published in English language were identified through searches of six databases, citation tracking, and hand searching of known review articles. Eligible studies were prospective, randomised controlled trials investigating effects of physical exercise programmes on the number of injuries in organised sports for athletes 18 years or younger. Randomised and non-randomised studies were included. Studies with combined injury data from organised and unorganised sports were excluded, as were studies investigating current injuries or samples with specific health problems.

MAIN OUTCOME MEASURES

The main outcome measure was the injury incidence rate (number of injuries divided by exposure) due to sport. This was expressed as a rate ratio (RR) that is, the rate in the intervention group divided by the rate in the control group.

STATISTICAL METHODS

The RR adjusted for clustering was used where reported. The reviewers extracted reported data, and calculated the RR for those studies where RR was not provided. Exposure was calculated as time period or number of matches or sessions. Meta-analyses were performed using a random effects model with the inverse-variance method in Review Manager Software: RevMan 5.1. Heterogeneity was described using the I^2 statistic.

RESULTS

Twenty-one studies were included with a total of 27 561 participants. The median of the average ages in the studies was 16.7 years (range 10.7–17.8). Interventions were single component and multicomponent programmes targeting any organised youth sport. Exercise-based interventions resulted in significant reductions in total injuries (RR 0.54, 95% CI 0.45 to 0.67, $p<0.001$, I^2 71%). Programmes targeting girls were more effective than those for boys (RR 0.44, 95% CI 0.28 to 0.68 vs RR 0.71, 95% CI 0.60 to 0.85; $p<0.05$), programmes including jumping or plyometric exercises had greater prevention effect (RR 0.45, 95% CI 0.35 to 0.57) than those without (RR 0.74, 95% CI 0.61 to 0.90, $p=0.003$) (table 1).

There were no differences in the effectiveness of programmes targeting particular injuries versus a global injury prevention focus, nor between studies of different sports, timing of programmes (preseason, or during season) or level of competition. Sensitivity analyses showed that inclusion of studies at high risk of bias (assessed with a 9-item tool based on the Cochrane Risk of Bias tool) did not influence the estimates of effectiveness.

LIMITATIONS/CONSIDERATIONS

Effectiveness estimates from the included studies were heterogeneous; this suggests that the effectiveness of these programmes may vary between different populations and according to the specific exercise protocol. The methodological quality of the included studies was moderate, but sensitivity analyses suggested that this may not have biased the findings; estimates from non-randomised studies were not different to those from randomised studies. Very few studies included youth aged <14 years and only 13% of participants across all studies were boys; this means that findings should be applied more cautiously to these populations. Effect estimates for different intervention approaches and population groups need to be interpreted with caution given the relatively small number of studies.

CLINICAL IMPLICATIONS

Exercise-based sports injury prevention programmes delivered to adolescents within routine training programmes can result in significant reduction in sports-related injuries. Importantly, the effect is large; the data suggest that delivering these interventions can

Table 1 Subgroup analyses

Comparison (number of studies)	Estimate (RR)	95% CI
Gender*		
Girls (10)	0.44	0.28 to 0.68
Boys (4)	0.71	0.60 to 0.85
Competition level		
Subelite athletes (15)	0.51	0.39 to 0.67
Elite athletes (4)	0.67	0.55 to 0.80
Activity type*		
Includes jumping/plyometric (13)	0.45	0.35 to 0.57
No jumping/plyometric (8)	0.74	0.61 to 0.90
Injury severity† (12)		
Minor injuries	0.75	0.63 to 0.88
Moderate injuries	0.58	0.44 to 0.78
Severe injuries	0.68	0.51 to 0.90
All injuries (10)	0.62	0.48 to 0.81
Injury location		
Lower extremity injuries (4)	0.57	0.44 to 0.72
Ankle injuries (2)	0.51	0.31 to 0.81

*Statistically significant difference.
†Injury severity based on absence from sport: minor, <1 week; moderate, 1–2/3/4 weeks; severe, >2/3/4 weeks.
RR, rate ratio.

halve injury risk. Preventive interventions can be delivered before and/or during the sporting season. It appears that including a plyometric component, as opposed to balance only, is important to maximise effectiveness but this requires further investigation.

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REFERENCES

1 Bielemann RM, Martinez-Mesa J, Gigante DP. Physical activity during life course and bone mass: a systematic review of methods and findings from cohort studies with young adults. *BMC Musculoskelet Disord* 2013;14:77.
2 Maffulli N, Longo UG, Gougoulias N, *et al*. Long-term health outcomes of youth sports injuries. *Br J Sports Med* 2010;44:21–5.
3 Emery CA. Risk factors for injury in child and adolescent sport: a systematic review of the literature. *Clin J Sport Med* 2003;13:256–68.
4 Caine D, Caine C, Maffulli N. Incidence and distribution of pediatric sport-related injuries. *Clin J Sport Med* 2006;16:500–13.