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Exercise to Improve Self-Esteem in Children and Young People

Eilin Ekeland, Frode Heian, Kåre Birger Hagen, Jo Abbott, Lena Nordheim

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Colophon

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Authors	Ekeland, Eilin Heian, Frode Hagen, Kåre Birger Abbott, Jo Nordheim, Lena
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Corresponding author	Eilin Ekeland Nasjonalt kunnskapssenter for helsetjenesten (Norwegian Centre for Health Services) P.O.Box 7004, St.Olavsplass Oslo N-0130 Norway Telephone: +47 23 25 50 39 E-mail: eilin.ekeland@kunnskapssenteret.no

Campbell Systematic Reviews

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The Campbell Collaboration
P.O. Box 7004 St. Olavs plass
0130 Oslo, Norway
www.campbellcollaboration.org

Cover sheet

Title

Exercise to improve self-esteem in children and young people

Reviewers

Ekeland E, Heian F, Hagen KB, Abbott J, Nordheim L

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Contact reviewer: Mrs Eilin Ekeland
Rådgiver/Adviser
Nasjonalt kunnskapssenter for helsetjenesten (Norwegian Centre for Health Services)
P.O.Box 7004, St.Olavsplass
Oslo
NORWAY
N-0130
Telephone 1: +47 23 25 50 39
E-mail: eilin.ekeland@kunnskapssenteret.no
URL: www.kunnskapssenteret.no
Secondary address (home):
Fossilv. 13 B
Drammen
NORWAY
3034
Telephone: +47 32810318
Facsimile: +47 32810845

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EE and FH have written the protocol and extracted the data,
assessed study quality and drafted the final review. EE has screened the searches and refererence-lists. KBH has been the supervisor and has given advice if EE and FH could not reach agreement. JA and LN have been responsible for the search strategy and carried out the search for trials.

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Synopsis

Some evidence that exercise has positive short-term effects on self-esteem in children and young people

Improving self-esteem may help to prevent the development of psychological and behavioural problems which are common in children and adolescents. Strong evidence exists for the benefits of exercise on physical health, but evidence for the effects of exercise on mental health is scarce. This review of trials suggests that exercise has positive short-term effects on self-esteem in children and young people, and concludes that exercise may be an important measure in improving children's self-esteem. However, the reviewers note that the trials included in the review were small-scale, and recognise the need for further well-designed research in this area.

Abstract

Background

Psychological and behavioural problems in children and adolescents are common, and improving self-esteem may help to prevent the development of such problems. There is strong evidence for the positive physical health outcomes of exercise, but the evidence of exercise on mental health is scarce.

Objectives

To determine if exercise alone or exercise as part of a comprehensive intervention can improve self-esteem among children and young people.

Search strategy

Computerised searches in MEDLINE, EMBASE, The Cochrane Controlled Trials Register (CENTRAL), CINAHL, PsycINFO and ERIC were undertaken and reference lists from relevant articles were scanned. Relevant studies were also traced by contacting authors. Dates of most recent searches: May 2003 in (CENTRAL), all others: January 2002.

Selection criteria

Randomised controlled trials where the study population consisted of children and young people aged from 3 to 20 years, in which one intervention arm was gross motor activity for more than four weeks and the outcome measure was self-esteem.

Data collection & analysis

Two reviewers independently selected trials for inclusion, assessed the validity of included trials and extracted data. Investigators were contacted to collect missing data or for clarification when necessary.

Main results

Twenty-three trials with a total of 1821 children and young people were included. Generally, the trials were small, and only one was assessed to have a low risk of bias. Thirteen trials compared exercise alone with no intervention. Eight were included in the meta-analysis, and overall the results were heteregeneous. One study with a low risk of bias showed a standardised mean difference (SMD) of 1.33 (95% CI 0.43 to 2.23), while the SMD's for the three studies with a moderate risk of bias and the four studies with a high risk of bias was 0.21 (95% CI -0.17 to 0.59) and 0.57 (95% CI 0.11 to 1.04), respectively. Twelve trials compared exercise as part of a comprehensive programme with no intervention. Only four provided data sufficient to calculate overall effects, and the results indicate a moderate short-term difference in self-esteem in favour of the intervention [SMD 0.51 (95% CI 0.15 to 0.88)].

Reviewers' conclusions

The results indicate that exercise has positive short-term effects on self-esteem in children and young people. Since there are no known negative effects of exercise and many positive effects on physical health, exercise may be an important measure in improving children's self-esteem. These conclusions are based on several small low-quality trials.

Background

Epidemiological studies using well-validated instruments have shown prevalence rates of psychological and behavioural problems in children and adolescents at levels between 10 and 20% (Sonuga-Barke 1997). These instruments have cut-off points set at levels that identify problems affecting the child's and/or the family's daily function. The data suggest that up to one-third of these children (i.e. 4-7% of the total child population) are considered to be in need of psychological treatment (Prior 1992).

The question of how to prevent psychological problems in children and young people has been of major interest for several years (Caplan 1964). Efforts have mainly been directed towards managing aspects of risk, but resilience research (Garmezy 1985; Rutter 1985; Haggerty 1996) has led to an increasing awareness of positive factors in the environment, social relations and individuals that protect against the development of problems. The negative effects of risk factors seem to be reduced or neutralised through confidence in one's own sense of personal value and through better mechanisms for coping with psychological stress. Among individual qualities, self-concept is one of the indicators given most attention.

Self-concept is our perception of self, and considerable research has identified several areas of importance: academic, social, emotional and physical self-concept (Harter 1983; Harter 1985; Sonstroem 1988). Self-esteem is the value we place on our self. The two terms self-concept and self-esteem are often used synonymously, although self-esteem is actually measured in the trials. Therefore self-esteem is the term used in this review.

There is strong evidence for positive physical health outcomes of living a physically active life (Blair 1992; Pate 1995; Erikssen 1998). Since the 1970s, there has also been an increasing body of research on psychological health outcomes of physical activity, and the results indicate positive effects for adults (Bouchard 1990; Fox 1992). Studies and reviews indicate a similar positive effect of physical activity on depression, anxiety, and behavioural problems like hyperactivity and conduct problems in children and adolescents (Fox 1992; Biddle 1993; Calfas 1994; Mutrie 1998).

The effect of physical activity on self-esteem in children has also been investigated, and one meta-analysis concluded that directed play or/and physical education programmes contributed to the development of self-esteem in elementary school-age children (Gruber 1986). This and other reviews (Calfas 1994; Mutrie 1998) have not been updated since initial publication. Other narrative reviews in which the effects of exercise on self-esteem were examined have included children as part of a wider investigation of links between exercise and self-esteem (Spence 1997; Fox 2000). Given the existence of new evidence, and in the light of a possible reduction in children's physical activity/physical performance over recent years (Ekeland 1999), there is a need for an updated review of the effectiveness of exercise-based interventions in promoting self-esteem and related concepts.

Objectives

To determine if exercise interventions can improve self-esteem among children and young people.

Criteria for considering studies for this review

Types of studies
All relevant randomised controlled trials and "quasi-randomised" trials, e.g. those that use alternate allocation, date of birth, etc.

Types of participants
Children aged from 3 years to young people up to 20 years of age.
Trials which also included children and young people with psychotic or borderline conditions, autism, physical handicap, eating disorders and chronic somatic/physical diseases were not included.

Types of interventions
The interventions included gross motor, energetic activity, for example, running, swimming, ball games and out-door play of moderate to high intensity, or strength training, in contrast to "ordinary" physical activity (for example, routine physical education (PE) classes, walking to school or play-time activities of low intensity). The minimum duration of the intervention had to be 4 weeks. The control group may be children receiving no intervention or children on a waiting list. "No intervention" arms could include children engaged in ordinary physical activity (which may be statutorily required, e.g. routine PE classes) but who are not otherwise engaged in organised gross motor, energetic activity.

Types of outcome measures
All measurements of children's self-esteem.

Search strategy for identification of studies
This review was prepared at the same time as two associated Cochrane reviews with the preliminary titles: "Exercise-based interventions in treatment of aggression and behaviour problems in children and young people" and "Exercise-based interventions in treatment of depression and anxiety in children and young people". Searching was conducted simultaneously for all three reviews.

Searching was done using the Cochrane Controlled Trials Register (CENTRAL) (Issue 2,2003), MEDLINE (1966-2002), EMBASE(1982-2002), CINAHL (1982-2002), PsycINFO (1887-2002) and ERIC (1965-2002). The authors of included studies were contacted, and manual searches were carried out in the Journal of the American Academy of Child and Adolescent Psychiatry (1998-2002) to identify randomised controlled trials.

The search strategy below was used to search the Cochrane Controlled Trials Register and modified as necessary to search the other databases mentioned:
CHILD*:ME
CHILD*
TEEN*
(YOUNG next PERSON*)
(YOUNG next PEOPLE*)
(((YOUTH* or ADOLESCEN*) or BOY*) or GIRL*)
STUDENT*
((((((#1 or #2) or #3) or #4) or #5) or #6) or #7)
MENTAL-DISORDERS*:ME
ATTENTION-DEFICIT-AND-DISRUPTIVE-BEHAVIOR-DI*:ME
AFFECTIVE-SYMPTOMS*:ME

AGGRESSION*:ME
DEPRESSION*:ME
SELF-INJURIOUS-BEHAVIOR*:ME
STRESS-PSYCHOLOGICAL*:ME
EMOTIONS*:ME
MENTAL-COMPETENCY*:ME
ADAPTATION-PSYCHOLOGICAL*:ME
PERSONALITY-DEVELOPMENT*:ME
BODY-IMAGE*:ME
MENTAL-HEALTH*:ME
((((((((((#9 or #10) or #11) or #12) or #13) or #14) or #15) or #16) or #17) or #18) or #19) or #20) or #21)
(MENTAL* next DISORDER*)
(ADJUSTMENT* next DISORDER*)
(ANXIETY next DISORDER*)
(PHOBIC near DISORDER*)
PHOBI*
(STRESS next DISORDER*)
ADHD
(ATTENTION next DEFICIT)
(DISRUPTIVE near (BEHAVIOR or BEHAVIOUR))
HYPERACTIV*
(CONDUCT near DISORDER*)
((BEHAVIOR or BEHAVIOUR) next DISORDER*)
(TIC near DISORDER*)
(TOURETTE* next SYNDROME)
(MOOD* near DISORDER*)
(AFFECTIVE next SYMPTOM*)
AGGRESS*
DEPRESS*
((((((((((((((#23 or #24) or #25) or #26) or #27) or #28) or #29) or #30) or #31) or #32) or #33) or #34) or #35) or #36) or #37) or #38) or #39) or #40)
(DYSTHYMIC next DISORDER*)
((SEASONAL next AFFECTIVE) next DISORDER*)
(NEUROTIC near DISORDER*)
(SELF-INJURIOUS next BEHAVIOR*)
(SELF-INJURIOUS next BEHAVIOUR*)
(SELF and INJUR*)
(PSYCHOLOGICAL near STRESS*)
ANXIET*
FEAR*
FRUSTRAT*
HAPPINESS*
HAPPY
LONEL*
(MENTAL* next COMPETEN*)
(PSYCHOLOGICAL near ADAPTATION*)
(PERSONALITY near DEVELOP*)
SELF-CONCEPT*
(SELF next CONCEPT*)

SELF-IMAGE*
(SELF next IMAGE*)
SELF-ESTEEM
(SELF next ESTEEM)
SELF-HARM*
(SELF next HARM*)
SELF-MUTILAT*
(SELF next MUTILAT*)
(BODY next IMAGE*)
((((((((((((((((((((((((#42 or #43) or #44) or #45) or #46) or #47) or #48) or #49) or #50) or #51) or #52) or #53) or #54) or #55) or #56) or #57) or #58) or #59) or #60) or #61) or #62) or #63) or #64) or #65) or #66) or #67) or #68)
(MENTAL next HEALTH*)
(WELL next BEING)
(WELL-BEING or WELLBEING)
((#70 or #71) or #72)
(((#22 or #41) or #69) or #73)
EXERCISE*:ME
EXERCISE-THERAPY*:ME
PHYSICAL-EDUCATION-AND-TRAINING*:ME
SPORTS*:ME
PLAY-AND-PLAYTHINGS*:ME
PLAY-THERAPY*:ME
DANCING*:ME
DANCE-THERAPY*:ME
EXERCIS*
(EXERCIS* near THERAP*)
(PHYSICAL near (EDUCAT* or TRAIN*))
SPORT*
PLAY*
DANC*
((((((((((((#75 or #76) or #77) or #78) or #79) or #80) or #81) or #82) or #83) or #84) or #85) or #86) or #87) or #88)
((#8 and #74) and #89)

Methods of the review

1. SELECTION OF TRIALS

Titles and abstracts from the searches were screened by one reviewer (EE) who excluded the studies clearly not relevant to the topic, such as studies of adults, not randomised controlled trials, and not exercise interventions. The rest were retrieved by EE, and judged independently by EE and FH against the inclusion criteria. If there was uncertainty or disagreement, a third reviewer (KBH) was consulted.

2. QUALITY ASSESSMENT

Two reviewers (EE and FH) independently assigned each selected study to quality categories described in the Cochrane Collaboration Handbook (Clarke 2001). Uncertainty or disagreement was resolved by discussion with KBH. When further information was needed, the authors of studies were contacted for clarification. Blinding of providers and patients is unlikely to be applicable and was not used as a criterion to assess the internal validity of included trials. The

following five criteria were used:

a) Concealment of allocation
ADEQUATE: (A) indicates adequate concealment of the allocation (for example, by telephone randomisation, or use of consecutively numbered, sealed, opaque envelopes);
UNCLEAR: (B) indicates uncertainty about whether the allocation was adequately concealed (for example, where the method of concealment is not known);
INADEQUATE: (C) indicates that the allocation was definitely not adequately concealed (for example, open random number lists or quasi-randomisation such as alternate days, odd/even date of birth, or hospital number).

b) Outcome assessment
MET: assessor unaware of the assigned treatment when collecting outcome measures
UNCLEAR: blinding of assessor not reported and cannot be verified by contacting investigators
NOT MET: assessor aware of the assigned treatment when collecting outcome measures.

c) Co-intervention
MET: interventions other than exercise avoided, controlled or used similarly across comparison groups.
UNCLEAR: use of interventions other than exercise not reported and cannot be verified by contacting the investigators
NOT MET: dissimilar use of interventions other than exercise across comparison groups, i. e. differences in the care provided to the participants in the comparison groups other than the intervention under investigation.

d) Losses to follow-up
MET: losses to follow up less than 20% and equally distributed between comparison groups
UNCLEAR: losses to follow up not reported
NOT MET: losses to follow up greater than 20%.

e) Intention-to-treat
MET: intention to treat analysis performed or possible with data provided
UNCLEAR: intention to treat not reported, and cannot be verified by contacting the investigators
NOT MET: intention to treat analyses not done and not possible for reviewers to calculate independently.

Studies were grouped as those with a low risk of bias (all criteria MET), those with a moderate risk of bias (3-4 criteria MET), and those with a high risk of bias (less than 3 criteria MET). Other methodological issues are documented in "Table of Included Studies."

3. DATA MANAGEMENT
Data were extracted independently by each reviewer, and compared using data extraction sheets and the "double entry" feature in RevMan 4.2.1. Data concerning population, age, baseline characteristics, characteristics of activity/activities and duration, compliance, and outcome measures were extracted for both all groups within each trial. Where it was not possible to extract data because they were not available or further information was needed, the first author of the paper was contacted for clarification. Authors of seven trials provided us with further information on design, methodological quality or results: Field 2002; Tuckman 2002; Marsh 2002; Munson 2002; Platzer 2002; Salokun 2002; Smith 2002. The data thus received are presented in the "Table of Included Studies."

4. ASSESSMENT OF HETEROGENEITY
Heterogeneity was assessed using the Chi-squared test of heterogeneity along with visual inspection of the graph.

5. DATA SYNTHESIS
Overall effects from the studies for which data were available were calculated. For studies not providing sufficient data to calculate overall effects, a qualitative summary is provided. Since self-esteem is a continuous outcome, and was measured with similar, but not identical, instruments across studies, standardised mean differences (SMDs) were calculated. There was considerable clinical heterogeneity between trials with differences in study quality, differences in the type or length/period of the intervention and differences in participant characteristics. Statistical heterogeneity was also identified. Therefore overall effects were calculated using a random effects model. Where studies contained more than one eligible intervention versus a control group, the Ns, means and standard deviations were pooled for use in the analysis. This was required in the case of Ford 1989, where one group received jogging, one swimming, one dancing and one weight-lifting. Still, the results from the weight-lifting arm were excluded in a sensitivity analysis. In another trial, data were combined from two intervention arms; strength-training with discussion and strength-training with leisure counselling (Munson 1985).

6. SENSITIVITY ANALYSES
Primary analyses were based on available data from all included studies relevant to the comparison and outcome of interest. In order to assess the robustness of conclusions to quality of data and clinical heterogeneity, sensitivity analyses were performed in terms of studies of different levels of methodological quality, differences in the type or length of the intervention, and differences in participant characteristics.

Description of studies
Sixty studies were retrieved, but only 23 were included. The excluded studies were not randomised studies, were studies with short time interventions or no gross motor activity, or we did not define outcome measures as measures of self-esteem (see table of excluded studies). Two of the included studies (Marsh 1988a; Hilyer 1979b) used two different interventions, and the analysis therefore includes 25 comparisons. Eighteen of the included studies were carried out in the USA, two in Canada, one in Nigeria and one in Australia. They included 24 to 288 participants aged from 3 to 19.8 years. The participants varied widely, including healthy children; children with learning disabilities and/or emotional disturbances; young offenders; children with low self-image and children with deficits in gross motor skills. The interventions lasted for between 4 and 20 weeks and included aerobic interventions, strength-training interventions, skills training and combinations of these. Some interventions combined the exercise with counselling, skills training and social activities, otherd focused only on exercise.

Alpert 1990 (USA) assessed the effect of exercise on cardiovascular fitness and agility, knowledge of health habits, self-esteem and levels of spontaneous activity. 24 healthy three to five year-old boys and girls were randomly assigned to aerobic classroom activity or to regular outdoor play (control group). The aerobic exercise period (20 minutes) consisted of vigorous movements to music in play-like manner, and was designed to raise the children's heart rate (HR) to 60-80% of maximum heart rate. The intervention lasted for 8 weeks. Compliance was 98%. Self-esteem was measured using the Thomas Self-Concept Values Test (Thomas 1972).

Basile 1995 (USA) evaluated the effects of antecedent physical exercise and a mastery task on behaviourally disturbed children's self-concept and rate of disruptive behaviour. 53 boys and 5 girls, aged 7 to13 years, were recruited from a day-treatment clinic for emotionally and behaviourally disturbed children, and randomly assigned to one of three groups. One group used jogging or walking in intervals. The second group was trained in basketball shooting, not energetic activity. Both these groups received verbal feedback and praise, and their training sessions lasted 20 minutes, four times a week for four weeks. The control group had no physical intervention. Self-esteem was measured using the Piers-Harris Children's Self-Concept Scale (Piers 1984).

Bluechardt 1995 (Canada) investigated how much motor proficiency and social skills could be enhanced in a group of 8- to 10-year-old children with learning disabilities using a closely supervised activity programme with an embedded social skills component. 45 pupils with learning disabilities but normal Wechsler Intelligence Scale for Children-Revised, were randomised to an intervention group with a twice-weekly 90-minute programme of pool and gymnastic activities, promoting skills and developing social skills, or a control group given assistance in deficient skills. The intervention lasted for 10 weeks. Self-esteem was measured using the Self-Perception Profile for Learning-Disabled Students (Renick 1988).

Boyd 1997 (Canada) used a cluster-randomised controlled trial to determine the effect of physical activity intervention on self-esteem in females at different ages. The participants were 181 healthy girls, aged 9 to16 years, randomly assigned as intact classes, one of two at each level, to either intervention or control. The intervention was a "package" that consisted of strength training, skipping and running, locomotor activities, education, and self-reported performances in log books. The authors intended to give the participants a number of successful experiences. The controls received regular PE. Both groups' lessons lasted for 40 minutes and were repeated nine times for the younger and 12 times for older students during 6 weeks. Compliance was not reported. Self-esteem was measured using the Self Description Questionnaires (SDQ I and II) (Marsh 1983).

Bruya 1977 (USA) evaluated an attempt to produce positive changes in self-concept by participation in normal movement experience in schools. He randomly assigned 72 healthy 9- to 11-year-old children from two class groups of 9 boys and 9 girls each by class, to an intervention- and a control group. The intervention consisted of movement experiences that included basketball skills for 30 minutes twice a week for 4 weeks. The control group received no training. Compliance was not reported and the intensity of physical activity and effect on skills was not described. Self-esteem was measured using the Piers-Harris Children's Self-Concept Scale (Piers 1984).

Elstein 1977 (USA) used a cluster-randomised trial to investigate the effects of three different types of physical education programme on learning disabled students aged 7 to 15 years, with normal IQ. They randomised intact classes to three different groups. One group was trained in basic motor and movement skills, balance, gymnastics and physical fitness. The children were encouraged to extend themselves. The second group performed sports and ball games with an individual adjustment. The control group had child-led free play with various equipment for activity available. All the groups met for 50 minutes twice each week, and the intervention lasted 9 months. Compliance was not reported. Self-esteem was measured using the Piers-Harris Children's Self-Concept Scale (Piers 1984).

Ford 1989 (USA) determined the effect of eight weeks' participation in an activity course on multiple measures of health-related fitness and psychological well-being. 108 healthy girls of mean age 19.8 years were enrolled in five groups. This review included 17 participants in a jogging for

fitness group, 15 in swimming for fitness, 21 in dancing for fitness, and 22 in a weight-lifting group. 22 participants in health science served as control group. The intervention groups met for 3 hours each week; the health science group met for 2 hours each week. The intervention lasted 8 weeks. Compliance was not reported, and the intervention was poorly described. Self-esteem was measured using the Rosenberg Self-Esteem Scale (Rosenberg 1965).

Herman-Tofler 1998 (USA) examined the effect of an aerobic conditioning programme on perceived athletic competence, physical appearance, social acceptance, perceived global self-worth, self-perceived behavioural conduct, figural creativity and aerobic power. 52 boys and girls from the third grade were randomly assigned to an intervention or control group. The intervention group performed 25 minutes of aerobic exercise with energetic music per week for 8 weeks, using large muscle groups at 60% to 85% of VO2 max (VO2 max is the maximum ability of the body to transport oxygen from the air to the muscles for energy generation and is measured in millilitres of oxygen per kilogram of body weight per minute of exercise). The control group met three times a week for traditional physical education. Self-esteem was measured using the Self-Perception Profile for Children (Harter 1985b).

Hilyer 1979a and Hilyer 1979b (USA) examined the effect of a programme of facilitative counselling in conjunction with systematic exercise on fitness and self-concept in college students with low self-concept. 120 students, mean age 19 years 10 months, were randomly assigned to one of three groups: a running group, a running with counselling group, and ordinary classes. The running programme was the same in both the intervention groups, and the students were encouraged to improve their running performance. Great care was taken to establish a positive atmosphere. The running groups lasted for 60 minutes three times each week. The running with counselling group met another hour once a week with attention to interpersonal relationships. Compliance was not reported. Self-esteem was measured using the Tennessee Self-Concept Scale (Fitts 1991).

Hilyer 1982 (USA) examined the effect of physical fitness training delivered by skilled counsellors on physiological and psychological changes among high security risk juvenile delinquents. 60 boys, aged 15.5 to 18.6 years, from a state industrial school for adjudicated youth, considered by the state as high security risks, were included in the study. They were randomly assigned to either intervention (which included weight training, running with gradual progress and flexibility training, combined with brief meetings with goal setting) or control (regular activity and team sport alone). The activities lasted for 90 minutes three times a week for 20 weeks. Compliance was not reported. Self-esteem was measured using the Self-Esteem Inventory Form A (Coopersmith 1968).

Luebke 1977 (USA) compared the main effects and interactions of a standard programme of physical education and a programme of movement education versus no structured programme, on physical fitness and self-concept. 73 healthy pupils in three third-grade classes were randomly assigned, as intact units, to each of the following three groups: basic locomotor gymnastics, ball handling, dance, rope-jumping skills; movement with force absorption, force production, pathways in space and contrasts in movement; and acontrol group that received no instruction. The intervention was given for 30 minutes twice a week for 13 weeks. Self-esteem was measured using the Piers-Harris Children's Self-Concept Scale (Piers 1984).

MacMahon 1987 (USA) evaluated the effects of a 20-week aerobic exercise programme on cardiovascular fitness, self-concept, academic achievement and motor proficiency in boys with learning disabilities. 54 boys were randomly assigned to one of two groups participating in separate sports programmes. The members of the aerobic group were involved in distance running, aerobic

dance and soccer, with HR above 160 for 25 minutes 5 days/week. The comparison group participated in a structured programme of games and less vigorous activities, maze patterns, dodge ball, volleyball, and HR was maintained below 150. Self-esteem was measured using the Piers-Harris Children's Self-Concept Scale (Piers 1984).

MacMahon 1988 (USA) evaluated the effect of a structured aerobic exercise programme on physical fitness, self-concept and mood in juvenile delinquents. 98 males from two juvenile detention facilities, aged 14 to 18 years, took part in the study. They were randomly assigned to either long-distance running and vigorous basketball with HR above 160, or to activities like baseball, volleyball, etc with HR less than 160. The activity programmes lasted for 40 minutes three times a week for 3 months. Compliance was not reported. Self-esteem was measured using the Piers-Harris Children's Self-Concept Scale (Piers 1984).

Marsh 1988a and Marsh 1988b (Australia) examined the different effects of a competitive and a cooperative fitness programme on fitness and multiple dimensional self-concepts. 137 healthy girls, age 11to14 years, were divided into four quartiles according to scores on the physical fitness test, and then from each strata randomly assigned into three groups: a competitive physical activity group, a co-operative physical activity group or a control group playing social volleyball games. The activity of the two intervention groups was a mix of callisthenics and athletics with music, designed to improve physical fitness in general and cardiovascular fitness in particular. In the cooperative group, the activities required cooperation between pairs, whereas those in the competitive group could be completed individually. According to the author, the compliance was good. Self-esteem was measured using the Self Description Questionnaires (SDQs) (Marsh 1983).

McGowan 1974 (USA) wanted to examine the effects of a success-oriented endurance-training programme on self-concept and peer approval. 37 seventh-grade boys with low self-image (positive total score 47 or below on Tennessee Self Concept Scale [Fitts 1991]) and chosen by three or fewer peers as "best friend" were included in the study. They were assigned to either success-oriented endurance training (running and competitive activities) or regular classes with no physical education at school. The intervention group met 3-4 times each week in 18 weeks. In some of these lessons, the intervention group competed against physical education classes, and it was arranged that the intervention group always won. Compliance was not reported. Self-esteem was measured using the Tennessee Self-Concept Scale (Fitts 1991).

Munson 1988 (USA) compared the effects of a leisure education programme versus physical activity or informal discussion on the self-esteem, leisure functioning, attitudes toward self, leisure, work, leisure participation, and satisfaction of behaviourally disordered youth offenders. 45 offenders from a security institution, mean age 17.2 years, were randomly assigned to leisure education, physical activity or informal discussion groups. All met for 1 hour each week for 10 weeks. Compliance was not reported. Self-esteem was measured using the Self-Esteem Inventory Form B (Coopersmith 1968).

Munson 1985 (USA) compared the effects of two intervention programmes and a no-treatment control condition on self-esteem, leisure attitudes and leisure behaviour among institutionalised juvenile delinquents. 31 males from a development centre, aged 14 to 18 years, were randomly assigned to either strength training combined with leisure counselling, strength training combined with discussion or a regular institution programme. All groups met for 90 minutes three times a week for 7 weeks. Compliance was good, according to the author. Self-esteem was measured using the Self-Esteem Inventory (Coopersmith 1968).

Percy 1981 (USA) assessed the effects of a systematic running programme on self-concept. 30 healthy fifth- and sixth-grade pupils were randomised to a running group and a control group. The running group ran a minimum of 1 mile at least three times each week for 7 weeks. They decided when to run themselves. The activity in the control group was not described. Compliance is not reported. Self-esteem was measured using the Coopersmith Self-Esteem Inventory (Coopersmith 1981).

Platzer 1976 (USA) investigated whether a daily perceptual-motor training programme improved the self-concept of young children. 40 preschool children, aged 35 to 72 months, from four day-care centres were included. All exhibited deficits in gross motor skills and self-concept, according to the Mann-Suiter Developmental Checklist on Motor Ability and Coopersmith's Behavioural Rating Form (Coopersmith 1981). They were assigned to either perceptual-motor training with reinforcement of success or to regular activity. Both groups were comprised of subgroups consisting of four to six subjects from each of the day-care centres. The intervention group training was performed for 30 minutes four times a week for 10 weeks. Compliance was good according to the author, but no measures were taken. Self-esteem was measured using the Goodenough's House-Tree-Person Projective Test (Goodenough 1926).

Salukon 1994 (Nigeria) examined the relationship between improvement in sport skills and increase in positive self-concept. 288 youths, aged 12 to 18 years, were randomly assigned to intervention (field hockey (96) or athletics (32 sprint, 32 discus, 32 long jump) or a control group that did not participate in any sport skill training. The intervention lasted 10 weeks, 45 minutes three times each week. Compliance was 100%. Self-esteem was measured using the Tennessee Self-Concept Scale (Fitts 1991).

Smith 1982 (USA) assessed the effects of two types of short-term physical education on self-concept and movement skills. 66 healthy - pupils were matched for academic achievement, classroom teacher, socio-economic background, sex and race. They were then randomly assigned to one of three groups: one with games and relays with emphasis on avoiding waiting for turn and inactivity, one group with problem-solving for developing motor skills and the third free play. The activities were performed for 30 minutes twice a week for 8 weeks. The compliance was good, according to the author. Self-esteem was measured using the Martinek-Zaichkowsky Self-Concept Scale (Martinek 1977).

Smith 1984 (USA) evaluated the physical, psychological and behavioural effects of participation in an aerobic exercise programme on elementary school children. 49 fourth- and fifth-grade healthy pupils were matched on sex, age and physical ability (9-minute run test), and randomly assigned to three groups: an aerobic exercise group with a three times weekly progressive running programme, increasing the duration and the distance they ran, a non-aerobic exercise group with progressive yoga, or a control group with one ordinary weekly physical education class. The intervention period was 10 weeks. Compliance was not described. Self-esteem was measured using the Piers-Harris Children's Self-Concept Scale (Piers 1984).

Tuckman 1986 (USA) evaluated whether running affected children physically and psychologically, by randomising 154 healthy fourth- to sixth-grade pupils to either running or ordinary PE classes. The running group ran for 30 minutes three times each week, and fourth and fifth grade had in addition two ordinary PE classes. They ran on a 400 m track, and there was a gradual increase in distance interval. The ordinary PE classes met 6 times each week for the fourth and fifth grades and three times each week for the sixth grade. They played basketball and volleyball, and ran just occasionally. The intervention lasted 12 weeks. According to the author, the compliance was good.

Self-esteem was measured using the Piers-Harris Children's Self-Concept Scale (Piers 1984).

Methodological quality of included studies

One study (Alpert 1990) met all five methodological criteria, and the risk of bias in this study was assessed to be low. The compliance was 98%. Tuckman 1986 met four criteria, whereas seven studies met three quality criteria (Bluechardt 1995; Herman-Tofler 1998; MacMahon 1987; Marsh 1988a; Salukon 1994; Smith 1982; Smith 1984). These eight studies were categorised as studies with moderate risk of bias. Five studies met two of the quality criteria (Basile 1995; Elstein 1977; MacMahon 1988; Munson 1988; Platzer 1976). The final 9 studies met only one or no quality criteria (Boyd 1997; Bruya 1977; Ford 1989; Hilyer 1979a; Hilyer 1982; Luebke 1977; McGowan 1974; Munson 1985; Percy 1981). Thus, altogether 14 studies met two or less of the quality criteria and were assessed to have a high risk of bias. Bluechardt 1995 report a compliance of 85% (intervention group) and 100% (control group) and Herman-Tofler 1998 had 100% compliance. When contacted, the authors of Marsh 1988a, Platzer 1976, Smith 1982 and Tuckman 1986 described the compliance as good, but provided no data.

Results

Twenty-three trials with a total of 1821 children and young people were included. Two of the references included two quite different interventions (Marsh 1988a; Hilyer 1979a). These we subdivided into separate studies (Marsh 1988b and Hilyer 1979b) giving at total of 25 studies in the analysis. Two other studies also had more than one intervention, but these interventions were considered similar (Ford 1989; Munson 1985), and therefore calculated as one intervention in the meta-analysis. The duration of most of the interventions varied from 4 to 14 weeks. Only one study had an intervention period of as much as 9 months (Elstein 1977). Outcomes were measured at the end of the interventions, and no follow-up results were given.

When different scores on self-esteem were used, the overall self-esteem score, often called global self-esteem score in the papers, was used in the analysis. In additional to represent the total score of these items, some assessment instruments differentiate between different domains of self-esteem, while others only give a global representation of self-esteem. To make comparisons possible, this review only consider measurements of global self-esteem. Six studies were cluster-randomised trials and were not included in the meta-analysis (Boyd 1997; Bruya 1977; Elstein 1977; Luebke 1977; Platzer 1976; Salukon 1994). A further seven did not report the results in a way that makes it possible to calculate overall effects (Basile 1995; Hilyer 1979a; Hilyer 1979b; Marsh 1988a; Marsh 1988b; McGowan 1974; Tuckman 1986) . Therefore, 12 studies provided sufficient data to be include in the meta-analysis. Since the outcomes were measured with similar, but not identical, instruments, SMD was calculated.

From a clinical point of view, the context in which the physical activity was carried out might 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 (not specified in the protocol).

1. EXERCISE ONLY VERSUS NO INTERVENTION

This comparison included 13 studies, with eight in the meta-analysis. The number of participants included in this meta-analysis was 214 in the exercise group and 166 in the control group. The overall SMD random effect model was 0.49 (95% confidence interval (CI) 0.16 to 0.81) in favour of the exercise intervention. Since the heterogeneity was significant ($p = 0.037$), we analysed the studies in strata of methodological quality. The subtotals for the study with a low risk of bias

showed a SMD of 1.33 (95% CI 0.43 to 2.23) in the same direction (Alpert 1990), 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 because of cluster-randomised design or missing data (Salukon 1994; Tuckman 1986; Basile 1995; Hilyer 1979a; Marsh 1988a). Hilyer 1979a (high risk of bias) found a significant improvement ($p < 0.01$) for a subgroup of participants: those with a low self-concept at baseline. The cluster-randomised trial (Salukon 1994, moderate risk of bias) reported a significant treatment effect ($p = 0.05$). Tuckman 1986 (moderate risk of bias), and Basile 1995 and Marsh 1988b (high risk of bias) reported no significant effect.

a) Sensitivity analysis
Since the interventions and participants could be considered heterogeneous, we employed sensitivity analyses to assess the robustness of the results. Because there might be a difference in effect between aerobic exercise and strength training, we made an analysis where the intervention group receiving weight training in Ford 1989 were excluded. This resulted in almost the same total score, SMD 0.50 (95% CI 0.14 to 1.03). No other studies had strength training as the only intervention. The duration of the intervention was also thought to have an important role. In a meta-analysis including only studies with an intervention duration of 10 weeks or more (MacMahon 1987; Smith 1984; MacMahon 1988; Munson 1988), the SMD decreased marginally [0.46 (95% CI 0.16 to 0.75)].

It might also be of interest if the interventions had a possible different effect in healthy children and children at risk or with defined problems. The total SMD for studies with healthy children are not significant [SMD 0.53 (95% CI -0.04 to 1.09)] (Alpert 1990; Herman-Tofler 1998; Smith 1982; Ford 1989; Percy 1981), whilst analysis of studies with children at risk or with defined problems resulted in a significant SMD of 0.49 (95% CI 0.17 to 0.82) (MacMahon 1987; MacMahon 1988; Munson 1988).

b) Analysis not pre-specified in the protocol
Many of the studies included in this review are small, and the randomisation procedures not appropriate. This may lead to baseline differences. When excluding the studies with clear baseline differences in self-esteem measures, the overall SMD increased marginally to 0.51 (95% CI 0.10 to 0.9).

2. EXERCISE AS PART OF A COMPREHENSIVE INTERVENTION VERSUS NO INTERVENTION
This group of interventions included 12 studies, with only four in the meta-analysis. The number of participants included in the meta-analysis was 89 in the exercise group and 72 in the control group. The results show an overall SMD of 0.51 (95% CI 0.15 to 0.88). No studies in this group had a low risk of bias, but in studies with a moderate risk of bias, the SMD was non-significant at 0.32 (95% CI -0.11 to 0.74) and in those with a high risk of bias, the SMD was 0.76 (95% CI 0.12 to 1.40). Studies not included in the meta-analysis because of a cluster-randomised design or missing data all had a high risk of bias. Boyd 1997, Elstein 1977, Hilyer 1979b and one cluster-randomised trial (Platzer 1976) found a significant treatment effect. Luebke 1977, Marsh 1988b, McGowan 1974 and one cluster-randomised trial (Bruya 1977) showed no significant differences between intervention and control groups.

a) Sensitivity analysis
In this comparison, it was not possible to categorise the interventions, and no studies had interventions less than 10 weeks. When the single study with healthy participants was excluded

from the meta-analysis (Smith 1982), the SMD increased to 0.64 (95% CI 0.22 to 1.06). When the study with obvious baseline differences in self-esteem (Munson 1985) was excluded, there was no clear difference [SMD 0.55 (95% CI 0.07 to 1.03)].

Discussion

The objective of this review was to determine if exercise interventions can improve self-esteem among children and young people. Sixty studies were retrieved for this review, but 37 were excluded because of no randomisation, no appropriate interventions or self-esteem not an outcome measure. The results, based on 25 comparisons with participants aged 3 to 20 years, indicate that exercise can improve self-esteem. This compares well to the meta-analysis of Gruber (Gruber 1986).

Only one of the included studies met all five methodological criteria and was assessed to have a low risk of bias. Eight had MET three or four methodological quality scores, and 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. There was a wide range of interventions in the included studies, and in this review they are grouped into two main comparisons, one where the 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 accomplished for only 12 studies, eight that looked at exercise only and four that looked at exercise combined with other aspects. Both these meta-analyses show an overall significant treatment effect, but there was no significant change in studies with a moderate risk of bias. Of the studies not included in the meta-analysis, seven showed a significant treatment effect and six did not.

It is questionable whether a meta-analysis is appropriate in this review. There were differences in participants, types of interventions and methods of measurements, and the test for heterogeneity in the exercise-only comparisons was significant. We therefore performed sensitivity analyses. 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. The only change in SMD of any possible important value was an increase in total SMD when healthy participants were excluded from the analysis of exercise interventions as a part of a comprehensive intervention. This is consistent with findings in many types of interventions or preventive programmes (Durlak 1997).

Self-esteem was measured using instruments that are well accepted and reasonably well tested for reliability and validity, with the possible exception of one study (Platzer 1976), where the quality of the method is not known. There were no follow-up data to demonstrate 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.

All the included studies used more or less "ordinary activity" as control treatment. The comparisons are therefore not between exercise and complete physical inactivity, although some studies have an upper limit for HR for activity in the control group. 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, and in which setting, gives positive effects.

Reviewers' conclusions

Implications for practice

The results of this review are necessarily limited due to 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 might be effective in improving self-esteem among children and young people, at least in the short term and for children and young people at risk. For exercise as part of a comprehensive intervention the size of the effect is moderate. For exercise alone the effect is about the same, but the results are heterogeneous. Since exercise has no known negative effects, and many positive effects on somatic health, it might be an important instrument in improving children's self-esteem.

Implications for research

This review reflects the paucity of rigorous research evaluating the effectiveness of exercise on children's self-esteem. The field needs to be further investigated by well-designed randomised controlled trials, and there is a need of follow-up data to demonstrate the extent to which the effect of programmes are maintained over time and linked to attempts to clarify clinical meaning.

Characteristics of included studies

Study ID	Methods	Participants	Interventions	Outcomes	Notes	Allocation concealment
Alpert 1990	RCT Outcome assessment: MET Co-intervention: MET Losses to follow-up: MET Intention-to-treat: MET	24 healthy boys and girls, aged 3 to 5 years	I: Aerobic classroom activity with music. HR 60-80% C: Outdoor play 30 min, 5 times per week for 8 weeks	A: Self-esteem (Thomas Self-Concept Values Test) B: Cardiopulmonary status (Graded submax. cycling) C: Gross-motor performance (Observations)	Compliance 98%	A
Basile 1995	RCT Outcome assessment: unclear Co-intervention: NOT MET Losses to follow-up: MET Intention-to-treat: unclear	53 boys and 5 girls from clinic (day treatment for emotionally and behaviorally disturbed children), aged 7 to 13 years	I: Jogging/walking C: Classroom activity Intervention not included in this review: Mastery basketball shooting 20 min, 4 times per week for 4 weeks	A: Self-concept (Piers-Harris Children Self-Concept Scale)	Compliance: not reported.	A
Bluechardt 1995	RCT Outcome assessment: unclear Co-intervention: MET Losses to follow-up: MET Intention-to-treat: MET	45 pupils with learning disabilities but normal WISCH-R, aged 8.3 to 10.5 years	I: Pool and gymnastic activities, promoting skills and developing social skills C: Assistance in deficient skills 90 min, 2 times per week for 10 weeks	A: Self-perception (Self-Perception Profile for Learning-Disabled Students) B: Motor performance (Bruininks Oseretsky test)	Compliance 85% in intervention group, 100 % in control group	B
Boyd 1997	Cluster RCT Outcome assessment: unclear Co-intervention: MET Losses to follow-up: unclear Intention-to-treat:unclear	181 healthy girls, aged 9 to 16 years	I: "Package": Strength training, skipping and running, locomotor activities, education, and self-reported performance in log books. C: Regular PE classes 40 min, 9 times for the	Self-concept (Self Description Questionnaires, SDQ I and II)	Compliance not reported	C

			youngest and 12 times for the older during 6 weeks			
Bruya 1977	Cluster RCT Outcome assessment :unclear Co-intervention: unclear Losses to follow-up: unclear Intention-to-treat : unclear	72 healthy pupils aged 9 to 11years	I: Training basketball skills C: No training 30 min, 2 times per week for 4 weeks	Self-concept (Piers-Harris Children's Self-Concept Scale)	Compliance not reported Intensity and skills learned not described	C
Elstein 1977	Cluster RCT Outcome assessment: NOT MET Co-intervention: NOT MET Losses to follow-up: MET Intention-to-treat: MET	33 learning-disabled children with normal IQ, aged 7 to 15 years.	I (a): Basic motor and movement skills, balance, gymnastics, physical fitness. Encouraged to extend themselves. I (b): Skills toward sports and ball-games. Individual adjustment. C: Free play, a lot of equipment for activity available. Child-led activity 50 min, 2 times per week for 9 months.	A: Self concept (Piers Harris Self-Concept Scale) B: Physical fitness - Youth fitness test.	Compliance not reported.	C
Ford 1989	RCT Outcome assessment: unclear Co-intervention: MET Losses to follow-up: Unclear Intention-to-treat: unclear	97 healthy girls, mean age 19.8 years	I: Jogging, swimming or dance for fitness, or weight-training C: Health science Group not included in this review: Life saving (n = 11) 3 hours per week for 8 weeks	A: Self esteem (Rosenberg Self-Esteem Scale) B: Physical fitness (Step-test, 1 min. sit-up test, sit and reach)	Compliance not reported	B
Herman-Tofler 1998	RCT Outcome assessment: MET Co-intervention: NOT MET	52 healthy 3rd-grade students	I: Aerobics 60-85% max VO2 C: Traditional physical	A: Self-perception (Self-Perception Profile for Children (Harter))	Compliance 100%	C

	Losses to follow-up: MET Intention-to-treat: MET		education, not aerobic 25 min, 3 times per week for 8 weeks	B: Aerobic power (Time completed 800m run)		
Hilyer 1979a	RCT Outcome assessment: unclear Co-intervention: MET Losses to follow-up: unclear Intention-to-treat: unclear	120 students, mean age 19.1 years	I: Running C: Ordinary classes 60 min 3 times per week for 10 weeks	A: Self-concept (Tennessee Self-Concept Scale) B: Physical fitness (Cooper's 12-min run)	Compliance not reported	B
Hilyer 1979b						D
Hilyer 1982	RCT Outcome assessment: unclear Co-intervention: MET Losses to follow-up: NOT MET Intention-to-treat: unclear	60 adjudicated boys from a state school, aged 15.5 to 18.6 years	I: Brief meetings with goal setting Flexibility training Weight training Run with gradually progress C: Regular activity, team sport 90 min 3 times per week for 20 weeks	A: Self esteem (Self-Esteem Inventory) B: Cardiovascular fitness.	High security risk boys. Compliance not reported	C
Luebke 1977	Cluster - RCT Outcome assessment: unclear Co-intervention: MET Losses to follow-up: unclear Intention-to-treat: unclear	50 healthy third- grade pupils	I: Basic locomotor gymnastics, ball handling, dance, rope-jumping skills C: No instruction Group not included in the analysis: Movements with force absorption, force production, pathways in space and contrasts in movement (n = 23) 30 min, 2 times per week for 13 weeks	A: Self-concept (Piers-Harris Children's Self-Concept Scale) B: Physical fitness (CAHPER fitness-performance test	Compliance not reported	C

MacMahon 1987	RCT Outcome assessment: MET Co-intervention: MET Losses to follow-up: MET Intention-to-treat: unclear	54 children with learning disabilities but normal WISCH-R, aged 7.1 to 12.75 years	I: Distance running, aerobic dance and soccer, HR>160 C: Maze patterns, dodge ball, volleyball, HR<150 25 min, 5 times per week for 20 weeks	A: Self-concept (Piers-Harris Children's Self-Concept Scale) B: Physical fitness (PWC-170, Sjøstrand and Wahlund protocol)	Compliance not reported	B
MacMahon 1988	RCT Outcome assessment: MET Co-intervention: MET Losses to follow-up: NOT MET Intention-to-treat: unclear	98 males from juvenile detention facilities, aged 14 to 18 years	I: Long-distance running and vigorous basketball, HR > 160 C: Less vigorous activity; baseball, volleyball etc, HR < 160 40 min 3 times per week for 3 months	A: Self-concept (Piers-Harris Children's Self-Concept Scale) B: Physical fitness (Submaximal testing with ergometer cycle)	Compliance not reported. Losses to follow-up equal in both groups (30%)	B
Marsh 1988a	Block RCT Outcome assessment: MET Co-intervention: MET Losses to follow-up: MET Intention-to-treat: NOT MET	137 girls, aged 11 to 14 years	I: Aerobics, competitive with individual training C: Social volleyball game 35 min, 14 times during 6 weeks	A: Self-concept (SDQ2) B: Physical fitness (Test and performance of seven exercises)	According to the author: Compliance good	C
Marsh 1988b						D
McGowan 1974	RCT Outcome assessment: unclear Co-intervention: unclear Losses to follow-up: unclear Intention-to-treat: unclear	37 seventh-grade boys with low self-image and sociogram score	I: Success-oriented endurance training (running and competitive activities) C: Regular classes without PE-classes 3 to 4 times per week for 18 weeks	A: Self-concept (Tennessee Self-Concept Scale) B: Cardiovascular fitness (Coopers 12-minute run)	Compliance not reported. Intervention group always won the competitions	B
Munson 1985	RCT Outcome assessment: NOT	31 males from development centre, aged 14 to 18 years	I: Strength training combined with leisure counselling or	A: Self-esteem (Self-Esteem Inventory)	Compliance not reported	C

	MET Co-intervention: MET Losses to follow-up: unclear Intention-to-treat: NOT MET		combined with discussion C: Regular institution programme 90 min, 3 times per week for 6 weeks	B: Muscular fitness		
Munson 1988	RCT Outcome assessment: NOT MET Co-intervention: MET Losses to follow-up: MET Intention-to-treat: NOT MET	26 offenders from a security institution, mean age 17.2 years	I: Strength training, frisbee, golf, volleyball, basketball etc. C: Discussions Group not included in the analysis: Structured procedure about leisure activity thoughts, feeling etc. (n = 13) 1 hour per week for 10 weeks	A: Self-esteem (Self-Esteem Inventory Form B)	Compliance not reported	C
Percy 1981	RCT Outcome assessment: unclear Co-intervention: unclear Losses to follow-up: unclear Intention-to-treat: unclear	30 healthy fifth- and sixth-grade pupils	I: Running C: No intervention 1 mile, 3 times per week for 7 weeks. Decided when to run themselves.	Self-esteem (Coopersmith Self-Esteem Inventory	Compliance not reported	B
Platzer 1976	Cluster RCT. Outcome assessment: MET Co-intervention: MET Losses to follow-up: NOT MET Intention-to-treat: NOT MET	40 preschool children who exhibited deficits in gross motor skills and self-concept, aged 35 to 72 months	Perceptual-motor training ensure success and reinforcement of success C: Regular activity 30 min, 4 times per week for 10 weeks	A: Self-concept (Goodenough's House, Tree, Person Projective Test) B: Gross motor (Cratty Gross Motor Test)	Compliance good according to the author, no measures taken	B
Salukon 1994	Cluster RCT	288 healthy young people,	I: Field hockey (96), sprint	A: Self-consept (Tennessee		C

	Outcome assessment: MET Co-intervention: unclear Losses to follow-up: MET Intention-to-treat: MET	aged 12 to 18 years.	(32), discus (32) or long jump (32) C: No skill training. 45 min, 3 times per week for 10 weeks	Self-Concept Scale) B: Skill in field-hockey (Schmithal and French		
Smith 1982	Stratified randomisation Outcome assessment: MET Co-intervention: MET Losses to follow-up: MET Intention-to-treat: NOT MET	66 healthy third-grade pupils	I: Games avoiding waiting for turn and inactivity C: Free play Group not included in the analysis: Problem-solving for developing skills 30 min, 2 times per week for 8 weeks	A: Self-concept (Martinek-Zaichkowsky Self-Concept Scale) B: Physical performance: (dash, ball-throwing and standing long jump)	Compliance good, according to the author.	C
Smith 1984	Block-RCT Outcome assessment: unclear Co-intervention: MET Losses to follow-up: MET Intention-to-treat: MET	32 healthy pupils, fourth and fifth grade	I: Progressive running C: Ordinary PE class Group not included in the analysis: Progressive yoga (n = 17) 10 weeks	A. Self-concept (Piers-Harris Children's Self-Concept Scale B: Physical fitness (9-minute run, sit-ups, sit and reach	Compliance not described	B
Tuckman 1986	RCT Outcome assessment: MET Co-intervention: MET Losses to follow-up: MET Intention-to-treat: NOT MET	154 healthy pupils fourth to sixth grades	I: Running C: Ordinary PE class 30 min, 3 times per week for 12 weeks	A: Self-concept (Piers-Harris Children's Self-Concept Scale) B: Physical fitness (800m run and 50-m dash)	Compliance good, according to the author.	A

Characteristics of excluded studies

Study ID	Reason for exclusion
Barenholtz 1995	The population was at risk for eating disorder
Berger 1988a	Outcome not self-esteem. Current for another review
Berger 1988b	Intervention period less than 4 weeks
Blackman 1988	Controlled trial, not randomised
Blackwell 1975	The amount of intervention was the same in the control group as in the intervention group.
Brown 1992	Outcome not self-esteem. Current for another review
Cameron 1999	Controlled trial, not randomised. Physical activity not a central part of the intervention
Cohen-Kahn 1994	Outcome not self-esteem. Current for another review
Collingwood 1991	Outcome drug abuse, not self-esteem
Culhane 1979	Controlled trial, not randomised
Dupuis et al 2000	Outcome not self-esteem, but a psychomotor test
Focht 1999	Intervention period less than 4 weeks
Folkins 1972	Controlled trial, not randomised
Föger 1993	Controlled trial, not randomised
Halloway 1988	Controlled trial, not randomised Not relevant outcome measure
Jasnoski 1981	Controlled trial, not randomised. Outcome perceived physical performance, not self-esteem
Kelly 1971	Controlled trial, not randomised. Outcome not self-esteem. Current for another review
Koocher 1971	Controlled trial Intervention period less than 4 weeks
Labbé 1993	Outcome measurements not defined as measure of self-esteem
Leith 1989	Intervention period less than 4 weeks.

Martinek 1978	Controlled trial, not randomised
McEntee 1995	Outcome not self-esteem. Current for another review
Medlyn 1980	Controlled trial, not randomised
Norris 1992	Controlled trial, not randomised. Outcome not self-esteem. Current for an-other review
O'Dea 2000	Physical activity not a central part of the intervention
Ouyang 2001	Outcome not self-esteem. Current for another review
Parker 1995	Intervention period less than 4 weeks.
Pollatschek 1989	Controlled trial, not randomised. Outcome measurement not defined as self-esteem
Roth 1987	Outcome not self-esteem. Current for another review
Silverman 1998	Outcome not self-esteem
Thomas 1975	The intervention not classified as gross-motor, energetic activity
Topp 1989	Outcome not self-esteem. Current for another review
Uzomah 2000	Intervention not defined as gross-motor, energetic activity
Williams 1986	Outcome not self-esteem. Current for another review
Worsley 1987	The same amount of physical activity in all groups

References to studies

Included studies

Alpert 1990

{published and unpublished data}

* Alpert B, Field T, Goldstein S, Perry S. Aerobics enhances cardiovascular fitness and agility in preschoolers. Health Psychology 1990;9(1):48-56.

Basile 1995

{published and unpublished data}

* Basile VC, Motta RW, Allison DB. Antecedent exercise as a treatment for disruptive behavior: Testing hypothesized mechanisms of action. Behavioral Interventions 1995;10:119 - 140.

Bluechardt 1995

{published and unpublished data}

* Bluechardt MHS. Effect of an after-school physical activity program on motor profiency and social skills of learning disabled children aged 8-11 years. Degree to Doctor of Philosophy, Graduate Department of Community Health 1994.

Boyd 1997

{published and unpublished data}

* Boyd KR, Hrycaiko DW. The effect of a physical activity intervention package on the self-esteem of pre-adolescent and adolescent females. Adolescence 1997;32:693-708.

Bruya 1977

{published and unpublished data}

* Bruya LD. Effect of selected movement skills on positive self-concept. Perceptual & Motor Skills 1977;45(1):252-254.

Elstein 1977

{published and unpublished data}

* Elstein AE. Effects of physical education on the physical fitness, sosial adjustment, and self-concept of learning disabled students.. Temple University, Ed.D., Education, special 1977.

Ford 1989

{published and unpublished data}

* Ford HT, Puckett JR, Blessing DL, Tucker L.A. Effects of selected physical activities on health-related fitness and psychological well-being. Psychological Reports 1989;64(1):203-208.

Herman-Tofler 1998

{published and unpublished data}

* Herman-Tofler LR, Tuckman BW. The effects of aerobic training on children's creativity, self-perception, and aerobic power. Child & Adolescent Psychiatric Clinics of North America 1998;7(4):773-790.

Hilyer 1979a

{published and unpublished data}

* Hilyer JC Jr, Mitchell W. Effect of systematic physical fitness training combined with counseling on the self-concept of college students. Journal of Counseling Psychology 1979;26(5):427-436.

Hilyer 1979b {published data only}

Hilyer JC Jr, Mitchell W. Effect of systematic physical fitness training combined with counseling on the self-concept of college students. Journal of Counseling Psychology 1979;26(5):427-436.

Hilyer 1982 {published and unpublished data}

* Hilyer JC, Wilson DG, Dillon C, Caro L, Jenkins C, Spencer, WA, Meadows ME, Booker W. Physical fitness training and counseling as treatment for youthful offenders. Journal of Counseling Psychology 1982;29(3):292-303.

Luebke 1977 {published and unpublished data}

* Luebke LLL. A comparison of the effects of two programs of elementary physical education on the self concept, knowledge of physical activity and physical fitness of third grade children. Dissertation at the Marguette University 1977.

MacMahon 1987 {published and unpublished data}

* MacMahon JR, Gross RT. Physical and psychological effects of aerobic exercise in boys with learning disabilities. Journal of Developmental & Behavioral Pediatrics 1987;8(5):274-277.

MacMahon 1988 {published and unpublished data}

* MacMahon JR, Gross RT. Physical and psychological effects of aerobic exercise in delinquent adolescent males. American Journal of Diseases of Children 1988;142(12):1361-1366.

Marsh 1988a {published and unpublished data}

* Marsh HW, Peart ND. Competitive and cooperative physical fitness training programs for girls: Effects on physical fitness and multidimensional self-concepts. Journal of Sport & Exercise Psychology 1988;10:390-407.

Marsh 1988b {published data only}

Marsh HW, Peart ND. Competitive and cooperative physical fitness training programs for girls: Effects on physical fitness and multidimensional self-concepts. Journal of Sport & Exercise Psychology 1988;10:390-407.

McGowan 1974 {published and unpublished data}

* McGowan RW, Jarman BO, Pederssen DM. Effects of a competitive endurance training program on self-concept and peer approval. The Journal of Psychology 1974;86:57-60.

Munson 1985 {published and unpublished data}

* Munson WW, Baker SB, Lundegren HM. Strength training and leisure counseling as treatments for institutionalized juvenile delinquests. Adapted Physical Activity Quarterly 1985;2:65-75.

Munson 1988 {published and unpublished data}

* Munson WW. Effects of leisure education versus physical activity or informal discussion on behaviorally disordered youth offenders. Adapted Physical Activity Quarterly 1988;5:305-317.

Percy 1981 {published and unpublished data}

* Percy LE, Dziuban CD, Martin JB. Analysis of effects of distance running on self-concepts of elementary students. Perceptual and Motor Skills 1981;52:42.

Platzer 1976 {published and unpublished data}

* Platzer WS. Effect of perceptual motor training on gross-motor skill and self-concept of young children. The American Journal of Occupational Therapy 1976;30(7).

Salukon 1994 {published and unpublished data}

* Salokun SO. Positive change in self-concept as a function of improved performance in sports. Perceptual & Motor Skills 1994;78(3):752-754.

Smith 1982 {published and unpublished data}

* Smith TL. Self-concepts and movement skills of third grade children after physical education programs. Perceptual and Motor Skills 1982;54:1145-1146.

Smith 1984 {published and unpublished data}

* Smith TP. An evaluation of the psychological effects of physical exercise on children. Dissertation Abstracts International 1984;7(44):2260.

Tuckman 1986 {published and unpublished data}

* Tuckman BW, Hinkle JS. An experimental study of the physical and psychological effects of aerobic exercise on schoolchildren. Health Psychology 1986;5(3):197-207.

Excluded studies

Barenholtz 1995 {published and unpublished data}

Barenholtz DE. The effects of an exercise program on the eating behavior, body image and self-esteem of adolescent girls. Dissertation Abstracts International 1995;56(5).

Berger 1988a {published data only}

* Berger BG, Friedmann E, Eaton M. Comparison of Jogging, the Relaxation Response, and Group Interaction for Stress Reduction. Journal og Sport & Exercise Psychology 1988;10:431-447.

Berger 1988b {published and unpublished data}

Berger BG and Owen DR. Relation of low and moderate intensity exercise with acute mood change in college joggers. Perceptual and Motor Skills 1998;87:611-621.

Blackman 1988 {published and unpublished data}

Blackman LA, Hunter G, Hilyer J, Harrison P. The effects of dance team participation on femele adolescent physical fitness and self-concept. Adolescence 1988;23:90.

Blackwell 1975 {published and unpublished data}

Blackwell EH. A comparative study of the effects of inclusive and exclusive physical education activities on the self-concept and selected motor ability components of first-grade students [EDD dissertation]. Hattiesburg, MI, USA: University of Southern Mississippi, 1975.

Brown 1992 {published data only}

* Brown SW, Welsh MC, Labbé EE, Vitulli WF, Kulkarni P. Aerobic Exercise in the Psychological Treatment of Adolescents. Perceptual and Motor Skills 1992;74:555-560.

Cameron 1999 {published and unpublished data}

Cameron JW. Self-esteem changes in children enrolled in weight management programs. Issues in Comprehensive Pediatric Nursing 1999;22:75-85.

Cohen-Kahn 1994 {published and unpublished data}

Cohen-Kahn DD. The effects of a graded mastery weight-training program on depression and overall functioning in inpatient adolescents [disseration]. San Diego: California School of Professional Psychology, 1994.

Collingwood 1991 {published and unpublished data}

Collingwood TR, Reynolds R, Kohl HW, Smith W, Sloan S. Physical fitness effects on substance abuse risk factors and use patterns. J Drug Education 1991;21(1):73-84.

Culhane 1979 {published and unpublished data}

Culhane JC. Physical fitness and self-concept: An investigation of self-concept modification by aerobic conditioning [dissertation]. Washington DC, USA: George Washington University, 1979.

Dupuis et al 2000 {published and unpublished data}

* Dupuis JM, Vivant JF, Daudet G, Bouvet A, Clement M, Dazord A, Dumet N, David M, Bellon G. Entrainement sportif personnalise dans la prise en charge de garcons obeses ages de 12 a 16 ans [Self training in the treatment of teenagers' obesity]. Archives de Pédiatrie 2000;7:1185 - 1193.

Focht 1999 {published and unpublished data}

Focht BC, Koltyn KF. Influence of resistance exercise of different intensities on state anxiety and blood pressure. Medicine and Science in Sports and Exercise 1999;31:456-463.

Folkins 1972 {published and unpublished data}

Folkins CH, Lynch S, Gardner MM. Psychological Fitness as a Function of Physical Fitness.

Archives of Physical Medicine and Rehabilitation 1972;53(11):503 - 508.

Föger 1993 {published and unpublished data}

Föger M, Bart G, Rathner G, Jäger B, Ficher H, Zollner -Neussl D. Körpeliche Aktivität, Ernährungsberatung und psychologische Führung in der Behandlung adipöser Kinder [Exercise, dietary counseling and psychological support in the treatment of obese children: A controlled study over 6 months]. Monatsschrift fur Kinderheilkunde 1993;141(6):491-497.

Halloway 1988 {published and unpublished data}

Halloway JB, Beuter A and Duda JL. Self-Efficacy and Training for Strength in Adolescent Girls. Journal of Applied Social Psychology 1988;18(8):699-719.

Jasnoski 1981 {published and unpublished data}

Jasnoski ML, Holmes DS, Solomon S, Aguiar C. Exercise, Changes in Aerobic Capacity, and Changes in Self-Perceptions: An Experimental Investigation. Journal of research in personality 1981;15:460-466.

Kelly 1971 {published and unpublished data}

Kelly F, Baer DJ. Physical Challenge as a Treatment for Delinquency. Crime and Delinquency 1971;17:437-445.

Koocher 1971 {published and unpublished data}

Koocher GP. Swimming, competence and personality change. Journal of Personality and Social Psychology 1971;18(3):275-278.

Labbé 1993 {published and unpublished data}

* Labbé EE, Welsh C. Children and running: Changes in physical fitness, self-efficacy, and health locus of control. Journal of Sport Behavior 1993;16(2).

Leith 1989 {published and unpublished data}

Leith LM. The effect of various physical activities, outcome, and emotional arousal on subject aggression scores. Int J Sport Psychol 1989;20:57-66.

Martinek 1978 {published data only}

Martinek TJ, Cheffers JT, Zaichkowsky LD. Physical activity, motor development and self-concept: race and age differences. Perceptual & Motor Skills 1978;46(1):147-154.

McEntee 1995 {published and unpublished data}

McEntee DJ. Cognitive group therapy and exercise in the treatment of anxiety and stress. Boston: University of Massachusetts, 1995.

Medlyn 1980 {published and unpublished data}

Medlyn IG. The effect of peer support upon ideal weight attainment and the self-concept of adolescent girls involved in a multidimensional physical education program [dissertation]. Bloomington, IN, USA: Indiana University, 1980.

Norris 1992 {published and unpublished data}

Norris R, Carroll D, Cochrane R. The Effects of Physical Activity and Exercise Training on Psychological Stress and Well-Being in an Adolescent Population. Journal of Psychosomatic Research 1992;36(1):55-65.

O'Dea 2000 {published and unpublished data}

O´Dea JA and Abraham S. Improving the Body Image, Eating Attitudes, and Behaviors of Young Male and Female Adolescents: A New Educational Approach that Focuses on Self-esteem. International Journal of Eating Disorders 2000;28:43-57.

Ouyang 2001 {published and unpublished data}

Ouyang W. The effect of sports training with cognitive therapy about mild depression in university students. Chinese Journal of Clinical Psychology 2002;9(2):112-114.

Parker 1995 {published and unpublished data}

Parker M, Stoltenberg CD. Use of adventure experiences in traditional counseling interventions. Psychological Reports 1995;77:1376-1378.

Pollatschek 1989 {published and unpublished data}

Pollatschek JL, Hagan FJO. An investigation of the psycho-physical influences of a quality daily physical education programme. Health Education Research 1989;4(3):341-350.

Roth 1987 {published and unpublished data}

Roth DL, Holmes DS. Influence of aerobic Exercise Training and relaxation training on physical and psychologic health following stressful life events. Psychosomatic Medicine 1987;49:355-365.

Silverman 1998 {published and unpublished data}

* Silverman SC. The effects of exercise on mood and self-efficacy in emotionally disturbed adolescents. Dissertion Abstracts International 1998;58(9).

Thomas 1975 {published and unpublished data}

Thomas JR, Chissom BS, Stewart C, Shelley F. Effects of Perceptual-Motor Training on Preschool Children: A Multivariate Approach. The research Quartely 1975;46(4):505-513.

Topp 1989 {published and unpublished data}

Topp R. Effects of relaxation or exercise on undergraduates' test anxiety. Perceptual and Motor Skills 1989;69:35-41.

Uzomah 2000 {published and unpublished data}

Uzomah CN. The role of challenge/initiative recreation games as a therapeutic regimen in fostering a positive self-concept for inner-city preschool children [dissertation]. College Park, MD, USA: University of Maryland, 2000.

Williams 1986 {published and unpublished data}

Williams JM, Getty D. Effects of levels of exercise on psychological mood states, physiscal fitness, and plasma beta-endorphin. Perceptual and Motor Skills 1986;63:1099-1105.

Worsley 1987 {published and unpublished data}

Worsley A, Coonan W, Worsley A. The first Body Owner's Programme: An integrated school-based physical and nutrition education programme. Health Promotion 1987;2(1):39-49.

** indicates the primary reference for the study*

Other references

Additional references

Biddle 1993

Biddle S. Children, Exercise and Mental Health. International Journal of Sport Psychology 1993;24:200-216.

Blair 1992

Blair SN, Kohl HW, Gordon NF et al. How much physical activity is good for health? Annual Review of Public Health 1992;13:99-126.

Bouchard 1990

Bouchard C, Shephard RJ, Stephens T, Sutton JR, McPherson BD. Exercise, Fitness and Health: A Consensus of Current Knowledge. Champaign, Illinois: Human Kinetics Publications, 1990.

Calfas 1994

Calfas KJ, Taylor WC. Effects of Physical Activity on Psychological Variables in Adolescents. Pediatric Exercise Science 1994;6:406-423.

Caplan 1964

Caplan G. Principles of Preventive Psychiatry. New York: Basic Books, 1964.

Clarke 2001

Clarke M, Oxman AD. Cochrane Reviewers' Handbook 4.1.4. In: Clarke M, Oxman AD, editor(s). The Cochrane Library. Vol. Issue 4. Oxford: Update Software, 2001.

Coopersmith 1968

Coopersmith S. The antecedents of self-esteem. San Francisco: Freeman, 1968.

Coopersmith 1981

Coopermith S. Self-esteem inventories. Palo Alto, CA, USA: Consulting Psychologist Press, 1981.

Durlak 1997

Durlak JA, Wells AM. Primarly prevention mental health programs for children and adolescents: A meta-analytic review. American Journal of Community Psychology 1997;25(2):115-152.

Egger 1997

Egger M, Davey S, Schneider M, Minder C. Bias in meta-analysis detected by a simple graphical test. British Medical Journal 1997;315:629 - 634.

Ekeland 1999

Ekeland E, Halland B, Refsnes KA et al. Er barn og unge mindre fysisk active nå enn tidligere? [Are Norwegian children and young people less physically active today than previously?]. Tidsskrift for Den Norske Lægeforening 1999;119:2358-62.

Erikssen 1998

Erikssen G, Liestøl K, Bjørnholt J et al. Changes in physical fitness and changes in mortality. The Lancet 1998;352:759-762.

Field 2002

Field T. Personal communication by email to Jane Dennis 2002.

Fitts 1991

Fitts WH. Tennessee Self Concept Scale. Los Angeles: Western Psychological Services, 1991.

Fox 1992

Fox KR. Physical education and the development of children's self-esteem. In: N. Armstrong, editor(s). New Directions in Physical Education. Vol. 2 - Towards a National Curriculum. Champaign, IL: Human Kinetics, 1992:33 - 54.

Fox 2000

Fox KR. Self-esteem, self-perceptions and exercise. International Journal of Sport Psychology 2000;31:228 -240.

Garmezy 1985

Garmezy N. Stress-resistant children: the search for protective factors. In: Stevenson JE, editor(s). Recent research in Developmental Psychopathology. Oxford/New York: Pergamon Press, 1985:Kap. 19.

Goodenough 1926

Goodenough F. Measurement of intelligence by drawings. New York: Harcourt Brace & World, 1926.

Gruber 1986

Gruber J. Physical activity and self-esteem development in children: a meta-analysis. In: Stull G, Eckern H, editor(s). Effects of physical activity on children. Champaign, Illinois: Human Kinetics, 1986:330-48.

Haggerty 1996

Haggerty RJ, Sherrod LR, Garmezy N, Rutter M. Stress, risk and resilience in children and adolescents. Processes, mechanisms and interventions. Cambridge: Cambridge University Press,

1996.

Harter 1983

Harter S. Developmental perspectives on the self-system. In: E.M. Heterington, editor(s). Handbook of Child Psychology. Vol. 4. New York: John Wiley, 1983:275-385.

Harter 1985

Harter S. Competence as a dimension of self-evaluation: Toward a comprehensive model of self-worth. In: R. Leahy, editor(s). The Development of Self. New York: Academic Press, 1985:55-121.

Harter 1985b

Harter S. Self-perception profile for children. Denver: University of Denver, 1985.

Marsh 1983

Marsh HW, Smith ID, Barnes J, Butler S. Self-concept: Reliability, dimensionality, validity, and the measurement of change. Journal of Educational Psychology 1983;75:772-790.

Marsh 2002

Marsh H. Personal communication by email to Jane Dennis 2002.

Martinek 1977

Martinek TJ, Zaichowsky LD. Self-Concept Scale for Children. Jacksonville Florida: Psychologists and Educators Inc, 1977.

Munson 2002

Munson W. Personal communication by letter to Jane Dennis 2002.

Mutrie 1998

Mutrie N, Parfitt G. Physical activity and its link with mental, social and moral health in young people. In: Biddle S, Sallis J, Cavill N, editor(s). Young and Active. London: Health Education Authority, 1998:49-68.

Pate 1995

Pate RR, Pratt M, Blair S et al. Physical activity and public health, a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. Journal of the American Medical Association 1995;273:402-407.

Piers 1984

Piers EV. Piers-Harris Children's Self-Concept Scale: Revised Manual. Los Angeles: Western Psychological Services, 1984.

Platzer 2002

Platzer W. Personal communication by email to Jane Dennis 2002.

Prior 1992

Prior M. Childhood temperament. Journal of Child Psychology and Psychiatry 1992;33:249-79.

Renick 1988

Renick M, Harter S. Manual for the self-perception profile for learning disabled students. Denver: University og Denver, 1988.

Rosenberg 1965

Rosenberg M. Society and the adolescent self-image. Princeton, NJ: Princeton University Press, 1965.

Rutter 1985

Rutter M. Resilience in the Face of Adversity. Protective Factors and Resistance to Psychiatric Disorder. British Journal of Psychiatry 1985;36:459-571.

Salokun 2002

Salokun O. Personal communication by email to Jane Dennis 2002.

Smith 2002

Smith 2002. Personal communication by letter to Jane Dennis 2002.

Sonstroem 1988

Sonstroem RJ, Morgan WP. Exercise and self-esteem: rationale and model. Medicine and science in sports and exercise 1988;21(3):329-337.

Sonuga-Barke 1997

Sonuga-Barke, EJS, Thompson M, Stevenson J, Viney D. Patterns of behaviour problems among pre-school children. Psychological Medicine 1997;27:909-18.

Spence 1997

Spence JC, Poon P. The effect of physical activity on self-concept: a meta-analysis. Alberta Centre for Well-Being (ACWB) Research Update 1997;4(4):http://www.centre4activeliving.ca/Research/ResearchUpdate/1997/WellBeing_June_97.htm.

Thomas 1972

Thomas WL. The Thomas Self-Concept Values Test. Chicago: W. Clement and Jessie V. Stone

Foundation, 1972.

Tuckman 2002

Tuckman B. Personal communication by email to Jane Dennis 2002.

Table of comparisons

Additional tables

01 Exercise only vs no treatment, studies not included in the meta-analysis

Risk of bias	Author	Data presented	Scores intervention	Scores control	Statistical test	Authors conclusions
Low risk of bias						
Moderate risk of bias	Salukon 1999 (Cluster RCT)	Mean and SD	Mean 324.03, SD: 6.18 (n = 192)	Mean: 275.79, SD: 4.76 (n = 96)	Analysis of covariance	The main effect of treatment was statistically significant at p = 0.05
	Tuckman 1986	Adjusted posttest mean	Boys: 63.4 Girls: 62.2 (n = 77)	Boys:63.7 Girls:61.1 (n = 77)	F-ratio intervention vs control: 1.02	No significant differences between groups
High risk of bias	Basile 1995	Results of covariance analysis			ANCONOVA (F (2.54) = 0.29, p = 0.75).	No significant differences between the groups
	Hilyer 1979a	Pre- and posttest scores, and SD for the difference	High self-concept group: 373.84 to 374.95 (SD: 21.55). Low self-concept: 314.19 to 326.81 (SD: 21.00)	High self-concept group: 374.21 to 377.16 (SD = 23.31). Low self-concept group 317.22 to 324.89 (SD = 16.49)	One-way analysis of gain scores	Significant improvement (p < 0.01) in the low-concept group
	Marsh 1988a	Pre- and posttest	4.43 to 4.61	4.45 to 4.48		No significant difference

Additional tables

02 Exercise as a comprehensive intervention vs no treatment, not in the meta-analy

Risk of bias	Author	Data presented	Scores intervention	Scores control	Statistical tests	Authors conclusions
Low risk of bias						
Moderate risk of bias						
High risk of bias	Boyd 1997 (Cluster-RCT)	No				The preadolescent intervention group increased their global self-esteem significantly
	Bruya 1977 (Cluster-RCT)	Mean and SD for postscore	Mean: 60.66, SD: 10.83 (n = 36)	Mean: 59.55, SD: 10.49 (n = 36)	Bartlett-Box p-value	No significant treatment effect
	Elstein 1977 (Cluster-RCT)	Baseline scores and gain scores	I (a): Baseline: 49.545, gain score: 8.212 (SD: 7.153)(n = 33) I(b): Baseline 55.090, gain score: 3.393 (SD: 9.503)	Baseline 58.454, gain score: 0.060 (SD: 7.956) (n = 33)	Analysis of variance of gain scores	Statistical difference of gain scores at $p < 0.001$
	Hilyer 1979b	Pre- and posttest scores, and SD of the difference	High self-concept group: 375 to 378.19(SD = 17.34) Low self-concept 312 to 340.23 (SD = 23.64)	High self-concept group: 374.21 to 377.16 (SD = 23.31). Low-concept group 317.22 to 324.89 (SD = 16.49)	One-way analysis of gain scores	Significant improvement ($p < 0.01$) in the low-concept group
	Luebke 1977 (Cluster-RCT)	Raw scores are not available			Covariance analysis	No significant difference
	Marsh 1988b	Pre- and posttest	4.27 to 4.28	4.45 to 4.48		No significant difference
	McGowan 1974	T-test scores	Significant increase in self-concept ($t = 1.79$, $p < 0.05$)	No significant difference from pre- to posttest		Significant increase in self-concept in the intervention group

	Platzer 1976 (Cluster RCT)	Mean and SD for postscore	Mean: 3.69, SD: 1.10 (n = 13)	Mean: 2.76, SD: 1.36 (n = 13)	One-tailed t-test	The experimental group scores significantly better.

Notes

Unpublished CRG notes

Exported from Review Manager 4.2.3
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Published notes

Amended sections

Cover sheet
Abstract
Background
Criteria for considering studies for this review
Search strategy for identification of studies
Methods of the review
Description of studies
Results
Discussion
Reviewers' conclusions
Acknowledgements
Potential conflict of interest
References to studies
Other references
Additional tables and figures

Contact details for co-reviewers

Mr Frode Heian
BUA, FSM Molde
6407 Molde
NORWAY
Telephone 1: +47 711 21 684
Telephone 2: +47 95916881
E-mail: Frode.Heian@helsenr.no
Secondary address (home):
Storvikvn 10
Molde
NORWAY
6407
Telephone: +47 712 51513

Ms Jo Abbott
Trials Search Coordinator
Cochrane Developmental, Psychosocial and Learning Problems Group
School of Policy Studies University of Bristol
8 Priory Road
Bristol
UK
Telephone 1: +44 117 954 6781
Facsimile: +44 117 954 6756
E-mail: j.abbott@bris.ac.uk
URL: http://www.bris.ac.uk/Depts/CochraneBehav/search/litsearch.html

Mr Kåre Birger Hagen
Norwegian Agency for Health and Social Affairs
P.O. 8054 Dep
0031 Oslo
NORWAY
Telephone 1: +47 24163280
E-mail: kare.birger.hagen@shdir.no

Ms Lena Nordheim
Norwegian Centre for Health Services
P.O 8054 Dep
0031 Oslo
NORWAY
Telephone 1: +47 24163276
E-mail: lena.victoria.nordheim@nchs.no

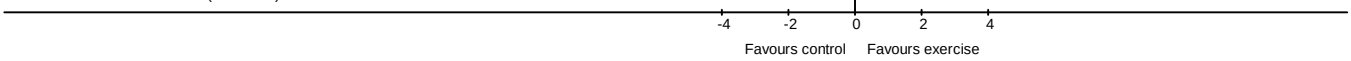
Review: Exercise to improve self-esteem in children and young people

Total number of included studies: 25

Comparison or outcome	Studies	Participants	Statistical method	Effect size
01 Exercise only vs no treatment				
01 Self esteem	8	380	SMD (random), 95% CI	0.49 [0.16, 0.81]
02 Exercise as a part of a comprehensive intervention vs no treatment				
01 Self-esteem	4	161	SMD (random), 95% CI	0.51 [0.15, 0.88]

Review: Exercise to improve self-esteem in children and young people
Comparison: 01 Exercise only vs no treatment
Outcome: 01 Self esteem

Study or sub-category	Exercise N	Exercise Mean (SD)	Control N	Control Mean (SD)	SMD (random) 95% CI	Weight %	SMD (random) 95% CI
01 Low risk of bias							
Alpert 1990	12	12.60(3.80)	12	8.10(2.60)		8.49	1.33 [0.43, 2.23]
Subtotal (95% CI)	12		12			8.49	1.33 [0.43, 2.23]
Test for heterogeneity: not applicable							
Test for overall effect: Z = 2.90 (P = 0.004)							
02 Moderate risk of bias							
Smith 1984	16	60.31(11.90)	16	56.00(16.19)		11.49	0.30 [-0.40, 0.99]
MacMahon 1987	27	80.30(23.00)	27	67.80(28.00)		14.54	0.48 [-0.06, 1.02]
Herman-Tofler 1998	25	3.40(0.53)	25	3.48(0.63)		14.26	-0.14 [-0.69, 0.42]
Subtotal (95% CI)	68		68			40.29	0.21 [-0.17, 0.59]
Test for heterogeneity: Chi² = 2.50, df = 2 (P = 0.29), I² = 20.1%							
Test for overall effect: Z = 1.07 (P = 0.28)							
03 High risk of bias							
Percy 1981	15	65.16(8.37)	15	50.50(12.12)		9.75	1.37 [0.56, 2.18]
MacMahon 1988	32	60.00(12.00)	37	54.90(11.00)		15.94	0.44 [-0.04, 0.92]
Munson 1988	12	19.43(3.61)	14	16.92(3.68)		9.91	0.67 [-0.13, 1.46]
Ford 1989	75	55.35(7.82)	20	54.30(6.60)		15.61	0.14 [-0.36, 0.63]
Subtotal (95% CI)	134		86			51.22	0.57 [0.11, 1.04]
Test for heterogeneity: Chi² = 6.76, df = 3 (P = 0.08), I² = 55.6%							
Test for overall effect: Z = 2.42 (P = 0.02)							
Total (95% CI)	214		166			100.00	0.49 [0.16, 0.81]
Test for heterogeneity: Chi² = 14.94, df = 7 (P = 0.04), I² = 53.1%							
Test for overall effect: Z = 2.95 (P = 0.003)							



Review: Exercise to improve self-esteem in children and young people
Comparison: 02 Exercise as a part of a comprehensive intervention vs no treatment
Outcome: 01 Self-esteem

Study or sub-category	Exercise N	Exercise Mean (SD)	Control N	Control Mean (SD)	SMD (random) 95% CI	Weight %	SMD (random) 95% CI
01 Low risk of bias							
Subtotal (95% CI)	0		0				Not estimable
Test for heterogeneity: not applicable							
Test for overall effect: not applicable							
02 Moderate risk of bias							
Smith 1982	22	18.50(2.91)	22	17.67(4.80)		28.95	0.21 [-0.39, 0.80]
Bluechardt 1995	21	3.50(0.50)	22	3.30(0.40)		28.01	0.43 [-0.17, 1.04]
Subtotal (95% CI)	43		44			56.96	0.32 [-0.11, 0.74]
Test for heterogeneity: Chi² = 0.28, df = 1 (P = 0.60), I² = 0%							
Test for overall effect: Z = 1.47 (P = 0.14)							
03 High risk of bias							
Hilyer 1982	23	18.22(3.87)	20	14.26(3.57)		25.59	1.04 [0.40, 1.68]
Munson 1985	23	19.79(2.06)	8	18.83(3.45)		17.46	0.38 [-0.43, 1.19]
Subtotal (95% CI)	46		28			43.04	0.76 [0.12, 1.40]
Test for heterogeneity: Chi² = 1.57, df = 1 (P = 0.21), I² = 36.5%							
Test for overall effect: Z = 2.31 (P = 0.02)							
Total (95% CI)	89		72			100.00	0.51 [0.15, 0.88]
Test for heterogeneity: Chi² = 3.80, df = 3 (P = 0.28), I² = 21.1%							
Test for overall effect: Z = 2.74 (P = 0.006)