REVIEW

Can exercise improve self esteem in children and young people? A systematic review of randomised controlled trials

E Ekeland, F Heian, K B Hagen

A systematic review to determine if exercise alone or as part of a comprehensive intervention can improve self esteem in children and young people is described. Twenty three randomised controlled trials were analysed. A synthesis of several small, low quality trials indicates that exercise may have short term beneficial effects on self esteem in children and adolescents. However, high quality research on defined populations with adequate follow up is needed.

Between 10% and 20% of children and adolescents have psychological and behavioural problems and about 7% need psychological treatment. Resilience research has led to an increasing awareness of positive factors in the environment, social relations, and individuals that protect against the development of problems. Among individual qualities, self concept is one of the indicators given most attention. Self concept is defined as an “organised configuration of prescriptions of the self which are admissible to awareness”. The evaluative component of self concept used in this article, self esteem, is “the degree to which individuals feel positive about themselves”.

Systematic reviews indicate a positive effect of physical activity on depression, anxiety, and behavioural problems in children and adolescents. The effect of physical activity on self esteem in children has also been investigated. One meta-analysis concluded that directed play and/or physical education programmes contributed to the development of self esteem in elementary school age children. This and other reviews have not been updated and lack description of systematic search and quality assessment of the included studies.

The aim of this systematic review is to determine if exercise interventions can improve self esteem among children and young people.

METHOD

Searching

Searches were conducted in the Cochrane Controlled Trials Register (CENTRAL) (Issue 1, 2004), Medline (1966–2002), Embase (1982–2002), CINAHL (1982–2002), PsycINFO (1887–2002), and ERIC (1965–2002). The search terms were a wide range of terms about children and young people, physical activity, and self esteem. The complete search strategy is available in the original publication. The authors of included studies were contacted, and the Journal of the American Academy of Child and Adolescent Psychiatry was hand searched (1998–2002). There were no language restrictions.

Selection

Inclusion of studies was restricted to randomised controlled trials and “quasi-randomised” trials—that is, a study that uses methods of allocation that are subject to bias in assignment, such as alternative allocation, case record numbers, dates of birth—with children from 3 years of age to young people up to 20 years old. Trials with children and young people with psychotic or borderline conditions, autism, physical handicap, eating disorders, and chronic somatic/physical diseases were excluded. The interventions had to be gross motor, energetic activity with minimum duration four weeks.

Two reviewers judged independently whether the studies fulfilled the inclusion criteria. If there was uncertainty or disagreement, a third reviewer was consulted.

Validity assessment

Two reviewers independently assigned these five quality criteria to each selected study:

1. Concealment of allocation
2. Outcome assessment (assessor unaware of the assigned treatment when collecting outcome measures)
3. Co-intervention (interventions other than exercises avoided, or used similarly across comparison groups)
4. Losses to follow up
5. Intention to treat

Uncertainty or disagreement was resolved by discussion with the third reviewer. Studies were then grouped as studies with a low risk of bias (all criteria met), studies with a moderate risk of bias (three to four criteria met), and studies with a high risk of bias (fewer than three criteria met). As there is no clear evidence that some criteria are more important than others, they were given equal weight.

Data extraction and study characteristics

Each reviewer independently extracted data on population, age, baseline characteristics, characteristics of activity, compliance, and outcome measures. In cases of missing information, one author of the paper was contacted.

Abbreviations: SMD, standardised mean difference; CI, confidence interval
Quantitative data synthesis

Self esteem was measured with similar, but not identical, instruments across studies, and standardised mean differences (SMDs) and 95% confidence interval (CI) were calculated. The SMD expresses the size of the treatment effect in each trial relative to the variability observed in that trial. There was clinical heterogeneity between trials, with differences in study quality, the type or length of the intervention, and participant characteristics. Statistical heterogeneity was assessed using the $\chi^2$ test of heterogeneity along with a visual inspection of the graph. Such heterogeneity was identified. Overall effects were therefore calculated using a random effects model. When the primary studies provided several measures of self esteem, the overall self esteem score, often called global self esteem score in the papers, was used in the analysis. The effect sizes were translated back into clinically relevant values by using the 80 mm Piers-Harris children’s self-concept scale. On the basis of data from one of the included studies, we used standard deviation (SD) of 11 points for this calculation. To further enlighten the interpretation of the effect magnitude, we calculated the percentage difference between control and intervention groups by using the back translated Piers-Harris scores and post-treatment value in the control group as the basis.

To assess the robustness of conclusions as to quality of data and clinical heterogeneity, sensitivity analyses were performed according to levels of methodological quality, the type or length of the intervention, and participant characteristics. In the protocol we also specified age, sex, and compliance as potential important variables in the sensitivity analyses. However, because of limited information in the included studies, it was not possible to explore further the influence of these variables.

None of the included cluster randomised studies provided data on intra-cluster correlation and could therefore not be included in the meta-analyses. For these and other trials that did not provide sufficient data to calculate overall effects, a qualitative summary was provided.

RESULTS

Trial flow

We identified 7299 citations, retrieved 212 potentially relevant papers, and assessed 58 in detail (fig 1). In the end, 23 were included. The excluded studies were those not randomised, with short term interventions, no gross motor activity, or without self esteem as the outcome measure.

Study characteristics

The included studies involved 24–288 participants aged 3–19.8 years. The participants were healthy, had learning disabilities and/or emotional disturbances, low self image, gross motor problems, or were young offenders. Most of the interventions lasted for 4–20 weeks, but one study had an intervention period of nine months. The interventions included aerobic, strength training, skills training, and combinations of these (tables 1 and 2). Two of the included studies compared two different interventions versus control, and the analysis therefore includes 25 comparisons.

Outcomes were measured at the end of the interventions, and no further follow up results were given for any of the studies. There was variation in the quality of the studies (table 3), and only one study met all five methodological criteria.

Synthesis of quantitative data

From a clinical point of view, the context in which the physical activity was carried out may be of importance to the outcomes. We therefore differentiated between studies that focused on exercise only and studies explicitly focusing on skill training, counselling, the social setting, or other motivational factors as a part of the exercise intervention.

Exercise as a single intervention versus no intervention

This comparison included 13 studies (table 1) with eight in the meta-analysis (fig 2). The overall SMD was 0.49 (95% CI 0.16 to 0.81) in favour of the exercise intervention. This corresponds to a difference of 5.4 points on a 0–80 scale, or about a 10% difference between the intervention and the control group. The subtotals for the study with a low risk of bias showed a SMD of 1.33 (95% CI 0.43 to 2.23), which corresponds to a difference of 14.6 points on the same scale. The studies with a moderate risk of bias showed a non-significant SMD of 0.21 (95% CI −0.17 to 0.59), and the studies with a high risk of bias had a SMD of 0.57 (95% CI 0.11 to 1.04). Five studies in this comparison were not included in the meta-analysis. Hilyer and Mitchell reported a significant improvement (p<0.01) for those with a low self concept at baseline. One study with a moderate risk of bias reported a significant effect (p =
Exercise as a part of a comprehensive intervention versus no intervention

This group of interventions included 12 studies (table 2), with only four in the meta-analysis (fig 3). The results show an overall SMD of 0.51 (95% CI 0.15 to 0.88), which corresponds to a difference of 5.6 points on a 0–80 scale, or about a 10% difference between the intervention and the control group. Of the studies not included in the meta-analysis, the analyses were carried out by categorising studies into three quality levels. In addition, the studies are grouped into two main comparisons, one where the intervention focus was exercise only (13 studies) and one where the exercise was combined with skills training, counselling, or social aspects (12 studies).

Because of cluster randomisation or insufficient data to calculate effect sizes, meta-analysis could be carried out for 12 studies, eight that looked at exercise only and four where the exercise was combined with other aspects. Both of these meta-analyses show a small overall significant treatment effect, corresponding to a difference of 5.4 and 5.6 points on a 0–80 scale, or about a 10% difference between the intervention and the control group. Of the studies not included in the meta-analysis, seven showed a significant treatment effect and six did not.

DISCUSSION

The objective of this review was to determine if exercise interventions can improve self esteem in children and young people. The results, based on 25 comparisons with participants aged 3–20 years, indicate that exercise can improve self esteem. This compares well with the meta-analysis of Gruber.11

Only one of the included studies was assessed to have a low risk of bias, and eight were categorised as studies with a moderate risk of bias. The remaining 14 studies had a high risk of bias. With these different methodological weaknesses in the studies, the analyses were carried out by categorising studies into three quality levels. In addition, the studies are grouped into two main comparisons, one where the intervention focus was exercise only (13 studies) and one where the exercise was combined with skills training, counselling, or social aspects (12 studies).

Because of cluster randomisation or insufficient data to calculate effect sizes, meta-analysis could be carried out for only 12 studies, eight that looked at exercise only and four that looked at exercise combined with other aspects. Both of these meta-analyses show a small overall significant treatment effect, corresponding to a difference of 5.4 and 5.6 points on a 0–80 scale, or about a 10% difference between the intervention and the control group. Of the studies not included in the meta-analysis, seven showed a significant treatment effect and six did not.

Table 1 Characteristics of randomised controlled trials comparing exercise as a single intervention with no intervention

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Interventions</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpert 1990a</td>
<td>24 healthy boys and girls, aged 3–5 years</td>
<td>I: Aerobic classroom activity with music. HR 60–80%</td>
<td>30 min, 5 times a week for 8 weeks</td>
</tr>
<tr>
<td>Basile 1995c</td>
<td>53 boys and 5 girls from clinic (day treatment for emotionally and behaviourally disturbed children), aged 7–13 years</td>
<td>C: Outdoor play</td>
<td>20 min, 4 times a week for 4 weeks</td>
</tr>
<tr>
<td>Ford 1989c</td>
<td>97 healthy girls, mean age 19.8 years</td>
<td>1: Classroom activity</td>
<td>3 hours a week for 8 weeks</td>
</tr>
<tr>
<td>Herman-Toller 1998c</td>
<td>52 healthy 3rd grade students</td>
<td>1: Aerobics 60–85% VO2MAX</td>
<td>25 min, 3 times a week for 8 weeks</td>
</tr>
<tr>
<td>Hillyer 1997c</td>
<td>120 students, mean age 19.1 years</td>
<td>1: Running</td>
<td>60 min, 3 times a week for 10 weeks</td>
</tr>
<tr>
<td>MacMahon 1987c</td>
<td>54 children with learning disabilities but normal WISC-R, aged 7.1–12.75 years</td>
<td>1: Distance running, aerobic dance, and soccer, HR &gt;160</td>
<td>25 min, 5 times a week for 20 weeks</td>
</tr>
<tr>
<td>MacMahon 1988c</td>
<td>98 boys from juvenile detention facilities, aged 14–18 years</td>
<td>1: Long distance running and vigorous basketball, HR &gt;160</td>
<td>40 min, 3 times a week for 3 months</td>
</tr>
<tr>
<td>Marsh 1988c</td>
<td>137 girls, aged 11–14 years</td>
<td>1: Aerobics, competitive with individual training</td>
<td>35 min, 14 times during 6 weeks</td>
</tr>
<tr>
<td>Munson 1988</td>
<td>26 offenders from a security institution, mean age 17.2 years</td>
<td>1: Social volleyball game</td>
<td>1 hour a week for 10 weeks</td>
</tr>
<tr>
<td>Percy 1981</td>
<td>30 healthy fifth and sixth grade pupils</td>
<td>1: No intervention</td>
<td>1 hour a week for 10 weeks</td>
</tr>
<tr>
<td>Salokun 1994c</td>
<td>288 healthy young people, aged 12–18 years</td>
<td>1: Field hockey (96), sprint (32), discus (32), or long jump (32)</td>
<td>45 min, 3 times a week for 10 weeks</td>
</tr>
<tr>
<td>Smith 1984</td>
<td>32 healthy pupils, fourth and fifth grade</td>
<td>1: Progressive running</td>
<td>10 weeks</td>
</tr>
<tr>
<td>Tuckman 1986c</td>
<td>154 healthy pupils, fourth to sixth grades</td>
<td>1: Aerobics, competitive with individual training</td>
<td>30 min, 3 times a week for 12 weeks</td>
</tr>
</tbody>
</table>

I, Intervention; C, control; WISC-R, Wechsler intelligence scale for children-revised.

0.05), whereas one with moderate risk of bias,17 and two with high risk of bias17 24 reported no significant effect.

The sensitivity analysis showed that the effect size was not significant when the studies of healthy children were analysed separately. There were little or no differences when we analysed the results without the strength training studies or excluded the studies with interventions less than 10 weeks or with great baseline differences.
Table 2  Characteristics of randomised controlled trials comparing exercise as a part of a comprehensive intervention with no intervention

<table>
<thead>
<tr>
<th>Study</th>
<th>Participants</th>
<th>Interventions</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluechard 1994&lt;sup&gt;a&lt;/sup&gt;</td>
<td>45 pupils with learning disabilities but normal WISC-R, aged 8.3–10.5 years</td>
<td>I: Pool and gymnastic activities, promoting skills and developing social skills</td>
<td>90 min, twice a week for 10 weeks</td>
</tr>
<tr>
<td>Boyd 1997&lt;sup&gt;a&lt;/sup&gt;</td>
<td>181 healthy girls, aged 9–16 years</td>
<td>C: Assistance in deficient skills</td>
<td>40 min, 9 times for the youngest and 12 times for the older during 6 weeks</td>
</tr>
<tr>
<td>Bruya 1977&lt;sup&gt;a&lt;/sup&gt;</td>
<td>72 healthy pupils, aged 9–11 years</td>
<td>C: Regular PE classes</td>
<td>30 min, twice a week for 4 weeks</td>
</tr>
<tr>
<td>Elstein 1977&lt;sup&gt;a&lt;/sup&gt;</td>
<td>33 learning disabled children with normal IQ, aged 7–15 years</td>
<td>C: No training</td>
<td>50 min, twice a week for 9 months</td>
</tr>
<tr>
<td>Hilyer 1979&lt;sup&gt;a&lt;/sup&gt;</td>
<td>120 students, mean age 19.1 years</td>
<td>I: Running with counselling</td>
<td>60 min, 3 times a week for 10 weeks</td>
</tr>
<tr>
<td>Hilyer 1982&lt;sup&gt;a&lt;/sup&gt;</td>
<td>60 adjudicated boys from a state school, aged 15.5–18.6 years</td>
<td>C: Ordinary classes</td>
<td>90 min, 3 times a week for 20 weeks</td>
</tr>
<tr>
<td>Luebke 1977&lt;sup&gt;a&lt;/sup&gt;</td>
<td>50 healthy third grade pupils</td>
<td>C: Regular activity, team sport</td>
<td>30 min, twice a week for 13 weeks</td>
</tr>
<tr>
<td>Marsh 1988&lt;sup&gt;a&lt;/sup&gt;</td>
<td>137 girls, aged 11–14 years</td>
<td>C: No instruction</td>
<td>35 min, 14 times during 6 weeks</td>
</tr>
<tr>
<td>McGowan 1974&lt;sup&gt;a&lt;/sup&gt;</td>
<td>37 seventh grade boys with low self image and sociogram score</td>
<td>I: Aerobics with cooperative training</td>
<td>3–4 times a week for 18 weeks</td>
</tr>
<tr>
<td>Munson 1985&lt;sup&gt;a&lt;/sup&gt;</td>
<td>31 boys from development centre, aged 14–18 years</td>
<td>C: Regular classes without PE classes</td>
<td>90 min, 3 times a week for 6 weeks</td>
</tr>
<tr>
<td>Platzer 1976&lt;sup&gt;a&lt;/sup&gt;</td>
<td>40 preschool children who exhibited deficits in gross motor skills and self concept, aged 35–72 months</td>
<td>C: Perceptual-motor training ensure success and reinforcement of success</td>
<td>30 min, 4 times a week for 10 weeks</td>
</tr>
<tr>
<td>Smith 1982&lt;sup&gt;a&lt;/sup&gt;</td>
<td>66 healthy third grade pupils</td>
<td>C: Regular activity</td>
<td>30 min, twice a week for 8 weeks</td>
</tr>
</tbody>
</table>

<sup>a</sup> I, Intervention; C, control; WISC-R, Wechsler intelligence scale for children-revised.

Table 3  Methodological quality of included studies

<table>
<thead>
<tr>
<th>Study</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Risk of bias</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpert 1990&lt;sup&gt;a&lt;/sup&gt;</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Low</td>
<td>98%</td>
</tr>
<tr>
<td>Beckman 1986&lt;sup&gt;5&lt;/sup&gt;</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Moderate</td>
<td>Good according to the author</td>
</tr>
<tr>
<td>Bluechard 1994&lt;sup&gt;a&lt;/sup&gt;</td>
<td>?</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Moderate</td>
<td>85% in intervention group, 100% in control group</td>
</tr>
<tr>
<td>Herman-Toller 1998&lt;sup&gt;13&lt;/sup&gt;</td>
<td>−</td>
<td>+</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>Moderate</td>
<td>Not reported</td>
</tr>
<tr>
<td>MacMahon 1987&lt;sup&gt;a&lt;/sup&gt;</td>
<td>?</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>?</td>
<td>Moderate</td>
<td>Not reported</td>
</tr>
<tr>
<td>Marsh 1988&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Moderate</td>
<td>Good according to the author</td>
</tr>
<tr>
<td>Salukon 1994&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−</td>
<td>+</td>
<td>?</td>
<td>+</td>
<td>+</td>
<td>Moderate</td>
<td>Not reported</td>
</tr>
<tr>
<td>Smith 1982&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Moderate</td>
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</tr>
<tr>
<td>Smith 1984&lt;sup&gt;a&lt;/sup&gt;</td>
<td>?</td>
<td>?</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Moderate</td>
<td>Not reported</td>
</tr>
<tr>
<td>Basile 1995&lt;sup&gt;a&lt;/sup&gt;</td>
<td>?</td>
<td>?</td>
<td>+</td>
<td>+</td>
<td>?</td>
<td>High</td>
<td>Not reported</td>
</tr>
<tr>
<td>Elstein 1977&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>High</td>
<td>Not reported</td>
</tr>
<tr>
<td>MacMahon 1988&lt;sup&gt;13&lt;/sup&gt;</td>
<td>?</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>?</td>
<td>High</td>
<td>Not reported</td>
</tr>
<tr>
<td>Munson 1988&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>High</td>
<td>Not reported</td>
</tr>
<tr>
<td>Platzer 1976&lt;sup&gt;a&lt;/sup&gt;</td>
<td>?</td>
<td>+</td>
<td>+</td>
<td>−</td>
<td>?</td>
<td>High</td>
<td>Good according to the author</td>
</tr>
<tr>
<td>Boyd 1997&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−</td>
<td>?</td>
<td>+</td>
<td>?</td>
<td>?</td>
<td>High</td>
<td>Not reported</td>
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<tr>
<td>Bruya 1977&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>High</td>
<td>Not reported</td>
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<tr>
<td>Ford 1989&lt;sup&gt;a&lt;/sup&gt;</td>
<td>?</td>
<td>?</td>
<td>+</td>
<td>+</td>
<td>?</td>
<td>High</td>
<td>Not reported</td>
</tr>
<tr>
<td>Hilyer 1979&lt;sup&gt;a&lt;/sup&gt;</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>?</td>
<td>High</td>
<td>Not reported</td>
</tr>
<tr>
<td>Hilyer 1982&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−</td>
<td>?</td>
<td>+</td>
<td>−</td>
<td>?</td>
<td>High</td>
<td>Not reported</td>
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<td>Luebke 1977&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−</td>
<td>?</td>
<td>+</td>
<td>?</td>
<td>?</td>
<td>High</td>
<td>Not reported</td>
</tr>
<tr>
<td>Munson 1985&lt;sup&gt;a&lt;/sup&gt;</td>
<td>−</td>
<td>−</td>
<td>+</td>
<td>?</td>
<td>−</td>
<td>High</td>
<td>Not reported</td>
</tr>
</tbody>
</table>

Quality criteria: 1, allocation; 2, outcome assessment; 3, co-intervention; 4, losses to follow up; 5, intention to treat. Categories: +, met; ?, unclear; −, not met. Overall quality: 5 met = low risk of bias; 3–4 met = moderate risk of bias; <3 met = high risk of bias.
Because of the clinical and statistical heterogeneity, we performed sensitivity analyses. The only change in SMD of any possible important value was an increase in total SMD when the studies with children at risk were analysed separately. The effect size changed only marginally when weight lifting results, intervention with duration shorter than 10 weeks, or studies with differences in baseline measures of self esteem were excluded from the analysis. This is consistent with findings in many types of interventions or preventive programmes.

Self esteem was reported by the children themselves on instruments that are well accepted and reasonably well tested.
for reliability and validity, with the possible exception of one study, where the quality of the method is not known. There were no follow up data to show the extent to which the effects of programmes were maintained over longer periods of time, and none of the studies included factors indicating the degree of fun or enthusiasm among participants in the programmes. Whether the treatment effects were of clinical importance remains unclear. Some claims that a SMD of 0.5, in this case corresponding to a difference of self esteem of 5.5 on a 0–80 scale, is a moderate effect. Still the important question of whether children with a difference in self esteem such as this have a different degree of robustness and protection against psychological problems remains unanswered.

All the included studies used more or less “ordinary activity” as control treatment. The comparisons are therefore not between exercise and complete physical inactivity. This means that the possible treatment effect of exercise might be underestimated in this review. The effect was also somewhat surprising considering the short duration of the interventions. The research included in this review cannot tell us anything about what kind of exercise might give positive effects, and in which setting.

The results of this review are limited because of the small number of participants in the included studies and the lack of studies with a low risk of bias. Despite the methodological problems referred to, the results indicate that exercise may be effective in improving self esteem in children and young people, at least in the short term and for children and young people at risk. As exercise has no known negative effects, and many positive effects, on somatic health, it is an important instrument in improving children’s health.

This review reflects the need for rigorous research evaluating the effectiveness of exercise on children’s self esteem. The field should be further investigated by well designed randomised controlled trials. There is a need for follow up data to show the extent to which the effects of programmes are maintained over time.

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Authors’ affiliations
E Ekeland, Norwegian Physiotherapist Association, Oslo, Norway
F Heian, BUA, FSM Molde, Norway
K B Hagen, NRRK, Oslo, Norway
Competing interests: none declared

REFERENCES
It is useful to have a good quality systematic review to summarise the state of the evidence in this area. Low self esteem in children can lead to a range of psychosocial problems. In view of both the economic cost of other interventions (such as any kind of talking or play therapy) and the additional health benefits for children of taking more exercise, this is a useful intervention to consider. It is hoped that the call for more high quality randomised controlled trials to assess effectiveness will be taken up by research commissioners.

E Coren
UK Cochrane Centre; ecoren@cochrane.co.uk

 współstanów

**Warming up lowers pivotal injuries in youth sports**

A structured warm up programme should be part of all youth sports to save serious knee and ankle injuries, say researchers in sports trauma, based on a cluster randomised control trial.

This is the first time a large enough trial has been carried out to show this definitely. The researchers are confident that their findings in handball players will apply to other sports with similar moves and similar patterns and mechanisms of injury and that players of all levels would benefit.

The risks of injuries to legs and of acute knee and ankle injuries were drastically reduced—by half or more—in handball clubs randomised to receive the programme than the control clubs whose members followed their usual training regime. The rate ratio of acute injuries overall and knee or ankle injuries also dropped significantly in matches.

The trial included 1837 players aged 15–17 years in federation handball clubs in central and eastern Norway, randomly assigned to the programme or to act as controls. The two groups were matched by region, playing level, sex, and number of players. The Oslo Sports Trauma Research Centre and Norway’s Handball Federation devised the programme to foster awareness and control in movements of the knee and ankles. It was used the first 15 consecutive training sessions, then once a week throughout the league (eight months).

Sports injuries count for up to a fifth of acute emergency injuries in Scandinavia. Most are knee and ankle injuries, the most serious being commonest among adolescents in sports that entail pivoting movements.

Can exercise improve self esteem in children and young people? A systematic review of randomised controlled trials

E Ekeland, F Heian and K B Hagen

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