

Exercise in prevention and treatment of anxiety and depression among children and young people (Review)

Larun L, Nordheim LV, Ekeland E, Hagen KB, Heian F



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[Intervention Review]

Exercise in prevention and treatment of anxiety and depression among children and young people

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Editorial group: Cochrane Depression, Anxiety and Neurosis Group.

Publication status and date: Edited (no change to conclusions), published in Issue 1, 2009.

Review content assessed as up-to-date: 22 May 2006.

Citation: Larun L, Nordheim LV, Ekeland E, Hagen KB, Heian F. Exercise in prevention and treatment of anxiety and depression among children and young people. *Cochrane Database of Systematic Reviews* 2006, Issue 3. Art. No.: CD004691. DOI: 10.1002/14651858.CD004691.pub2.

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ABSTRACT

Background

Depression and anxiety are common psychological disorders for children and adolescents. Psychological (e.g. psychotherapy), psychosocial (e.g. cognitive behavioral therapy) and biological (e.g. SSRIs or tricyclic drugs) treatments are the most common treatments being offered. The large variety of therapeutic interventions give rise to questions of clinical effectiveness and side effects. Physical exercise is inexpensive with few, if any, side effects.

Objectives

To assess the effects of exercise interventions in reducing or preventing anxiety or depression in children and young people up to 20 years of age.

Search methods

We searched the Cochrane Controlled Trials Register (latest issue available), MEDLINE, EMBASE, CINAHL, PsycINFO, ERIC and Sportdiscus up to August 2005.

Selection criteria

Randomised trials of vigorous exercise interventions for children and young people up to the age of 20, with outcome measures for depression and anxiety.

Data collection and analysis

Two authors independently selected trials for inclusion, assessed methodological quality and extracted data. The trials were combined using meta-analysis methods. A narrative synthesis was performed when the reported data did not allow statistical pooling.

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Main results

Sixteen studies with a total of 1191 participants between 11 and 19 years of age were included.

Eleven trials compared vigorous exercise versus no intervention in a general population of children. Six studies reporting anxiety scores showed a non-significant trend in favour of the exercise group (standard mean difference (SMD) (random effects model) -0.48, 95% confidence interval (CI) -0.97 to 0.01). Five studies reporting depression scores showed a statistically significant difference in favour of the exercise group (SMD (random effects model) -0.66, 95% CI -1.25 to -0.08). However, all trials were generally of low methodological quality and they were highly heterogeneous with regard to the population, intervention and measurement instruments used. One small trial investigated children in treatment showed no statistically significant difference in depression scores in favour of the control group (SMD (fixed effects model) 0.78, 95% CI -0.47 to 2.04). No studies reported anxiety scores for children in treatment.

Five trials comparing vigorous exercise to low intensity exercise show no statistically significant difference in depression and anxiety scores in the general population of children. Three trials reported anxiety scores (SMD (fixed effects model) -0.14, 95% CI -0.41 to 0.13). Two trials reported depression scores (SMD (fixed effects model) -0.15, 95% CI -0.44 to 0.14). Two small trials found no difference in depression scores for children in treatment (SMD (fixed effects model) -0.31, 95% CI -0.78 to 0.16). No studies reported anxiety scores for children in treatment.

Four trials comparing exercise with psychosocial interventions showed no statistically significant difference in depression and anxiety scores in the general population of children. Two trials reported anxiety scores (SMD (fixed effects model) -0.13, 95% CI -0.43 to 0.17). Two trials reported depression scores (SMD (fixed effects model) 0.10, 95% CI

-0.21 to 0.41). One trial found no difference in depression scores for children in treatment (SMD (fixed effects model) -0.31, 95% CI -0.97 to 0.35). No studies reported anxiety scores for children in treatment.

Authors' conclusions

Whilst there appears to be a small effect in favour of exercise in reducing depression and anxiety scores in the general population of children and adolescents, the small number of studies included and the clinical diversity of participants, interventions and methods of measurement limit the ability to draw conclusions. It makes little difference whether the exercise is of high or low intensity. The effect of exercise for children in treatment for anxiety and depression is unknown as the evidence base is scarce.

PLAIN LANGUAGE SUMMARY

Exercise for preventing and treating anxiety and depression in children and young people

Exercise is promoted as an active strategy to prevent and treat depression and anxiety. We found that the research data are sparse and mostly done on college students. Six small trials indicate that exercise decreases reported anxiety scores in healthy children when compared to no intervention. Five small trials indicate that exercise decreases reported depression scores when compared to no intervention. The research base for children in treatment is scarce; only three small trials investigated the effect of exercise in depression.

BACKGROUND

Psychological problems represent a challenge to modern societies. Depression is the fourth most important disease in the estimation of disease burden (Murray 1996). Prevalence figures are dependent upon case definitions, identification procedures and cultural differences. Sonuga-Barke reports a prevalence of ten to twenty percent for psychological problems in children and adolescents

(Sonuga-Barke 1997). Seven to ten percent of children in the UK are estimated to suffer from moderate to severe mental health problems that impede normal development (Kurtz 1992). Haggerty suggests that there is evidence of a worsening trend, particularly in socially disadvantaged populations (Haggerty 1996). It is suggested that four to seven percent of the child population is in need of psychological treatment (Prior 1992). The stability of problems

seems higher than previously anticipated. Depression and anxiety are the two most common disorders (Crawford 2002).

Psychotherapy, psychosocial and pharmacological interventions are common treatments used for children with depression and anxiety, sometimes incorporating stress management techniques and occasionally physical activity (Biddle 1993, Ekeland 2003). Antidepressants such as selective serotonin reuptake inhibitors (SSRIs), with the exception of fluoxetine, are no longer prescribed for child/adolescent populations and tricyclic antidepressants (TCAs) are not effective. Many common non-drug treatments, such as cognitive behavioral therapy, can be expensive and in short supply (Biddle 2000).

Early intervention, designed to prevent mental illness and to promote good mental health, is an important policy focus. There is an acceptance among medical authorities that physical activity is an important part of healthy living (WHO/ 1995). So far, development in the use of exercise in health promotion and treatment has focused on the impact of exercise on reducing the risk of physical health problems such as cardiovascular diseases, some types of cancer, diabetes, obesity and to a lesser extent muscular-skeletal problems such as low back pain and osteoporosis (Biddle 2000). To date, little attention has been paid to the contribution of exercise in preventing and treating mental disorders, illnesses, and general mental malaise (Biddle 2000). There are several benefits associated with the use of exercise. Exercise is inexpensive, moderate exercise has few negative side effects and might even give positive side effects. Exercise can be self-sustaining, in that the individual can maintain it once the basic skills have been learnt (Crawford 2002).

There is strong evidence that leading a physically active life is beneficial to one's health (Blair 1992; Pate 1995; Erikssen 1998). An increasing body of research on physical activity indicates positive effects on mental health outcomes in adults (Erikssen 1998). A recent Cochrane review indicates a positive effect from physical activity on self-esteem (Ekeland 2003). Similar positive effects on specific problems like depression, anxiety, hyperactivity and conduct problems in children and adolescents have been reported (Biddle 1993; Calfas 1994; Mutrie 1998). However, these reviews have not been updated. Given the existence of new evidence, a current review of the effectiveness of exercise-based intervention in prevention and treatment of anxiety and depression among children and young people is needed.

OBJECTIVES

- (1) To determine whether exercise interventions reduce or prevent anxiety or depression among children and young people compared to other treatments or no treatment.
- (2) If so, what are the characteristics of the most effective interventions?

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials.

Types of participants

Children and young people aged 0 to 20 years, with or without anxiety and depression. Trials involving children and youth with psychotic or borderline conditions, autism, physical handicap, eating disorders or chronic somatic diseases were excluded. All kinds of settings were included.

Types of interventions

Interventions that included vigorous physical activity of clearly specified quality with a minimum duration of four weeks. This could be in addition to routine physical activity such as physical education (PE) classes; walking to school or play-time activities. The control group could be children on a waiting list, a non-intervention group, a low intensity exercise group or a psychosocial intervention group.

Types of outcome measures

Anxiety and depression reported by the individual, health personnel, parent(s) or teacher with a standardised procedure.

Primary outcome:

- (1) Anxiety or depression symptoms post-treatment.
- (2) Prevalence of anxiety or depression.

Studies using state anxiety as the sole outcome measure for anxiety were excluded.

Search methods for identification of studies

We searched MEDLINE Ovid (1966 to 2005), PsycInfo OVID (1887 to 2005), Sport Discus Webspirs (1949 to 2005), CINAHL OVID (1982 to 2005), EMBASE OVID (1980 to 2005), Cochrane Controlled Trials Register (via Wiley, latest issue available) and ERIC Webspirs (1965 to 2005). The electronic search strategies are enclosed (Table 1; Table 2; Table 3; Table 4; Table 5; Table 6; Table 7). References from included studies and relevant reviews were screened for relevant references. Unpublished and on-going trials were requested from authors and field experts.

Data collection and analysis

(1) Study selection - criteria for evaluating eligibility of retrieved studies

Two reviewers (LL and LN) independently reviewed titles and abstracts to identify potentially relevant studies according to the inclusion criteria. Articles and dissertations were retrieved in full-text and the selection criteria were applied by the same reviewers. Consensus was used to solve disagreements concerning the final inclusion of randomised controlled trials (RCTs) and a third reviewer (KBH) was consulted when disagreement persisted.

(2) Quality assessment

The methodological quality of each RCT was independently assessed by two reviewers (LL and LN). The articles were not blinded with respect to authors, institution or journal. Consensus was used to resolve disagreement about quality ratings. A third reviewer (KBH) was consulted if disagreement persisted.

Internal validity was assessed using seven criteria: Generation of allocation sequence, concealment of allocation, co-interventions, baseline comparability, intention-to-treat analysis, losses to follow up and blinding of outcome assessor (Clarke 2001). Blinding of providers and patients was not used as a criterion as it is not applicable for this intervention. The seven criteria were rated as “met”, “unclear” or “not met” (Table 8).

An overall assessment of internal validity was based on a summary of these seven criteria:

- High quality means at least six of the criteria were rated as “met”.
- Moderate quality means that three to five of the criteria were rated as “met”.
- Low quality means that two or less of the criteria were rated as “met”.

(3) Data extraction

Two reviewers (LL and LN) independently collected characteristics, population, intervention, analyses and outcomes from each study using a dedicated extraction form (Table 8). The authors were contacted to obtain missing data. They were requested to confirm methodological rating and data abstraction.

Outcomes were extracted at baseline, post test and follow up if given. When depression and anxiety were measured by more than one instrument, the most common across studies was chosen.

(4) Analysis

Overall effects from the studies with available data were calculated. In studies not providing sufficient data to calculate overall effects, a narrative summary was provided. Since anxiety and depression were continuous outcomes, and were measured with similar, but not identical, instruments across studies, standardised mean differences (SMDs) were calculated using a random effects model. When the analysis was based on one or two studies fixed-effect models were used. The weight given to each study was determined by the precision of its effect estimate. Prevention studies were defined as including children and young people from a

general population, that is, children or young people having no clinical diagnoses and not being treated in a psychiatric setting, such as in-patient psychiatric homes or psychiatric facilities. At-risk populations, such as children or young people with physiological conditions (e.g. obesity), non-clinical depression and juvenile delinquents were also considered as part of the general population. Separate analyses were performed for the following comparisons:

- 01 Exercise versus no intervention - general population
- 02 Exercise versus no intervention - in treatment
- 03 Exercise versus low intensity exercise - general population
- 04 Exercise versus low intensity exercise - in treatment
- 05 Exercise versus psychosocial interventions - general population
- 06 Exercise versus psychosocial interventions - in treatment

Where there were sufficient data, differences in general and at-risk populations were examined in sub-group analyses. Heterogeneity was tested by applying a chi-squared test. When the P value of this test was lower than 0.25, an I-squared statistic was performed. When the I-squared statistic test showed a value greater than 50 %, we considered this to indicate a substantial heterogeneity. A random-effects model was used and the robustness of the results was analysed with sensitivity analyses. Methodological quality, difference in the type, length or period of the intervention or difference in participant characteristics were chosen as explanatory variables.

RESULTS

Description of studies

See: [Characteristics of included studies](#); [Characteristics of excluded studies](#).

In total 16 studies with a total of 1191 participants, published from 1983 to 2005, were included. The included studies were in English. Thirteen were from the United States of America (Beffert 1994, Berger 1988, Brown 1992; Carl 1984; Cohen-Kahn 1995, Goodrich 1984, Hilyer 1982; Jacobs 1984; Kanner 1991; MacMahon 1988, McCann 1984; Roth 1987, Smith 1983), one from Canada (McArthur 1989), one from Chile (Bonhauser 2002) and one from China (Lau 2004).

The majority of the studies were prevention studies (13 studies, 1108 participants). Seven studies included children and young people from a general population (Beffert 1994; Berger 1988; Bonhauser 2002; Goodrich 1984; Jacobs 1984; Roth 1987; Smith 1983). Six studies included children and young people at risk. These participants were recruited from somatic hospitals (Lau 2004; McArthur 1989); from juvenile delinquent institutions (Hilyer 1982; MacMahon 1988); and from special education schools (Carl 1984). One study included university students with moderate depressive symptoms (McCann 1984). Three studies (Brown 1992; Cohen-Kahn 1995; Kanner 1991) included children in treatment (83 participants) recruited from psychiatric in-

stitutions (psychiatric facility, psychiatric in-patients and psychiatric treatment centres respectively).

The intervention included different aerobic exercise such as walking, running, aerobics (12 studies) or weight lifting (4 studies). The intervention period varied from 6 to 40 weeks. Only two studies reported follow-up results at six to eight weeks after the intervention period (Roth 1987; Smith 1983). Vigorous exercise was compared to:

- No intervention: No treatment, waiting list or regular physical activity as provided by the school or institution.
- Low Intensity: Low intensity physical exercise, relaxation classes or yoga.
- Psychosocial interventions: Discussion group or group counselling.

Anxiety was assessed by State-Trait Anxiety Inventory for Children (STAIC), State-Trait Anxiety Inventory for Adults (STAI) in five studies, Hospital Anxiety and Depression Inventory (HADS) in two studies, and Profile of Mood States (POMS) in one study. Depression was assessed by Beck Depression Inventory (BDI) in six studies, Hospital Anxiety and Depression Inventory (HADS) in two studies, Reynold's Adolescent Depression Scale (RADS), Profile of Mood States (POMS), The Multiple Adjective Check List (MAACL), and Children's Depression Inventory (CDI) in one study respectively. As the BDI and STAIC instruments were used in a majority of studies we chose outcome measures based on these scales in the multiple instrument studies.

The effort of contacting authors to obtain missing data proved difficult. In many cases the addresses given were outdated and none of the authors responded to our requests.

Risk of bias in included studies

None of the studies were rated as high quality, which was defined as studies meeting at least six of the seven criteria for internal validity (generation of allocation sequence, concealment of allocation, co-interventions, baseline comparability, intention-to-treat analysis, losses to follow up and blinding of outcome assessor). Four studies (Kanner 1991; McArthur 1989; Smith 1983, Bonhauser 2002) were rated as moderate quality as they met three or four of the seven criteria. The remainder of the studies (Beffert 1994; Berger 1988; Brown 1992; Carl 1984; Cohen-Kahn 1995; Goodrich 1984; Hilyer 1982; Jacobs 1984; MacMahon 1988; McCann 1984; Roth 1987) were rated as low quality as they met less than three of the criteria. None of the studies had sufficient information about the randomisation procedure (concealment and generation of allocation), except one (Goodrich 1984) who reported generation of allocation. Details about the quality ratings are provided in a separate table (Table 9).

Effects of interventions

Study selection

Sixteen studies were included in the final analyses. Our search identifies of 3665 different titles. The number of articles which were obtained in hard copy was 156, of which 129 were excluded. Of the remaining 27, seven studies were excluded (Table 2) and four were awaiting assessment (Cao 2002; He 2002; Ouyang 2001; Silverman 1998).

Effect of physical exercise on anxiety and depression

Comparison 01 Exercise versus no intervention - general population

Anxiety

Five studies of low quality (Berger 1988; Carl 1984; Hilyer 1982; Jacobs 1984; Roth 1987) and one of moderate quality (Smith 1983) (with a total of 339 children) showed a borderline statistically significant difference ($P = 0.05$) in favour of the treatment group (SMD (random effects model) -0.48, 95% CI -0.97 to 0.01). The intervention consisted of vigorous physical activity lasting at least three times a week for six to twenty weeks.

However, the I-squared test indicated a substantial heterogeneity between the trials (I-squared = 76.1%). Since the participants could be considered as somewhat heterogeneous, we did a sensitivity analysis on the studies with non-risk participants only (Berger 1988; Carl 1984; Jacobs 1984; Smith 1983). The overall effect was somewhat lower (SMD (random effects model) -0.32, 95% CI -0.73 to 0.09) (Figure 01), but there was still a substantial heterogeneity (I-squared = 52.9%). For the two studies with children at risk (Hilyer 1982; Roth 1987) the sensitivity analysis showed a statistically significant difference ($P = 0.001$) in favour of treatment (SMD (fixed effects model) -0.79, 95% CI -1.27 to -0.31) (Figure 02) but the I-squared indicates the possibility of greater heterogeneity (I-squared = 91.4%). Since participants' characteristics could not explain heterogeneity, we did another sensitivity analysis for the intervention type. Because there might have been a difference in effect between aerobic exercise and strength training, we made an analysis where the intervention group receiving weight training (Jacobs 1984) or aerobic exercise and weight training combined (Hilyer 1982) were excluded. This did not significantly change the results (SMD (random effects model) -0.19, 95% CI -0.44 to 0.06) (Figure 03) but the I-squared test indicates homogeneity (I-squared = 0 %). The one study (44 participants, Jacobs 1984) using weight training as exercise intervention found a statistically significant difference ($P = 0.002$) in favour of the treatment group (WMD (fixed effects model) -7.46, 95% CI -12.24 to -2.68) (Figure 04).

Two studies could not be included in the overall analysis due to lack of data reporting. One study of moderate quality (Bonhauser 2002), with 198 participants, found a significant decrease in anxiety scores in the exercise group (score difference -0.94, 95% CI -1.43 to -0.43, $P = 0.000$). Another study of low quality (Lau 2004), with 37 obese participants, found no statistical difference in anxiety score.

Two studies (Roth 1987; Smith 1983) reported results at six to eight weeks follow up. There was no evidence of enduring benefits ($P = 0.22$) of exercise on anxiety symptoms (SMD (fixed) -0.32 , 95% CI -0.83 to 0.19).

Depression

The overall results from five studies of low quality (Beffert 1994; Berger 1988; Goodrich 1984; Hilyer 1982; Roth 1987), including 145 participants, showed a statistically significant difference ($P = 0.03$) in favour of the intervention group (SMD (random effects model) -0.66 , 95% CI -1.25 to -0.08) at post-treatment. Four of the interventions were fitness training (Beffert 1994; Berger 1988; Hilyer 1982; Roth 1987), while one used weight training (Goodrich 1984).

However, the I-squared test indicated a substantial heterogeneity between the trials (I-squared = 80%). Since the participants could be considered as somewhat heterogeneous, we did a sensitivity analysis on the studies with non-risk participants only (Berger 1988; Goodrich 1984). The overall effect shows a tendency in favour of exercise (SMD (fixed-effect model) -0.20 , 95% CI -0.48 to 0.08) (Figure 05) but still shows heterogeneity (I-squared = 54.9%). For the three studies including children at risk (Beffert 1994; Hilyer 1982; Roth 1987) the overall effect was somewhat lower (SMD (fixed effects model) -0.08 (95% CI -0.47 to 0.31) (Figure 06) and there was still heterogeneity (I-squared = 67.9%). Since participants' characteristics could not explain heterogeneity, we did another sensitivity analysis for intervention type. Because there might be a difference in effect between aerobic exercise and strength training, we made an analysis based on studies with aerobic exercise interventions only (Berger 1988; Roth 1987) (Figure 07). This changed the significance of the results (SMD (fixed effects model) -0.11 , 95% CI -0.40 to 0.18) but the I-squared test indicates homogeneity (I-squared = 0%). The one study (44 participants, Goodrich 1984) using weight training as exercise intervention found a statistically significant difference ($P = 0.04$) in favour of the treatment group (WMD (fixed effects model) -3.64 , 95% CI -7.12 to -0.16) (Figure 08).

One study could not be included in the overall analysis due to lack of reporting of data (McCann 1984). The study (43 participants) indicated that aerobic exercise gave a significant greater decrease in depression ($P = 0.05$) than in the placebo group.

At the eight week follow-up results, one study (Roth 1987), with 28 participants, showed no statistically significant difference ($P = 0.10$) in favour of the intervention group (SMD (fixed) -0.65 , 95% CI -1.42 to 0.12).

Comparison 02 Exercise versus no intervention- children in treatment

Depression

One study of low quality (Brown 1992), with 11 participants, showed no statistically significant difference ($P = 0.2$) in favour of the control group (SMD (fixed) 0.78 , 95% CI -0.47 to 2.04). The intervention consisted of aerobic exercise.

Comparison 03 Exercise versus low intensity exercise/relax-

ation- general population

Anxiety

Three studies (Berger 1988; Roth 1987; Smith 1983), with a total of 215 participants, compared vigorous exercise with other kinds of low intensity exercise for anxiety. Two of the studies were of low quality (Berger 1988; Roth 1987) and one study was of moderate quality (Smith 1983). There was no statistically significant difference ($P = 0.29$) between the control and the intervention group after 10 to 12 weeks of training (SMD (fixed) -0.14 , 95% CI -0.41 to 0.13).

There was no statistically significant difference ($P = 0.31$) in the two studies with 66 participants (Roth 1987; Smith 1983) reporting results at six to eight weeks after the intervention period (SMD (fixed) -0.25 , 95%CI -0.73 to 0.23).

Depression

Two studies (Berger 1988; Roth 1987) of low quality, including 182 participants, found no significant difference ($P = 0.31$) between the two comparison groups (SMD (fixed) -0.15 , 95% CI -0.44 to 0.14). One follow-up study (eight weeks after the intervention), with 16 participants, (Roth 1987) found no statistically significant difference ($P = 0.11$) between the two interventions (SMD (fixed) -0.58 , 95% CI -1.27 to 0.12). The intervention comprised aerobic exercise such as walking or running.

Comparison 04 Exercise versus low intensity exercise/relaxation- children in treatment

Depression

Depression score in the two studies (Kanner 1991; Cohen-Kahn 1995) of moderate and low quality respectively, and a total of 70 participants, showed no statistically significant difference ($P = 0.2$) between treatment and control group after an intervention period of eight weeks (SMD (fixed) -0.31 , 95%CI -0.78 to 0.16). The intervention comprised aerobic exercise (Kanner 1991) or weight lifting (Cohen-Kahn 1995).

Comparison 05 Exercise versus psychosocial interventions-general population

Anxiety

Two studies of low quality, including a total of 173 participants (Carl 1984; Berger 1988), examined change in anxiety scores when vigorous physical exercise was compared to group counselling and discussion. There was no statistically significant difference ($P = 0.39$) between the groups (SMD (fixed) -0.13 , 95% CI -0.43 to 0.17). The intervention comprised aerobic exercise, such as running or walking.

Depression

Two studies with respectively low (Berger 1988) and moderate (McArthur 1989) quality scores, including a total of 161 participants, compared exercise with psychosocial interventions. By the end of treatment no significant statistically difference ($P = 0.53$) was found between the groups (SMD (fixed) 0.10 , 95% CI -0.21 to 0.41). The intervention was aerobic exercise.

Comparison 06 Exercise versus psychosocial interventions-children in treatment

Depression

One study (Kanner 1991) of moderate quality, with 53 participants, examined the effect on depression when exercise was compared with recreational therapy. By the end of treatment no significant statistically difference ($P = 0.35$) was found between the groups (SMD (fixed) -0.31, 95% CI -0.97 to 0.35).

DISCUSSION

Exercise may reduce mean depression and anxiety scores in the general population of children and young people. However, the studies are generally of low methodological quality and they are highly heterogeneous with regard to the population, intervention and measurement instruments investigated. It makes little difference whether the exercise is of high or low intensity. When vigorous exercise was compared to low intensity exercise or psychosocial interventions no difference in anxiety and depression scores was found.

The evidence for the effect of exercise on children receiving psychiatric treatment is scarce. The three trials included in the review investigated depression scores only; no trials had anxiety as an outcome measure. Only two studies (Roth 1987; Smith 1983) included follow up at six to eight weeks after the intervention ended, which is a major limitation. Given the very small number of studies it is impossible to state whether vigorous exercise would be more effective than low intensity exercise or psychosocial interventions. The majority of the included studies have an age group of 16 years old, or older, which means that the evidence base is even more scarce for children less than 16 years of age.

The present review does not provide strong evidence for any of the comparisons. All but four (Bonhauser 2002; Kanner 1991; McArthur 1989; Smith 1983) of the included studies were of low quality and none calculated power. We found two randomised controlled trials (Bonhauser 2002; Lau 2004) published after the year 2000; the majority of the included studies are dissertations older than 15 years. This may indicate a general belief in the effect of physical exercise. According to a published protocol in The Cochrane Library (Lawlor 2000) the effect of exercise on depression has been the subject of research for several decades and is anticipated by a number of researchers and clinicians to be effective in the treatment of depression. This might be the case for adults, but we have not been able to support this assertion in children and young people. A recent systematic review (Strong 2005), which includes multiple study designs, found no RCTs but states that quasi-experimental trials show a strong positive association between physical activity and improved anxiety and depression scores.

There were no follow-up data to demonstrate the extent to which the effects of programmes were maintained over longer periods

of time. Only two small studies reported follow-up results, which meant that we, to date, cannot tell whether there is an enduring effect of exercise or not. None of the studies included factors indicating the degree of fun or enthusiasm among participants in the programmes. Anxiety and depression were measured using instruments that are well accepted and reasonably well tested for reliability and validity. The majority of the studies were rated with low quality scores. The main weaknesses were the absence of information about randomisation methods and allocation concealment, blinding of researchers when collecting outcome measures and intention-to-treat analyses. Two studies could not be entered in the meta-analysis due to insufficient reporting of effect estimates. It is surprising that this was two relatively new studies, published in 21st Century. There is a possibility that the studies would have been rated higher on the quality score if we had managed to obtain data for the authors, but our efforts proved unsuccessful.

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 heart rate limit for activity in the control group. This means that the possible treatment effect of exercise might be underestimated in this review. However, it is questionable whether pooling studies in meta-analyses is appropriate in this review. There were differences in participants, types of interventions and methods of measurements across studies, and the test for heterogeneity was significant in all comparisons. Sensitivity analyses could only be performed for one of the comparison (exercise versus no intervention in a general population), as the number of studies was low in the other comparisons. Interestingly, the sensitivity analysis showed absolute homogeneity when pooling studies with the same type of intervention. This did not alter the overall effect estimate for anxiety, but changed the significance of the results for depression.

Current guidelines on identification and management of depression in children and young people suggest regular exercise as part of the intervention (Nice 28-2005). There are Cochrane reviews looking at pharmacological (Hazell 2002, Hetrick 2004), psychological and educational (Merry 2004), or psychotherapy interventions (Watanabe 2004). None of these explicitly state if physical exercise is used in addition to either of the treatments. It would be interesting to see head to head comparisons with and without physical exercise, i.e. cognitive-behavioural therapy combined with exercise versus cognitive-behavioural therapy alone.

AUTHORS' CONCLUSIONS

Implications for practice

Whilst there appears to be a small effect in favour of exercise in reducing depression and anxiety scores in the general population of children and adolescents, the small number of studies included and

the clinical diversity of participants, interventions and methods of measurement limit the ability to draw conclusions. Exercise is a much less expensive intervention than those currently applied by many practitioners. It makes little difference whether the exercise is of high or low intensity. There is insufficient evidence to say whether aerobic or weight training is the better way to exercise. For children and young people in treatment the evidence is scarce. Since exercise has no known negative effects, and has many positive effects on somatic health, it might be an important instrument in improving children and young peoples emotional health.

Implications for research

This review reflects the paucity of rigorous research evaluating the effectiveness of exercise on anxiety and depression in children and young people. The field needs to be further investigated by well-designed randomised controlled trials, and there is a need for

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. Furthermore, future studies should focus on children under the age of 16, as the majority of studies have included university and college students. Differences in effects due to type and intensity of exercise interventions should be explored. Additional studies are needed to compare in head to head trials the relative efficacy of exercise as an adjunct to or in comparison with cognitive-behavioural therapies. The authors recommend that additional studies of this kind be undertaken.

ACKNOWLEDGEMENTS

Thanks to the Cochrane Collaboration Depression, Anxiety and Neurosis Group editorial team, for her help and support. Thanks to Andy Oxman for his enthusiasm and inspiration.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [ordered by study ID]

Beffert 1994

Methods	Randomised controlled trial. Baseline assessment shows differences between groups in aerobic capacity and weight in favour of exercise group. Blinding of assessor not reported. Co-intervention unclear. Losses to follow-up greater than 20% in control group (21, 4%)
Participants	26 schoolboys and -girls, 12-15 years, with moderate depressive symptoms according to RADS (< 75). Students were excluded if they were: Categorised with severe depression, currently treated for depression, restricted from participation in aerobic exercise, no written parental consent
Interventions	Walking-running program and strengthening exercises 20 minutes three times per week for six weeks. Control group: Waiting list. Compliance not reported
Outcomes	Depressive symptoms after intervention (6 weeks) measured by RADS (4 factors subscales= dysphoric mood, anhedonia (negative affect), negative self-evaluation, somatic complaints)
Notes	Sample pool consisted of 627 students. Screening done twice to eliminate situational or transitional mood disorders

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Berger 1988

Methods	Randomised trial to intervention groups, control were randomly cluster allocated. Participants show similarity at baseline. Blinding of assessor not reported. Co-intervention unclear. Overall losses to follow-up more than 20% in the jogging (21, 4%) and discussion group (27%). Intention-to-treat not done
Participants	387 healthy university students, mean age 20. Students were voluntarily enrolled and excluded if they had physical disabilities, were unavailable at group meetings, had high score on social desirability or low adherence to interventions
Interventions	Aerobic exercise consisting of jogging 20 minutes 3 times a week for 12 weeks. Control groups: 1) Relaxation group consisting of meditation 20 min at least 5 times a week. 2) Discussion group 75 minutes a week in self selected health projects 3) No intervention. Compliance not reported
Outcomes	Anxiety and depression after intervention (12 weeks) measured by POMS (Profile on Mood States)
Notes	

Risk of bias

Berger 1988 (Continued)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Bonhauser 2002

Methods	Cluster-randomised trial, 4 school-classes unit of randomisation. Baseline assessment shows no differences between groups. Blinding of assessor not reported. Co-intervention avoided. Losses to follow-up 8% and 7% in exercise group and control group respectively. ITT-analysis performed	
Participants	Four ninth grade classes (mean age approx 15 years) with a total of 198 healthy students	
Interventions	90 min sessions consisting of stretching, dynamic movement of large muscle groups, and sports practice of participants' choice (e.g. basketball, aerobics) three times a week for 40 weeks during one school-year. Control group: Standard exercise class for 90 min once a week	
Outcomes	Anxiety and depression symptoms at the end of the schoolyear measured by HADS (Hospital Anxiety and Depression Scale)	
Notes	Cluster randomisation (school classes), but analyses performed on individual level	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Brown 1992

Methods	Randomised controlled trial. Baseline assessment shows differences between groups in depression, anxiety, heart rate, and activity level in favour of control group. Blinding of assessor not reported. Co-intervention unclear. Losses to follow-up greater than 50% in both groups	
Participants	11 boys and -girls in psychiatric facility (mean age at baseline 15.6), with primary diagnosis dysthymia and conduct disorder. Patients were excluded if they had no written parental consent	
Interventions	Running/aerobic exercise program three times per week combined with regular scheduled physical activity for 9 weeks. Control subjects: Regular scheduled physical activity classes	
Outcomes	Depressive symptoms after intervention (9 weeks) measured by BDI and anxiety measured by POMS Tension-Anxiety scale	
Notes		

Risk of bias

Brown 1992 (Continued)

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Carl 1984

Methods	Cluster randomised trial. Participants show similarity at baseline. Blinding of assessor not reported. Co-intervention unclear. Overall losses to follow-up less than 20% (17%), but no numbers of distribution between groups. Intention-to-treat not done	
Participants	68 special education schoolboys and -girls , 11-14 years old. Students were excluded if written parental consent was not obtained	
Interventions	Aerobic exercise consisting of jogging/walking, 30 minutes 3 times a week for 9 weeks. Control group: 1) Group counselling, 2) Arts and crafts instruction, 3) No treatment. Compliance not reported	
Outcomes	State anxiety after intervention (9 weeks) measured by STAITC (Spielberger Trait-state Anxiety Inventory for Children)	
Notes		

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Cohen-Kahn 1995

Methods	Randomised controlled trial. Participants show similarity at baseline. Blinding of assessor not reported. Co-intervention unclear. Losses to follow-up not reported, only stated by author as high due to heavy rainfall during the intervention period	
Participants	19 psychiatric inpatients, 12-18 years, including mood disorders and conduct disorders. Patients were excluded if medical history implied high risk for injury	
Interventions	Individualised outdoor weight training program 60 minutes three times per week for eight weeks. Control group: Same program, but below recommended intensity level	
Outcomes	Depression after intervention (8 weeks) measured by Beck Depression Inventory (BDI)	
Notes		

Risk of bias

Item	Authors' judgement	Description
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Cohen-Kahn 1995 (Continued)

Allocation concealment?	Unclear	B - Unclear
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Goodrich 1984

Methods	Randomised trial, control group adjusted to match numbers in intervention group. Higher proportion of athletic lifestyle in exercise group at baseline. Blinding of assessor not reported. Co-intervention unclear. Overall losses to follow-up less than 20% in the intervention (12%) and control group (13%). Intention-to-treat not done
Participants	56 healthy university students volunteered. Mean age for the 44 students who completed the study was 19.9 years. No explicit exclusion criteria given
Interventions	Exercise group: Two extra weight training sessions per week in addition to regular class session once a week, 20-25 minutes for eight weeks. Control groups: Regular class session once a week. Compliance not reported
Outcomes	Depression after intervention (8 weeks) measured by MAACL (Multiple Affect Adjective Check List)
Notes	Those in the control group who had undertaken an aerobic exercise program on their own were eliminated from the study

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Hilyer 1982

Methods	Randomised controlled trial. Blinding of assessor not reported. Losses to follow-up greater than 20% in both groups (I: 23%, C: 33%)
Participants	43 male juvenile delinquents in a state industrial school (mean age approx 17), with at least 20 weeks left of rehabilitation
Interventions	1 ½ hours physical fitness training three times weekly for 20 weeks with a physical fitness counsellor. Control subjects: Regular physical education program provided by the institution
Outcomes	Depression after intervention (20 weeks) measured by Becks' Depression Inventory (BDI) and anxiety measured by Spielberger Trait-state Anxiety Inventory (STAI)
Notes	

Risk of bias

Item	Authors' judgement	Description
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Hilyer 1982 (Continued)

Allocation concealment?	Unclear	B - Unclear
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Jacobs 1984

Methods	Quasi randomised trial. Participants show similarity at baseline. Blinding of assessor not reported. Co-intervention unclear. Losses reported to 12 %
Participants	44 university students participating in a weight training course, mean age 19,71
Interventions	Restricted exercise stations and aerobic weight training, 25 minutes, two times pr week for 8 weeks in addition to ordinary course. Control group: Ordinary course only
Outcomes	Trait anxiety after intervention (8 weeks) measured by State-Trait Anxiety Inventory
Notes	Control group participants taking part in physical activities were removed from the subject pool. . Of the remaining control subjects, a number equal to the number of experimental subjects was randomly selected to act as the comparison control group

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

Kanner 1991

Methods	Randomised controlled trial. Participants show similarity at baseline. Blinding of assessor not reported. Co-intervention unclear. Overall loss to follow-up 22%
Participants	53 children at a psychiatric treatment centre, mean age 13.32. Children were excluded if they had any physical illness or no written parental consent was obtained
Interventions	High intensity exercise (aerobic) group (70-85% of maximum heart rate) for 60 min three times per week for 8 weeks. Low intensity group (non-aerobic, below 40% of maximum heart rate) otherwise same as high intensity group. Control group: Recreational therapy
Outcomes	Depression after intervention (8 weeks) measured by Children's Depression Inventory
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Lau 2004

Methods	Randomised controlled trial. Baseline assessment shows no differences between groups. Blinding of assessor not reported. Co-intervention avoided. Losses to follow-up and Intention to treat not reported, but identical number at baseline and post-test	
Participants	37 patients in a paediatric obesity clinic, age range 10-17.	
Interventions	60 min resistance training (circuit) on a level of 70-85 % of 1RM tailored individually, three times per week for six weeks in a combination with a diet program. Control group: Diet program only	
Outcomes	Anxiety and depression symptoms measured by HADS (Hospital Anxiety and Depression Scale)	
Notes		
<i>Risk of bias</i>		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

MacMahon 1988

Methods	Quasi-randomised controlled trial. Baseline characteristics only given on age and time of incarceration. Assessor not blinded. Co-intervention unclear. Losses to follow-up 30%	
Participants	69 male juvenile delinquents in detention facilities, mean age 16,3	
Interventions	Aerobic exercise group: 40 minutes of high intensity exercise (heart rate above 160 beats per minute) three times a week for 12 weeks. Control group: Low intensity exercise (heart rate not exceeding 120 beats per minute), otherwise same as aerobic exercise group	
Outcomes	Depression after treatment (12 weeks) measured by Beck's Depression Inventory	
Notes		
<i>Risk of bias</i>		
Item	Authors' judgement	Description
Allocation concealment?	No	C - Inadequate

McArthur 1989

Methods	Randomised controlled trial. Participants show similarity at baseline, but BDI score higher in intervention and no information of age and gender between groups. Blinding of assessor not reported. Co-intervention used similarly. No losses to follow-up	
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McArthur 1989 (Continued)

Participants	33 children referred to a hospital weight control clinic, mean age 13.2. Included children were more than 20% overweight with no medical abnormalities and not currently affected by major psychological or family problems	
Interventions	Aerobics 45-70 minutes for twelve weeks on an average of 4 times per week. Control group: Leisure skill development to help participants make better use of their leisure time provided by a recreational therapist. Both groups received additional sessions on nutritional education and behavioural modification	
Outcomes	Depression measured by Beck's Depression Inventory.	
Notes		
<i>Risk of bias</i>		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

McCann 1984

Methods	Randomised controlled trial. Baseline data for depression only. Assessor not blinded. Co-intervention unclear. Losses to follow-up met (6%, 6.6% and 12.5% in the intervention, relaxation, and control group respectively)	
Participants	43 female university students with moderate depressive symptoms according to BDI (< 11), mean age not stated	
Interventions	Rhythmical aerobic exercise 1 hr twice per week. In addition subjects were required to exercise outside of class at least to the point of achieving a total (including class exercise) of 30 aerobic points a week (Cooper). They were told that physical exercise reduced stress. Control group: Waiting-list. Compliance not reported	
Outcomes	Depression after treatment 10 weeks measured by Beck's Depression Inventory	
Notes		
<i>Risk of bias</i>		
Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Roth 1987

Methods	Randomised controlled trial. Sufficient baseline data. Assessor not blinded. Overall losses to follow-up 15% (21.5%, 9.5% and 14% in the intervention, relaxation, and control group respectively)
Participants	55 university students (27 males) with a high number of negative life events according to Life Experience Survey and not participating in physically activity or relaxation classes. Mean age 18.9
Interventions	Individualised walking-running program at approximately 75% of maximum heart rate for 11/2 mile for 30 minutes, three times a week for 11 weeks. Control group: 1) Relaxation training (same intensity as intervention group). 2) No treatment. Mean attendance was 23.1 (SD = 3.0) and 24.8 (SD = 2.4) of 29 meetings in intervention and relaxation group respectively
Outcomes	Depression and anxiety after intervention (11 weeks) and follow-up (8 weeks) measured by Beck's Depression Inventory and Spielberger Trait Anxiety Inventory
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Smith 1983

Methods	Randomised controlled trial. Sufficient baseline data. Assessor not blinded. Losses to follow up 7, 5% (distribution between groups not given)
Participants	49 4th and 5th grade elementary school children (16 males). Parental consent obtained
Interventions	Jogging progressively increasing from 5 to 20 min, three times a week for 10 weeks. Control group: 1) Yoga, same intensity as jogging group 2) No treatment. All participants took part in regular physical education classes (once a week)
Outcomes	Anxiety after intervention (10 weeks) and at follow-up (6 weeks) measured by Spielberger State-Trait Anxiety Inventory
Notes	

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Unclear	B - Unclear

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Baron 1993	Not relevant intervention.
Cai 2000	Not relevant intervention.
Lankford	Not relevant study design.
Noval	Not relevant study design.
O'Connor 1995	Not relevant outcome measure.
Rueter 1980	Participants < 20 years
Stawicki 1997	Not relevant intervention

DATA AND ANALYSES

Comparison 1. Exercise versus no intervention - general population

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Anxiety	6		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
1.1 Post-treatment	6	339	Std. Mean Difference (IV, Random, 95% CI)	-0.48 [-0.97, 0.01]
1.2 Follow-up 6-8 weeks	2	60	Std. Mean Difference (IV, Random, 95% CI)	-0.32 [-0.83, 0.19]
2 Depression	5		Std. Mean Difference (IV, Random, 95% CI)	Subtotals only
2.1 Post-treatment	5	302	Std. Mean Difference (IV, Random, 95% CI)	-0.66 [-1.25, -0.08]
2.2 Follow-up 8 weeks	1	28	Std. Mean Difference (IV, Random, 95% CI)	-0.65 [-1.42, 0.12]

Comparison 2. Exercise versus no intervention - in treatment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Depression post-treatment	1	11	Std. Mean Difference (IV, Fixed, 95% CI)	0.78 [-0.47, 2.04]

Comparison 3. Exercise versus low intensity exercise/relaxation -general population

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Anxiety	3		Std. Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Post-treatment	3	215	Std. Mean Difference (IV, Fixed, 95% CI)	-0.14 [-0.41, 0.13]
1.2 Follow-up 6-8 weeks	2	66	Std. Mean Difference (IV, Fixed, 95% CI)	-0.25 [-0.73, 0.23]
2 Depression	2		Std. Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Post-treatment	2	182	Std. Mean Difference (IV, Fixed, 95% CI)	-0.15 [-0.44, 0.14]
2.2 Follow-up 8 weeks	1	33	Std. Mean Difference (IV, Fixed, 95% CI)	-0.58 [-1.27, 0.12]

Comparison 4. Exercise vs low intensity exercise/relaxation - in treatment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Depression	2		Std. Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Post-treatment	2	70	Std. Mean Difference (IV, Fixed, 95% CI)	-0.31 [-0.78, 0.16]

Comparison 5. Exercise versus psychosocial interventions - general population

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Anxiety	2		Std. Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Post-treatment	2	173	Std. Mean Difference (IV, Fixed, 95% CI)	-0.13 [-0.43, 0.17]
2 Depression	2		Std. Mean Difference (IV, Fixed, 95% CI)	Subtotals only
2.1 Post-treatment	2	161	Std. Mean Difference (IV, Fixed, 95% CI)	0.10 [-0.21, 0.41]

Comparison 6. Exercise versus psychosocial interventions - in treatment

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Depression	1		Std. Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.1 Post-treatment	1	36	Std. Mean Difference (IV, Fixed, 95% CI)	-0.31 [-0.97, 0.35]

Comparison 7. Sub group analysis population characteristics

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Anxiety - non-risk population	4	260	Std. Mean Difference (IV, Random, 95% CI)	-0.32 [-0.73, 0.09]
2 Anxiety - at risk	2	79	Std. Mean Difference (IV, Fixed, 95% CI)	-0.79 [-1.27, -0.31]
3 Depression - non-risk population	2	197	Std. Mean Difference (IV, Fixed, 95% CI)	-0.20 [-0.48, 0.08]
4 Depression - at risk	3	107	Std. Mean Difference (IV, Fixed, 95% CI)	-0.08 [-0.47, 0.31]

Comparison 8. Sub group analysis type of intervention

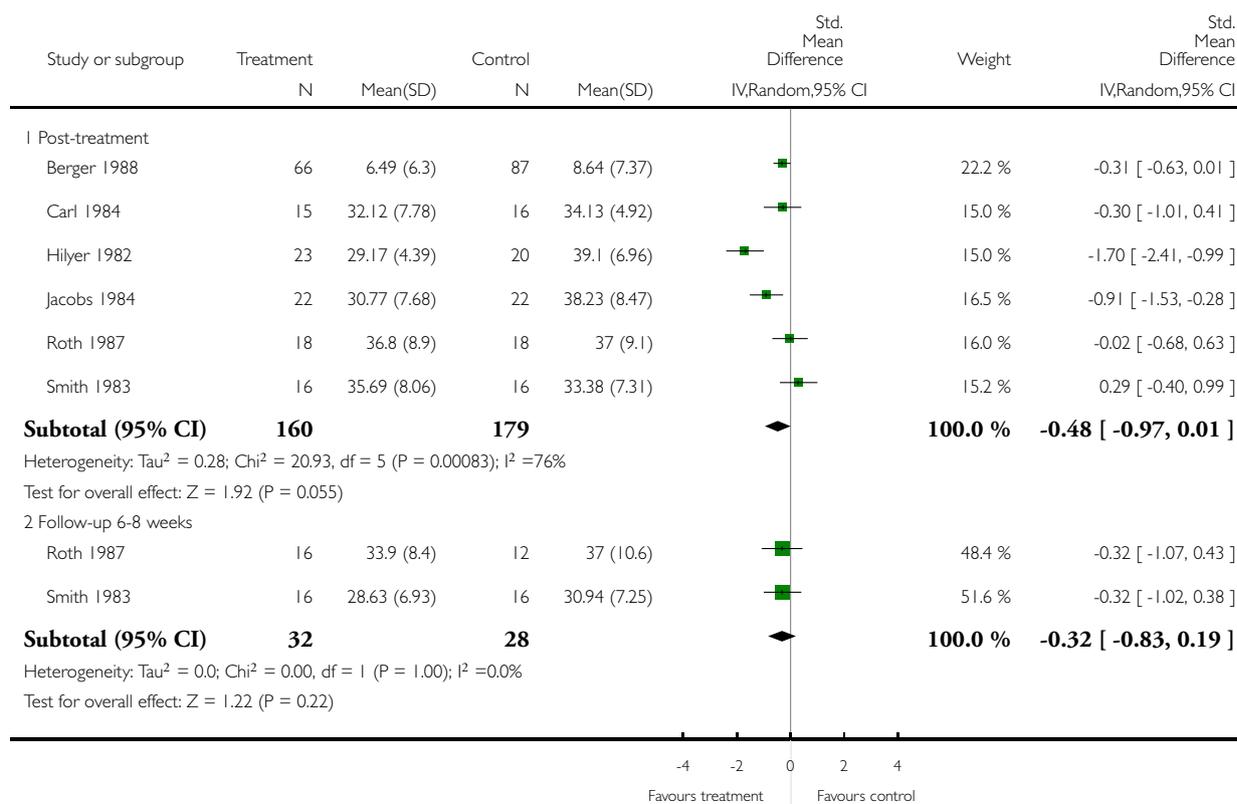
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Anxiety - aerobic exercise	4	253	Std. Mean Difference (IV, Fixed, 95% CI)	-0.19 [-0.44, 0.06]
2 Anxiety - strength exercise	1	44	Mean Difference (IV, Fixed, 95% CI)	-7.46 [-12.24, -2.68]
3 Depression - aerobic exercise	2	189	Std. Mean Difference (IV, Fixed, 95% CI)	-0.11 [-0.40, 0.18]
4 Depression - strength exercise	1	44	Mean Difference (IV, Fixed, 95% CI)	-3.64 [-7.12, -0.16]

Analysis 1.1. Comparison 1 Exercise versus no intervention - general population, Outcome 1 Anxiety.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 1 Exercise versus no intervention - general population

Outcome: 1 Anxiety

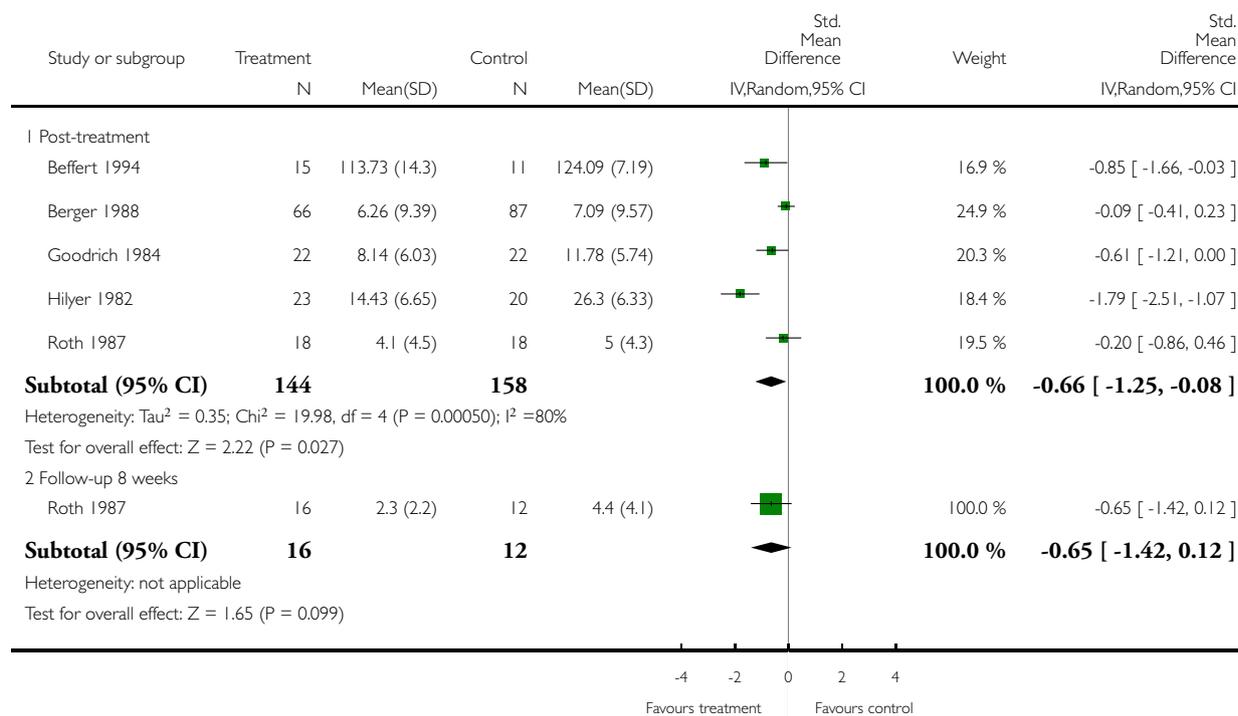


Analysis 1.2. Comparison 1 Exercise versus no intervention - general population, Outcome 2 Depression.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 1 Exercise versus no intervention - general population

Outcome: 2 Depression

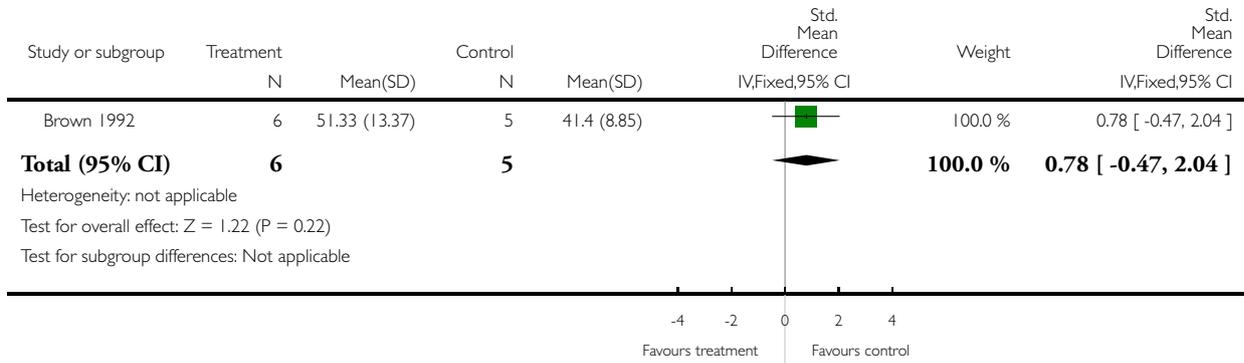


Analysis 2.1. Comparison 2 Exercise versus no intervention - in treatment, Outcome 1 Depression post-treatment.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 2 Exercise versus no intervention - in treatment

Outcome: 1 Depression post-treatment

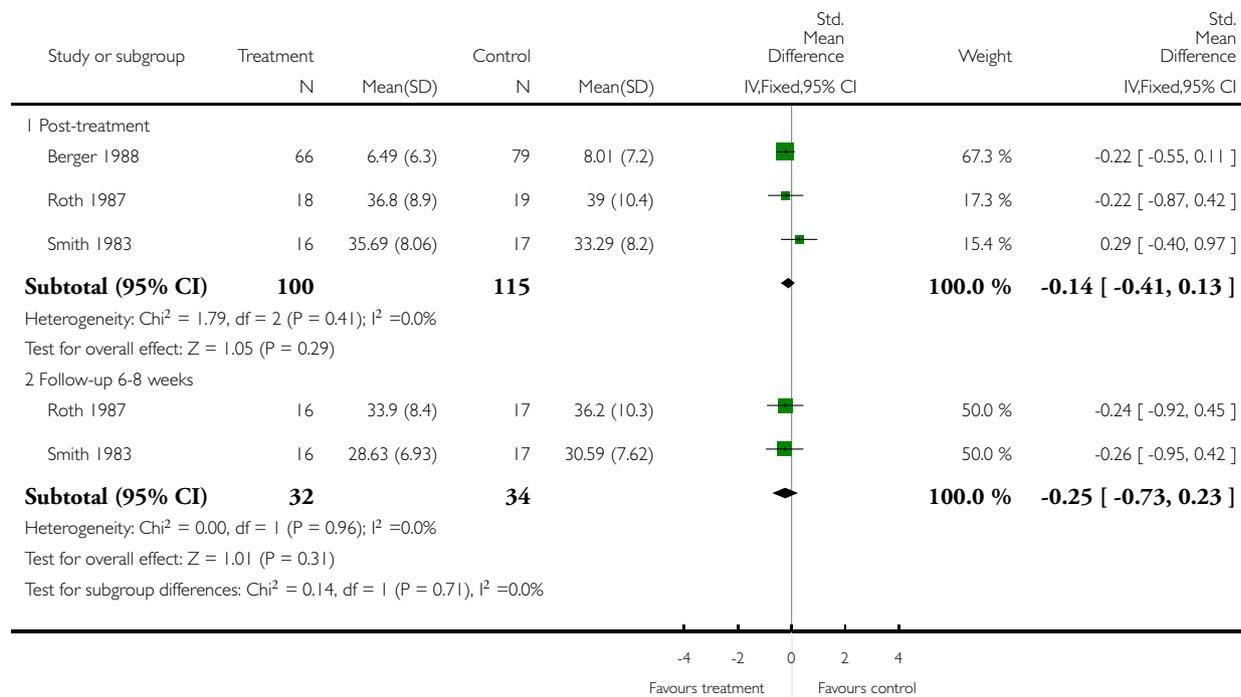


Analysis 3.1. Comparison 3 Exercise versus low intensity exercise/relaxation -general population, Outcome 1 Anxiety.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 3 Exercise versus low intensity exercise/relaxation -general population

Outcome: 1 Anxiety

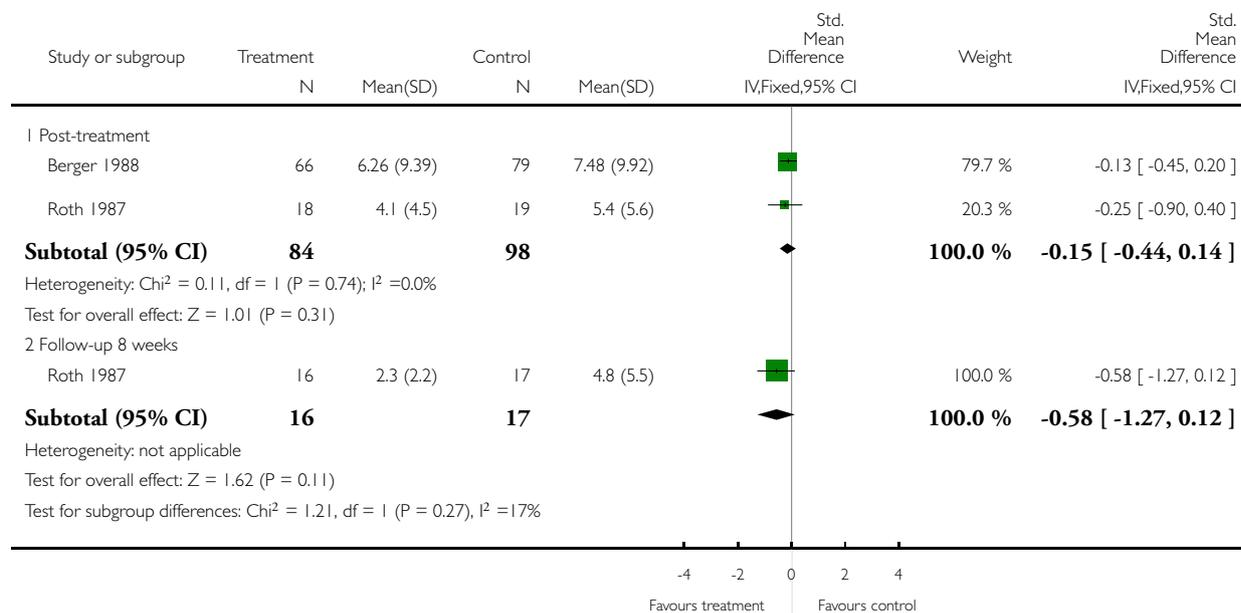


Analysis 3.2. Comparison 3 Exercise versus low intensity exercise/relaxation -general population, Outcome 2 Depression.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 3 Exercise versus low intensity exercise/relaxation -general population

Outcome: 2 Depression

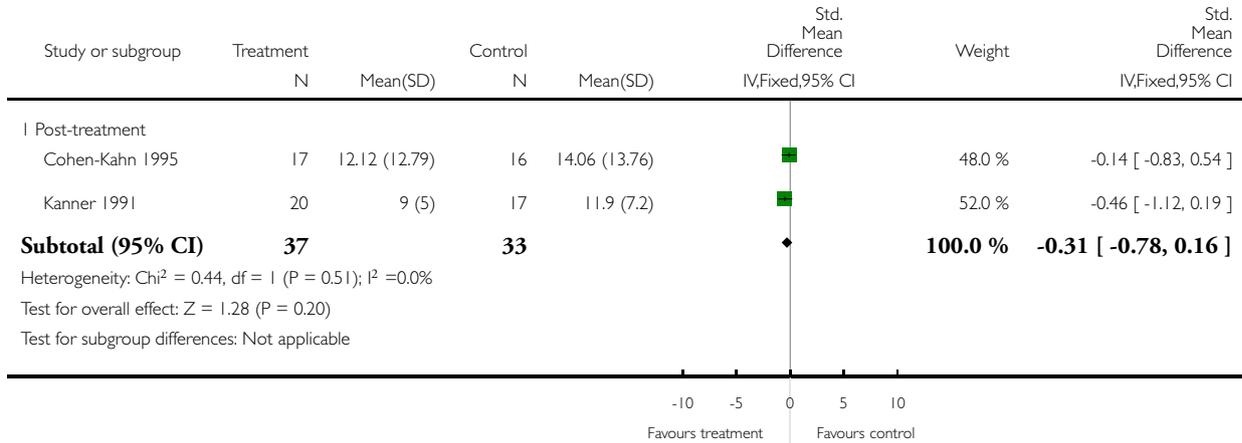


Analysis 4.1. Comparison 4 Exercise vs low intensity exercise/relaxation - in treatment, Outcome 1 Depression.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 4 Exercise vs low intensity exercise/relaxation - in treatment

Outcome: 1 Depression

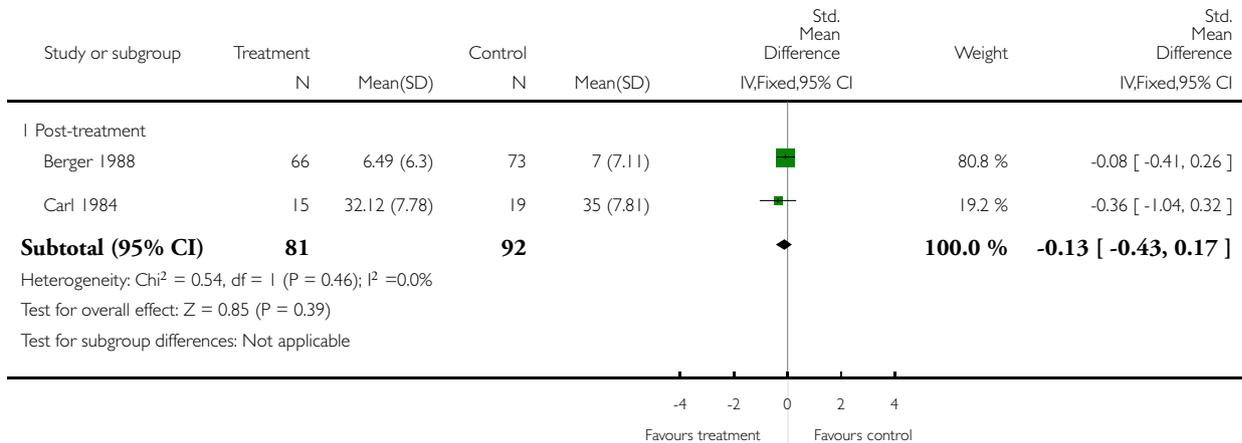


Analysis 5.1. Comparison 5 Exercise versus psychosocial interventions - general population, Outcome 1 Anxiety.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 5 Exercise versus psychosocial interventions - general population

Outcome: 1 Anxiety

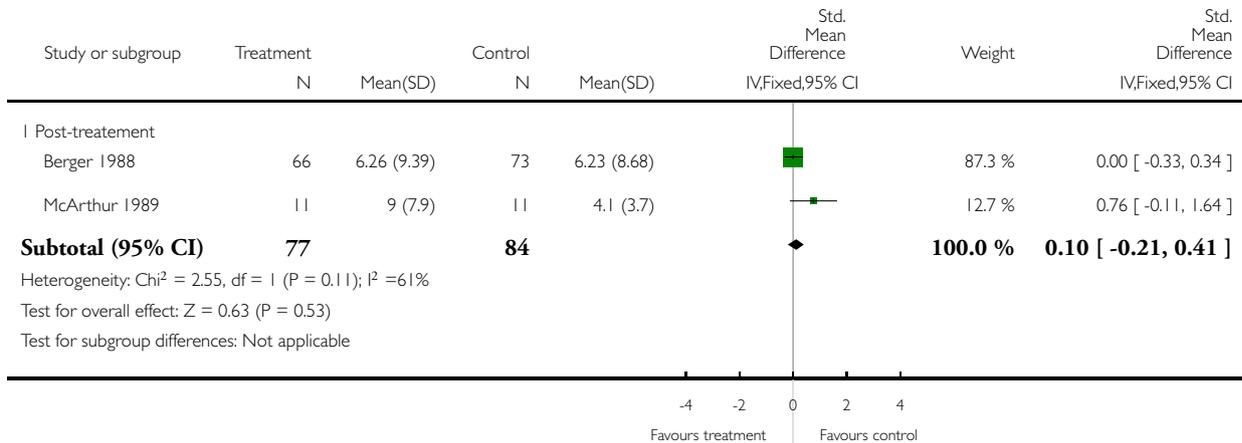


Analysis 5.2. Comparison 5 Exercise versus psychosocial interventions - general population, Outcome 2 Depression.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 5 Exercise versus psychosocial interventions - general population

Outcome: 2 Depression

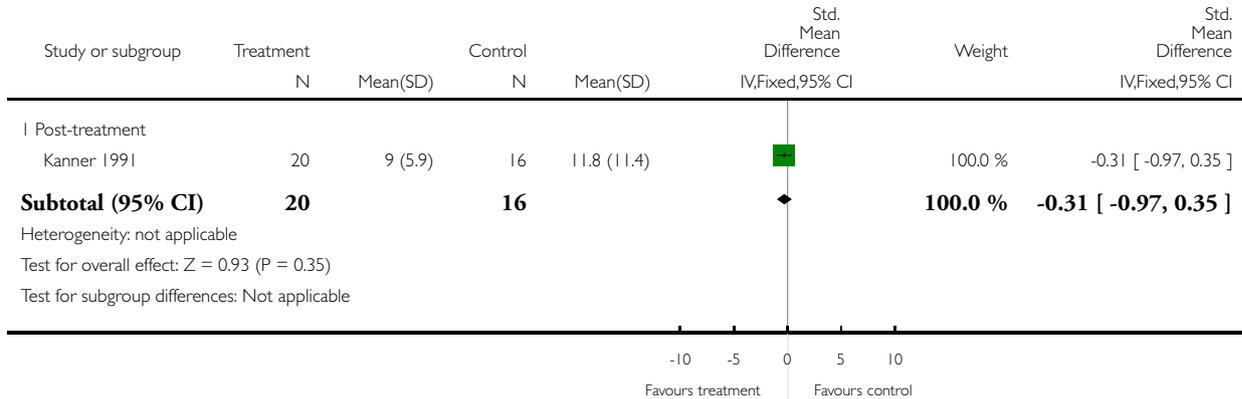


Analysis 6.1. Comparison 6 Exercise versus psychosocial interventions - in treatment, Outcome 1 Depression.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 6 Exercise versus psychosocial interventions - in treatment

Outcome: 1 Depression

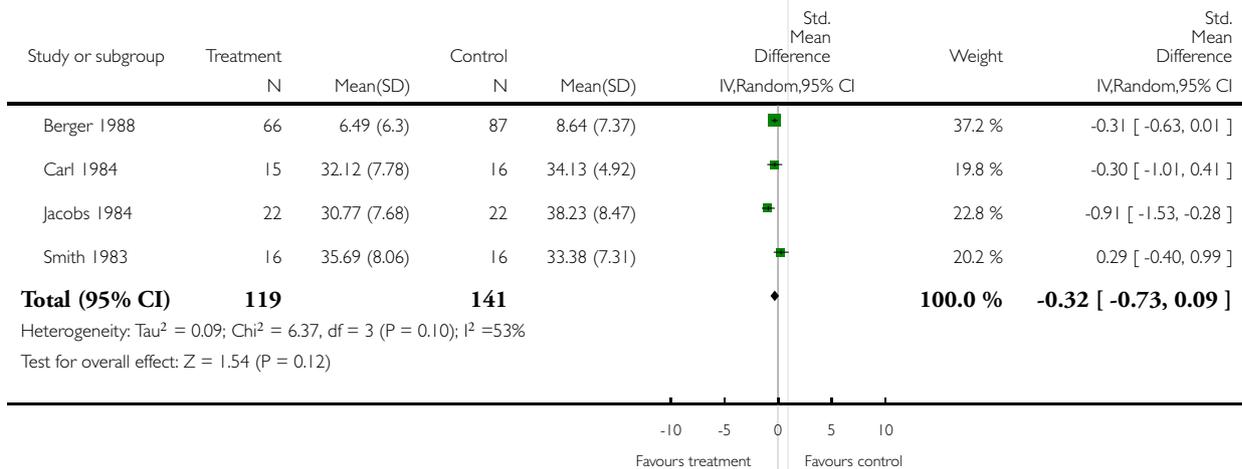


Analysis 7.1. Comparison 7 Sub group analysis population characteristics, Outcome 1 Anxiety - non-risk population.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 7 Sub group analysis population characteristics

Outcome: 1 Anxiety - non-risk population

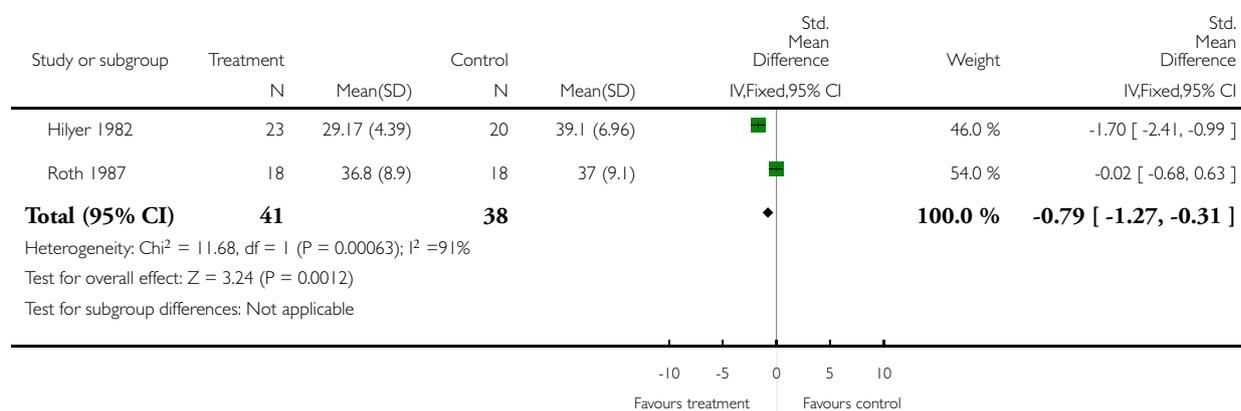


Analysis 7.2. Comparison 7 Sub group analysis population characteristics, Outcome 2 Anxiety - at risk.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 7 Sub group analysis population characteristics

Outcome: 2 Anxiety - at risk

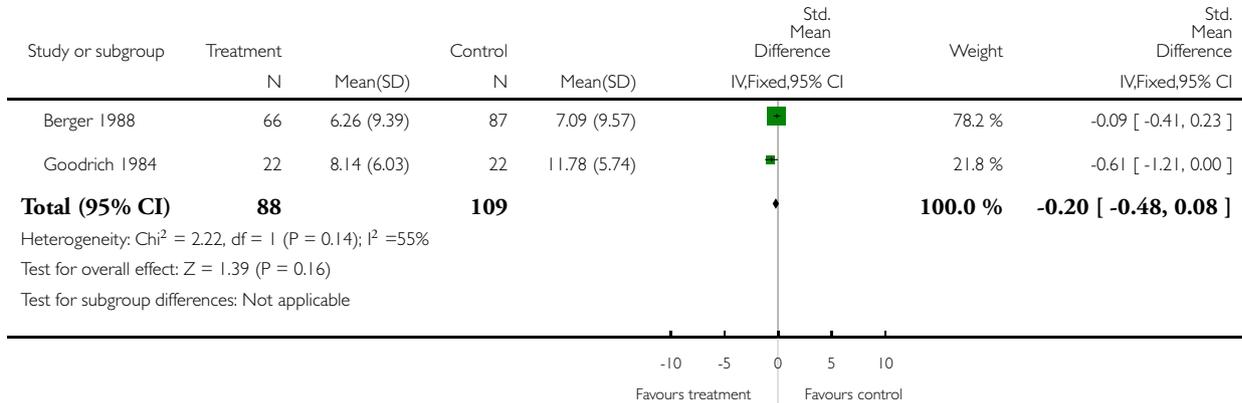


Analysis 7.3. Comparison 7 Sub group analysis population characteristics, Outcome 3 Depression - non-risk population.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 7 Sub group analysis population characteristics

Outcome: 3 Depression - non-risk population

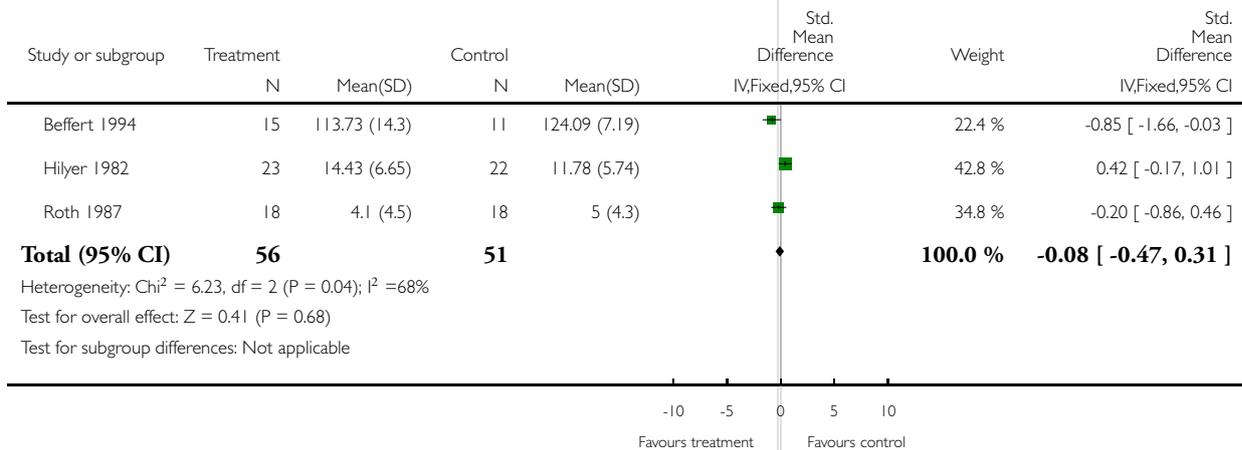


Analysis 7.4. Comparison 7 Sub group analysis population characteristics, Outcome 4 Depression - at risk.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 7 Sub group analysis population characteristics

Outcome: 4 Depression - at risk

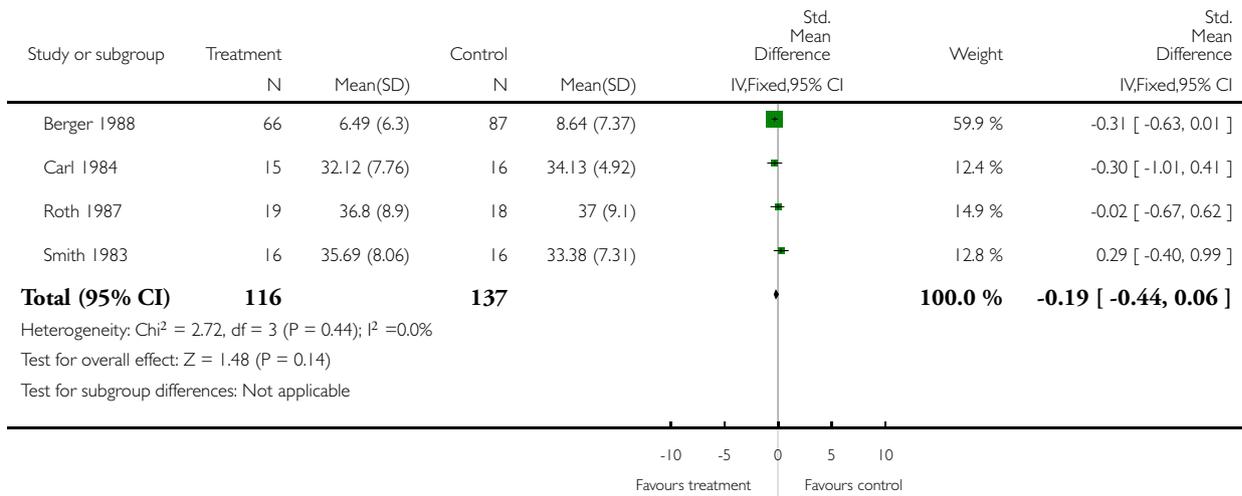


Analysis 8.1. Comparison 8 Sub group analysis type of intervention, Outcome I Anxiety - aerobic exercise.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 8 Sub group analysis type of intervention

Outcome: I Anxiety - aerobic exercise

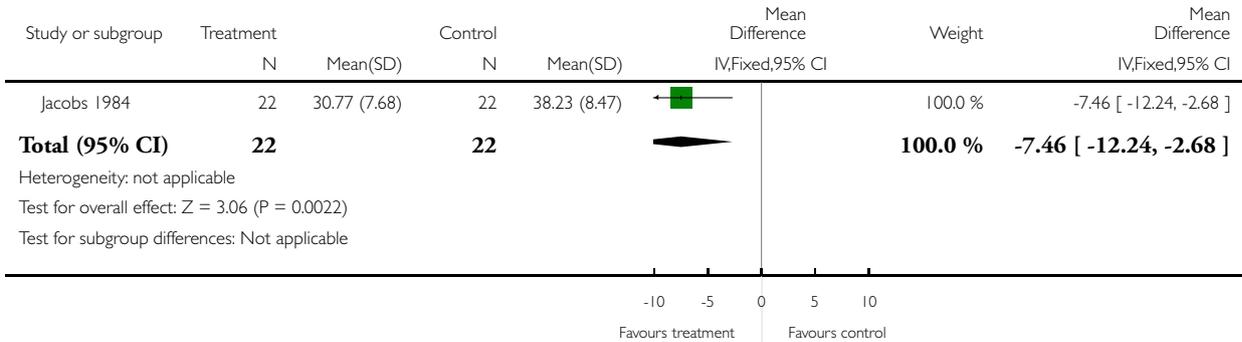


Analysis 8.2. Comparison 8 Sub group analysis type of intervention, Outcome 2 Anxiety - strength exercise.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 8 Sub group analysis type of intervention

Outcome: 2 Anxiety - strength exercise

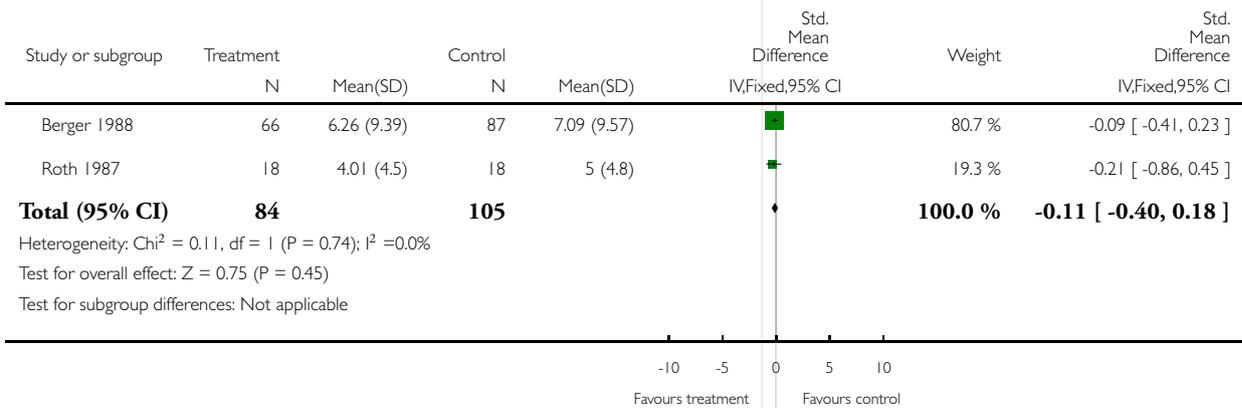


Analysis 8.3. Comparison 8 Sub group analysis type of intervention, Outcome 3 Depression - aerobic exercise.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 8 Sub group analysis type of intervention

Outcome: 3 Depression - aerobic exercise

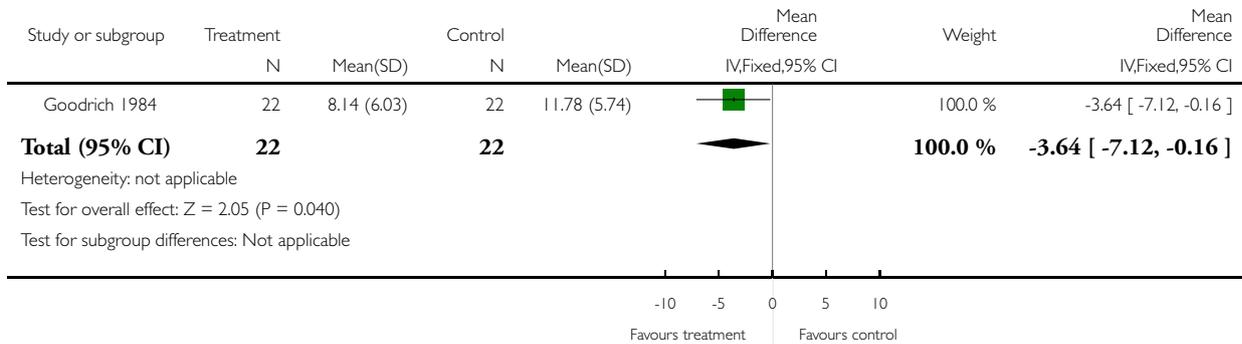


Analysis 8.4. Comparison 8 Sub group analysis type of intervention, Outcome 4 Depression - strength exercise.

Review: Exercise in prevention and treatment of anxiety and depression among children and young people

Comparison: 8 Sub group analysis type of intervention

Outcome: 4 Depression - strength exercise



ADDITIONAL TABLES

Table 1. Search Strategy Medline Ovid

- 1.Anxiety/
- 2.exp Anxiety Disorders/
- 3.Anxiety, Separation/
- 4.Depression/
- 5.Depressive Disorder/
- 6.Depression, involuntional/
- 7.Dysthymic disorder/
- 8.Seasonal affective disorder/
- 9.Bereavement/
- 10.(nervousness or anxiety or anxiousness or angst or apprehension or fear).tw.
- 11.(obsessive compulsive disorder\$ or obsessive compulsive neuros?s or compulsive neuros?s or obsessive neuros?s).tw.
- 12.(phobic disorder\$ or phobic neuros?s or phobia\$).tw.
- 13.(stress disorder\$ or posttraumatic neuros?s or post traumatic neuros?s).tw.
- 14.(depression or depressive or depressed or melancholia or dysphoria or despair or despondency).tw.
- 15.(seasonal affective disorder\$ or seasonal mood disorder\$).tw.
- 16.(dysthymic disorder\$ or dysthymia).tw.
- 17.(sadness or low mood or melancholy).tw.
- 18.panic.tw.
- 19.or/1-18
- 20.Exercise/

Table 1. Search Strategy Medline Ovid (Continued)

21.Exercise Therapy/
22.Dance Therapy/
23.Tai Ji/
24.Walking/
25.Yoga/
26.Exertion/
27.Physical fitness/
28.Dancing/
29.“Play and Playthings”/
30.exp Sports/
31.exp “Physical Education and Training”/
32.(exercis\$ or exertion or physical fitness or physical effort or physical activit\$ or physical endurance or physical strength or human physical condition\$ or physical train\$ or physical education\$ or sport or sports or gymnastic\$ or athletic\$).tw.
33.or/20-32
34.adolescent/ or exp child/
35.exp Pediatrics/
36.exp Students/
37.(child\$ or adolescen\$ or pediatric\$ or paediatric\$).tw,jw.
38.(boy\$1 or girl\$1 or kid\$1 or school\$ or preschool\$ or juvenil\$ or under?age\$ or teen\$ or minor\$ or pubescen\$ or young people or young person\$ or youth\$ or student\$).tw.
39.or/34-38
40.randomized controlled trial.pt.
41.controlled clinical trial.pt.
42.Randomized Controlled Trials/
43.Random Allocation/
44.Double-Blind Method/
45.Single-Blind Method/
46.or/40-45
47.limit 46 to animal
48.limit 46 to human
49.47 and 48
50.47 not 49
51.46 not 50
52.clinical trial.pt.
53.exp clinical trials/
54.clin\$ with trial\$.tw.
55.PLACEBOS/
56.placebo\$.tw.
57.random\$.tw.
58.exp research design/
59.or/52-58
60.limit 59 to animal
61.limit 59 to human
62.60 and 61
63.60 not 62
64.59 not 63
65.Comparative Study/
66.exp evaluation studies/
67.Follow-Up Studies/

Table 1. Search Strategy Medline Ovid (Continued)

68.Prospective Studies/
69.(control\$ or prospectiv\$ or volunteer\$).tw.
70.or/65-69
71.limit 70 to animal
72.limit 70 to human
73.71 and 72
74.71 not 73
75.70 not 74
76.51 or 64 or 75
77.19 and 33 and 39 and 76

Table 2. Search Strategy Psycinfo Ovid

1.exp anxiety/
2.anxiety disorders/ or death anxiety/ or obsessive compulsive disorder/ or panic disorder/ or phobias/ or school phobia/ or social phobia/ or posttraumatic stress disorder/ or separation anxiety/
3.exp fear/
4.“depression (emotion)”/
5.major depression/ or anaclitic depression/ or dysthymic disorder/ or endogenous depression/ or involuntional depression/ or reactive depression/ or recurrent depression/ or treatment resistant depression/
6.seasonal affective disorder/
7.neurosis/ or childhood neurosis/ or experimental neurosis/ or neurasthenic neurosis/ or traumatic neurosis/
8.sadness/
9.(nervousness or anxiety or anxiousness or angst or apprehension or fear).tw.
10.(obsessive compulsive disorder\$ or obsessive compulsive neuros?s or compulsive neuros?s or obsessive neuros?s).tw.
11.panic.tw.
12.(phobic disorder\$ or phobic neuros?s or phobia\$).tw.
13.(stress disorder\$ or posttraumatic neuros?s or post traumatic neuros?s).tw.
14.(depression or depressive or depressed or melancholia or dysphoria or despair or despondency).tw.
15.(seasonal affective disorder\$ or seasonal mood disorder\$).tw.
16.(dysthymic disorder\$ or dysthymia).tw.
17.(sadness or low mood or melancholy).tw.
18.or/1-17
19.exp exercise/
20.movement therapy/
21.physical fitness/ or physical endurance/ or physical strength/
22.exp sports/ or athletic participation/ or athletic training/
23.dance/
24.dance therapy/
25.walking/
26.(exercis\$ or exertion or physical fitness or physical effort or physical activit\$ or physical endurance or physical strength or human physical condition\$ or physical train\$ or physical education\$ or sport or sports or gymnastic\$ or athletic\$).tw.
27.or/19-26
28.pediatrics/
29.(child\$ or adolescen\$ or pediatric\$ or paediatric\$).tw,jw.
30.(boy\$1 or girl\$1 or kid\$1 or school\$ or preschool\$ or juvenil\$ or under?age\$ or teen\$ or minor\$ or pubescen\$ or young people

Table 2. Search Strategy Psycinfo Ovid (Continued)

or young person\$ or youth\$ or student\$).tw.
 31.students/ or business students/ or classmates/ or exp college students/ or dental students/ or exp elementary school students/ or graduate students/ or high school students/ or junior high school students/ or kindergarten students/ or law students/ or medical students/ or postgraduate students/ or exp preschool students/
 32.or/29-31
 33.randomi\$.tw.
 34.singl\$.tw.
 35.doubl\$.tw.
 36.trebl\$.tw.
 37.tripl\$.tw.
 38.blind\$.tw.
 39.mask\$.tw.
 40.((singl\$ or doubl\$ or trebl\$ or tripl\$) adj6 (blind\$ or mask\$)).tw.
 41.(clin\$ adj6 trial\$).tw.
 42.placebo\$.tw.
 43.crossover.tw.
 44.(random\$ adj6 (assign\$ or allocat\$)).tw.
 45.placebo/
 46.treatment effectiveness evaluation/
 47.mental health program evaluation/
 48.or/33,40-47
 49.exp empirical methods/
 50.experimental design/ or between groups design/ or followup studies/ or exp longitudinal studies/ or repeated measures/
 51.exp experimental subjects/
 52.experiment controls/
 53.exp "sampling (experimental)"/
 54.treatment outcomes/
 55.(empirical study or followup study or longitudinal study or prospective study or treatment outcome study).fc.
 56.(clinical protocol\$ or feasibility stud\$ or pilot stud\$ or controlled trial\$ or controlled stud\$ or multicenter trial\$ or multicenter stud\$ or comparative stud\$ or outcome\$ assessment).tw.
 57.or/33,40-56
 58.18 and 27 and 32 and 57

Table 3. Search Strategy Sports Discus

#1 explode "ANXIETY" in DE,SH
 #2 explode "NEUROSIS" in DE,SH
 #3 explode "FEAR" in DE,SH
 #4 "FEAR-OF-FAILURE" in DE,SH
 #5 "FEAR-OF-SUCCESS" in DE,SH
 #6 "PHOBIA" in DE,SH
 #7 "LIFE-SATISFACTION" in DE,SH
 #8 "HAPPINESS" in DE,SH
 #9 (nervousness or anxiety or anxiousness or angst or apprehension or fear) in ti,ab
 #10 ((obsessive compulsive disorder*) or (obsessive compulsive neuros?s) or (compulsive neuros?s) or (obsessive neuros?s))in ti,ab
 #11 panic in ti,ab
 #12 ((phobic disorder*) or (phobic neuros?s) or phobia*) in ti,ab

Table 3. Search Strategy Sports Discus (Continued)

#13 ((stress disorder*) or (posttraumatic neuros?s) or (post traumatic neuros?s)) in ti,ab
#14 (depression or depressive or depressed or melancholia or dysphoria or despair or despondency) in ti,ab
#15 ((seasonal affective disorder*) or (seasonal mood disorder*)) in ti,ab
#16 ((dysthymic disorder*) or dysthymia) in ti,ab
#17 (sadness or (low mood*) or melancholy) in ti,ab
#18 1 or 2 or 3 or 4 or 5 or 6 or 7 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17
#19 explode "EXERCISE" in DE,SH
#20 explode "SPORT" in DE,SH
#21 "physical-activity" in DE,SH
#22 "physical-endurance" in DE,SH
#23 explode "PHYSICAL-FITNESS" in DE,SH
#24 explode "EXERCISE-PRESCRIPTION" in DE,SH
#25 explode "DANCE" in DE,SH
#26 explode "WALKING" in DE,SH
#27 "PLAY" in DE,SH
#28 (exercis* or exertion or (physical fitness) or (physical effort) or (physical activit*) or (physical endurance) or (physical strength) or (human physical condition*) or (physical train*) or (physical education*) or sport or sports or gymnastic* or athletic*) in ti,ab
#29 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28
#30 explode "CHILD" in DE,SH
#31 explode "ADOLESCENT" in DE,SH
#32 "PREPUBESCENT" in DE,SH
#33 "PUBERTY" in DE,SH
#34 "YOUNG-ADULT" in DE,SH
#35 explode "SCHOOL" in DE,SH
#36 "PEDIATRICS" in DE,SH
#37 (child* or adolescen* or pediatric* or paediatric*) in ti,ab,jn

Table 4. Search Strategy Cinahl

1.Anxiety/ or Anticipatory anxiety/ or Separation anxiety/ 2.Anxiety disorders/ or Obsessive-Compulsive disorder/ or Panic disorder/ or Phobic disorder/ or Stress Disorders, Post-Traumatic/ 3.Depression/ or Depression, reactive/ or dysthymic disorder/ or Seasonal Affective disorder/ 4.(nervousness or anxiety or anxiousness or angst or apprehension or fear).tw. 5.(obsessive compulsive disorder\$ or obsessive compulsive neuros?s or compulsive neuros?s or obsessive neuros?s).tw. 6.panic.tw. 7.(phobic disorder\$ or phobic neuros?s or phobia\$).tw. 8.(stress disorder\$ or posttraumatic neuros?s or post traumatic neuros?s).tw. 9.(depression or depressive or depressed or melancholia or dysphoria or despair or despondency).tw. 10.(seasonal affective disorder\$ or seasonal mood disorder\$).tw. 11.(dysthymic disorder\$ or dysthymia).tw. 12.(sadness or low mood or melancholy).tw. 13.or/1-12 14.exp Exercise/ 15.Physical activity/ 16.Physical fitness/ 17.Therapeutic exercises/ or Aerobic exercises/ or Aquatic Exercises/
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Table 4. Search Strategy Cinahl (Continued)

18.Walking/
19.exp Sports/
20.exp Dancing/
21.“Play and playthings”/
22.exp Exertion/
23.“Physical education and training”/
24.Yoga/
25.(exercis\$ or exertion or physical fitness or physical effort or physical activit\$ or physical endurance or physical strength or human physical condition\$ or physical train\$ or physical education\$ or sport or sports or gymnastic\$ or athletic\$.)tw.
26.or/14-25
27.exp child/ or adolescent/
28.Pediatrics/
29.exp Students/
30.(child\$ or adolescen\$ or pediatric\$ or paediatric\$).tw,jw.
31.(boy\$1 or girl\$1 or kid\$1 or school\$ or preschool\$ or juvenil\$ or under?age\$ or teen\$ or minor\$ or pubescen\$ or young people or young person\$ or youth\$ or student\$).tw.
32.or/27-31
33.13 and 26 and 32
34.Clinical trial/
35.(controlled adj (study or trial)).tw.
36.(randomised or randomized).tw.
37.(random\$ adj1 (allocat\$ or assign\$)).tw.
38.exp pretest-posttest design/
39.exp quasi-experimental studies/
40.comparative studies/
41.experiment\$.tw.
42.impact.tw.
43.intervention?.tw.
44.evaluat\$.tw.
45.effect?.tw.
46.or/34-45
47.33 and 46

Table 5. Search Strategy Embase

1.exp Fear/
2.exp Affective neurosis/ or Anxiety neurosis/ or Panic/ or Separation anxiety/ or Phobia/ or Social phobia/
3.(nervousness or anxiety or anxiousness or angst or apprehension or fear).tw.
4.(obsessive compulsive disorder\$ or obsessive compulsive neuros?s or compulsive neuros?s or obsessive neuros?s).tw.
5.panic.tw.
6.(phobic disorder\$ or phobic neuros?s or phobia\$).tw.
7.(stress disorder\$ or posttraumatic neuros?s or post traumatic neuros?s).tw.
8.(depression or depressive or depressed or melancholia or dysphoria or despair or despondency).tw.
9.(seasonal affective disorder\$ or seasonal mood disorder\$).tw.
10.(dysthymic disorder\$ or dysthymia).tw.
11.(sadness or low mood or melancholy).tw.
12.or/1-11

Table 5. Search Strategy Embase (Continued)

13.exp Exercise/ or exp Physical activity/ or exp Sport/ or Dancing/
14.Training/
15.(exercis\$ or exertion or physical fitness or physical effort or physical activit\$ or physical endurance or physical strength or human physical condition\$ or physical train\$ or physical education\$ or sport or sports or gymnastic\$ or athletic\$).tw.
16.or/13-15
17.exp child/
18.Childhood/
19.exp Adolescent/
20.exp Adolescence/
21.Pediatrics/
22.Student/
23.(child\$ or adolescen\$ or pediatric\$ or paediatric\$).tw,jw.
24.(boy\$1 or girl\$1 or kid\$1 or school\$ or preschool\$ or juvenil\$ or under?age\$ or teen\$ or minor\$ or pubescen\$ or young people or young person\$ or youth\$ or student\$).tw.
25.or/17-24
26.Clinical Article/
27.Clinical Study/
28.Clinical Trial/
29.Controlled Study/
30.Randomized Controlled Trial/
31.Major Clinical Study/
32.Double Blind Procedure/
33.Multicenter Study/
34.Single Blind Procedure/
35.Phase 3 Clinical Trial/
36.Phase 4 Clinical Trial/
37.Crossover Procedure/
38.PLACEBO/
39.or/26-38
40.allocat\$.ti,ab.
41.assign\$.ti,ab.
42.blind\$.ti,ab.
43.(clinical\$ adj25 (study or trial)).ti,ab.
44.compar\$.ti,ab.
45.control\$.ti,ab.
46.cross?over.ti,ab.
47.factorial\$.ti,ab.
48.follow?up.ti,ab.
49.placebo\$.ti,ab.
50.prospectiv\$.ti,ab.
51.random\$.ti,ab.
52.((singl\$ or doubl\$ or trebl\$ or tripl\$) adj25 (blind\$ or mask\$)).ti,ab.
53.trial.ti,ab.
54.(versus or vs).ti,ab.
55.or/40-54
56.39 or 55
57.Human/
58.Nonhuman/
59.ANIMAL/

Table 5. Search Strategy Embase (Continued)

60.Animal Experiment/
61.58 or 59 or 60
62.57 and 61
63.56 not 61
64.56 and 62
65.63 or 64
66.12 and 16 and 25 and 65

Table 6. Search Strategy Cochrane Library

1.Anxiety [single term]
2.Anxiety Disorders [explode]
3.Anxiety, Separation [single term]
4.Depressive Disorder [single term]
5.Dysthymic Disorder [single term]
6.Seasonal Affective Disorder [single term]
7.Depressive Disorder, Major [single term]
8.MeSH descriptor Child Behavior Disorders [single term]
9.nervousness [Title, Abstract]
10.anxiety [Title, Abstract]
11.angst or fear [Title, Abstract]
12.anxiousness [Title, Abstract]
13.apprehension [Title, Abstract]
14.neurocirculatory next asthenia [Title, Abstract]
15.cardiac next neurosis [Title, Abstract]
16.effort next syndrome [Title, Abstract]
17.hyperkinetic next heart next syndrome [Title, Abstract]
18.obsessive next compulsive next disorder* [Title, Abstract]
19.obsessive next compulsive next neuros*s [Title, Abstract]
20.phobic next disorder* [Title, Abstract]
21.phobic next neuros*s [Title, Abstract]
22.phobia* [Title, Abstract]
23.stress next disorder* [Title, Abstract]
24.combat next disorder* [Title, Abstract]
25.war next neuros*s [Title, Abstract]
26.combat next neuros*s [Title, Abstract]
27.depression [Title, Abstract]
28.depressive* or depressed [Title, Abstract]
29.involitional next paraphrenia [Title, Abstract]
30.involitional next psychosis [Title, Abstract]
31.melancholia or melancholy or sadness or (low next mood) or despair or despondency [Title, Abstract]
32.seasonal next affective next disorder* [Title, Abstract]
33.seasonal next mood next disorder* [Title, Abstract]
34.dysphoria [Title, Abstract]
35.bipolar next affective next disorder* [Title, Abstract]
36.bipolar next mood next disorder* [Title, Abstract]

Table 6. Search Strategy Cochrane Library (Continued)

- 37.(dysthymic next disorder*) or dysthymia [Title, Abstract]
- 38.bipolar next disorder* [Title, Abstract]
- 39.panic [Title, Abstract]
- 40.(#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #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 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39)
- 41.Exercise [single term]
- 42.Exercise Therapy [single term]
- 43.Dance Therapy [single term]
- 44.Tai Ji [single term]
- 45.Walking [single term]
- 46.Yoga [explode]
- 47.Exertion [single term]
- 48.Physical Fitness [single term]
- 49.Dancing [single term]
- 50.Play and Playthings [single term]
- 51.Sports [explode]
- 52.Physical Education and Training [explode]
- 53.exercis* or sport or sports or gymnastic* or athletic* [Title, Abstract]
- 54.physical next exercis* [Title, Abstract]
- 55.exertion [Title, Abstract]
- 56.physical next effort* [Title, Abstract]
- 57.human next physical next condition [Title, Abstract]
- 58.physical next activit* [Title, Abstract]
- 59.physical next endurance [Title, Abstract]
- 60.physical next strength [Title, Abstract]
- 61.walking or walks or yoga or dance or dancing or sport or sports or baseball* or basketball* or softball* or rugby or soccer or football* or bicycling or boxing or golf or gymnastic* or calisthenic* or gong fu or gongfu or judo or karate or aikido or mountaineering or tennis or badminton or running or jogging or skating or lacrosse or squash or skateboard* or snowboard* or skiing in Record Title or walking or walks or yoga or dance or dancing or sport or sports or baseball* or basketball* or softball* or rugby or soccer or football* or bicycling or boxing or golf or gymnastic* or calisthenic* or gong fu or gongfu or judo or karate or aikido or mountaineering or tennis or badminton or running or jogging or skating or lacrosse or squash or skateboard* or snowboard* or skiing in [Title, Abstract]
- 62.tai next ji [Title, Abstract]
- 63.gong next fu [Title, Abstract]
- 64.martial next arts [Title, Abstract] delete
- 65.kung next fu [Title, Abstract]
- 66.tae next kwon next do [Title, Abstract]
- 67.tae next kwondo [Title, Abstract]
- 68.taekwondo [Title, Abstract]
- 69.physical next train* [Title, Abstract]
- 70.physical next education [Title, Abstract]
- 71.#41 or #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 OR #69 OR #70
- 72.Child [explode]
- 73.Adolescent [explode]
- 74.Students [explode]
- 75.boy or boys or girl or girls or kid or kids or school* or preschool* or juvenil* or under*age* or teen* or minor or minors or pubescen* or youth* or student* in Record Title or boy or boys or girl or girls or kid or kids or school* or preschool* or juvenil* or under*age* or teen* or minor or minors or pubescen* or youth* or student* [Title, Abstract]

Table 6. Search Strategy Cochrane Library (Continued)

76.young next people [Title, Abstract]
77.young next person* [Title, Abstract]
78.(#72 OR #73 OR #74 OR #75 OR #76 OR #77)
79.(#40 AND #71 AND #78)

Table 7. Search Strategy ERIC

1.DE=(“Anxiety” or “Communication Apprehension” or “Computer Anxiety” or “Mathematics Anxiety” or “Science Anxiety” or “Separation Anxiety” or “Test Anxiety” or “Writing Apprehension”)
2.DE=(“Fear” or “Fear of Success” or “School Phobia”)
3.DE=“Depression (Psychology)”
4.DE=“Posttraumatic Stress Disorder”
5.DE=Sadness
6.TI=((stress disorder*) or (posttraumatic neuros?s) or (post traumatic neuros?s)) or AB=((stress disorder*) or (posttraumatic neuros?s) or (post traumatic neuros?s))
7.TI=((phobic disorder*) or (phobic neuros?s) or phobia) or AB=((phobic disorder*) or (phobic neuros?s) or phobia)
8.TI=(depression or depressive or depressed or melancholia or dysphoria or despair or despondency) or AB=(depression or depressive or depressed or melancholia or dysphoria or despair or despondency)
9.TI=(nervousness or anxiety or angst or apprehension or fear) or AB=(nervousness or anxiety or angst or apprehension or fear)
10.TI=panic or AB=panic
11.TI=((seasonal affective disorder*) or (seasonal mood disorder*)) or AB=((seasonal affective disorder*) or (seasonal mood disorder*))
12.TI=((obsessive compulsive disorder*) or (obsessive compulsive neuros?s) or (compulsive neuros?s) or (obsessive neuros?s)) or AB=((obsessive compulsive disorder*) or (obsessive compulsive neuros?s) or (compulsive neuros?s) or (obsessive neuros?s))
13.TI=((dysthymic disorder*) or dysthymia) or AB=((dysthymic disorder*) or dysthymia)
14.TI=(sadness or (low mood) or melancholy) or AB=(sadness or (low mood) or melancholy)
15.TI=(cardiac neurosis) or AB=(cardiac neurosis)
16.TI=(effort syndrome) or AB=(effort syndrome)
17.TI=(hyperkinetic heart syndrome) or AB=(hyperkinetic heart syndrome)
18.TI=((combat disorder*) or (combat neuros?s) or (war neuros?s)) or AB=((combat disorder*) or (combat neuros?s) or (war neuros?s))
19.TI=((involuntal paraphrenia) or (involuntal psychosis)) or AB=((involuntal paraphrenia) or (involuntal psychosis))
20.TI=((bipolar affective disorder*) or (bipolar mood disorder*)) or AB=((bipolar affective disorder*) or (bipolar mood disorder*))
21.#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10 or #11 or #12 or #13 or #14 or #15 or #16 or #17 or #18 or #19 or #20
22.DE=(“Physical Activities” or “Athletics” or “Aquatic Sports” or “Canoeing” or “Diving” or “Sailing” or “Surfing” or “Swimming” or “Water Polo” or “Waterskiing” or “Archery” or “Bowling” or “College Athletics” or “Extramural Athletics” or “Fencing (Sport)” or “Golf” or “Gymnastics” or “Tumbling” or “Handball” or “Intramural Athletics” or “Lifetime Sports” or “Olympic Games” or “Orienteering” or “Racquet Sports” or “Badminton” or “Racquetball” or “Squash (Game)” or “Tennis” or “Roller Skating” or “Special Olympics” or “Table Tennis” or “Team Sports” or “Baseball” or “Basketball” or “Field Hockey” or “Football” or “Ice Hockey” or “Lacrosse” or “Soccer” or “Softball” or “Team Handball” or “Volleyball” or “Water Polo” or “Track and Field” or “Weightlifting” or “Winter Sports” or “Ice Hockey” or “Ice Skating” or “Skiing” or “Womens Athletics” or “Wrestling” or “Bicycling” or “Dance” or “Exercise” or “Aerobics” or “Calisthenics” or “Plyometrics” or “Horseback Riding” or “Lifting” or “Weightlifting” or “Running” or “Jogging” or “Underwater Diving” or “Walking”)
23.DE=“Physical Education”
24.DE=“Physical Activity Level”
25.DE=(“Physical Fitness” or “Health Related Fitness”)

Table 7. Search Strategy ERIC (Continued)

26.DE="Outdoor Activities"
27.DE="Dance Therapy"
28.TI=(exercis* or exertion or (physical fitness) or (physical effort) or (physical activit*) or (physical endurance) or (physical strength) or (human physical condition*) or (physical train*) or (physical education*) or sport or sports or gymnastic* or athletic*) or AB=(exercis* or exertion or (physical fitness) or (physical effort) or (physical activit*) or (physical endurance) or (physical strength) or (human physical condition*) or (physical train*) or (physical education*) or sport or sports or gymnastic* or athletic*)
29.#22 or #23 or #24 or #25 or #26 or #27 or #28
30.DE=("Children" or "Adopted Children" or "Foster Children" or "Grandchildren" or "Hospitalized Children" or "Latchkey Children" or "Migrant Children" or "Minority Group Children" or "Missing Children" or "Preadolescents" or "Problem Children" or "Transient Children" or "Young Children" or "Infants" or "Neonates" or "Premature Infants" or "Kindergarten Children" or "Preschool Children" or "Toddlers")
31.DE=Adolescents
32.DE="Early Adolescents"
33.DE="Late Adolescents"
34.DE=("Youth" or "Affluent Youth" or "Black Youth" or "Disadvantaged Youth" or "Migrant Youth" or "Out of School Youth" or "Rural Youth" or "Suburban Youth" or "Urban Youth")
35.DE="Young Adults"
36.DE=("Students" or "Adult Students" or "Advanced Students" or "American Indian Students" or "Asian American Students" or "Bilingual Students" or "Black Students" or "College Students" or "College Freshmen" or "College Juniors" or "College Seniors" or "College Sophomores" or "College Transfer Students" or "Reverse Transfer Students" or "First Generation College Students" or "Graduate Students" or "Dental Students" or "Law Students" or "Medical Students" or "Graduate Medical Students" or "In State Students" or "On Campus Students" or "Out of State Students" or "Preservice Teachers" or "Student Teachers" or "Resident Assistants" or "Two Year College Students" or "Undergraduate Students" or "Premedical Students" or "Commuting Students" or "Continuation Students" or "Day Students" or "Elementary School Students" or "Evening Students" or "Foreign Students" or "Full Time Students" or "High Risk Students" or "Hispanic American Students" or "Lower Class Students" or "Majors (Students)" or "Education Majors" or "Married Students" or "Middle Class Students" or "Middle School Students" or "Nonmajors" or "Nontraditional Students" or "Nursing Students" or "Part Time Students" or "Pregnant Students" or "Reentry Students" or "Secondary School Students" or "High School Students" or "College Bound Students" or "High School Freshmen" or "High School Seniors" or "Noncollege Bound Students" or "Junior High School Students" or "Self Supporting Students" or "Single Students" or "Special Needs Students" or "Student Volunteers" or "Terminal Students" or "Transfer Students" or "College Transfer Students" or "Reverse Transfer Students" or "White Students")
37.#30 or #31 or #32 or #33 or #34 or #35 or #36
38.#21 and #29 and #37
39.DE="Meta Analysis"
40.TI=(clin* within 3 trial*) or AB=(clin* within 3 trial*)
41.TI=((singl* or doubl* or tripl* or trebl*) and (mask* or blind*)) or AB=((singl* or doubl* or tripl* or trebl*) and (mask* or blind*))
42.TI=(random within 3 (allocat* or assign*)) or AB=(random within 3 (allocat* or assign*))
43.TI=(crossover or cross-over) or AB=(crossover or cross-over)
44.#39 or #40 or #41 or #42 or #43
45.#38 and #44

Table 8. Datacollection form

Reviewer (INITIALS):_____

Date of completing form:_____.(finished)

Publication title:_____

Publication identifier/Refman ID (first author, year)_____

Publication type

journal article report book dissertation other (Specify: _____)

Publication status published not published

Publication year Year(s) of data collection_____

Country or countries of origin: _____

Language of publication: _____

TYPE OF DESIGN

Randomised controlled trial

Cluster randomised trial

Quasi randomised trial

None of the designs, exclude

TRIAL QUALITY

Generation of allocation sequence

MET. Resulting sequences are unpredictable (explicitly stated use of either computer-generated random numbers, table of random numbers, drawing lots or envelopes, coin tossing, shuffling cards, or throwing dice).

UNCLEAR. Vague statement that the study was randomised but not describing the generation of the allocation sequence.

NOT MET. Explicit description of inadequate generation of sequence (e.g., using case record numbers, alternation, date of admission, date of birth).

Concealment of allocation

MET. Participants and investigators cannot foresee assignment (e.g. central randomisation performed at at site remote from trial location, sequentially numbered, sealed, opaque envelopes).

UNCLEAR. Vague statement that the study was randomised but not describing the concealment of the allocation sequence.

NOT MET. Explicit statement that allocation was not concealed OR statement indicating that participants or investigators can foresee upcoming assignment (e. g., open allocation schedule, unsealed or non-opaque envelopes).

Baseline assessment

MET. Adequate when table of participants show similarity (i.e. age, disorder, BMI, activity level).

UNCLEAR. Sufficient information could not be obtained.

NOT MET The groups show considerable diversity

Table 8. Datacollection form (Continued)

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.
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.
Losses to follow-up
MET. Losses to follow up less than or equal to 20% and equally distributed between comparison groups.
UNCLEAR. Losses to follow up not reported.
NOT MET Losses to follow up greater than 20% or not equally distributed between comparison groups.
Intention-to-treat
MET. Intention to treat analysis performed or possible with data provided.
UNCLEAR. Intention to treat not reported, and could not be undertaken by contacting the investigators.
NOT MET. Intention to treat analyses not done and not possible for reviewers to calculate independently.
PARTICIPANTS
Age Data
Age group Intervention group 1 Intervention group 2 Control group
Intervention group 1 Intervention group 2 Control
Mean Age all
St. dev.all
Gender
Percent females intervention group 1
Percent females intervention group 2
Percent females control group
Characteristics
Healthy Comments:
At risk Comments:
Clinical diagnosis Comments:
INTERVENTION
Implementing agent:
School Kindergarten Community Hospital Sports club Mixed University Unclear/not reported
Other , please specify: _____
Attrition (Percent)
Attrition in intervention group 1.....
Attrition in intervention group 2.....

Table 8. Datacollection form (Continued)

Attrition in control group.....

Compliance/Adherence (percent)
 Intervention group 1...
 Intervention group 2...
 Control group.....

Co-intervention
 other interventions avoided used similarly dissimilarly unclear/not reported

If co-intervention, specify:

TRIAL CHARACTERISTICS
 Description of intervention

Duration of intervention (pre-test to post-test)
 Same for all Individual durations
 Mean duration.....

Intensity of intervention
 Mean number of minutes per session
 Mean number of sessions per week

Length of follow-up (after post-test)
 Years and months

Type of comparison
 Exercise vs no intervention Exercise vs other intervention Exercise versus waiting list

Means and standard deviations frequencies or proportions p-values regression coefficientes other

Sample size at baseline
 Number in intervention group 1
 Number in intervention group 2
 Number in control group

RESULTS
 Outcome 1: Dimension
 Method (questionnaire, interview etc)
 Instrument (name of method/instrument used)

Table 9. Quality assessment of included studies

Name of study	Gen. of allocation	Conc. of allocation	Baseline assessment	Outcome Assesment	Co- inter-vention	Losses-to follow up	Intention to treat	Total Score	Quality category
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Table 9. Quality assessment of included studies (Continued)

Bef- fert1993	Unclear	Not met	Not met	Unclear	Unclear	Not met	Met	1	Low
Berger1988b	Unclear	Unclear	Met	Unclear	Unclear	Not met	Not Met	1	Low
Bonnhauser 2005	Unclear	Unclear	Met	Unclear	Met	Met	Met	4	Moderate
Brown 1992	Unclear	Unclear	Not met	Unclear	Unclear	Not met	Unclear	0	Low
Carl1983	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Not Met	0	Low
Cohen- Kahn1995	Unclear	Unclear	Met	Unclear	Unclear	Unclear	Unclear	1	Low
Goodrich1991	Met	Unclear	Unclear	Unclear	Unclear	Met	Not met	2	Low
Hi- lyer1982	Unclear	Unclear	Met	Unclear	Met	Not met	Not met	2	Low
Ja- cobs1984	Not met	Not met	Met	Unclear	Unclear	Met	Not met	2	Low
Kan- ner1991	Unclear	Unclear	Met	Unclear	Met	Unclear	Met	3	Moderate
Lau 2004	Unclear	Unclear	Met	Unclear	Met	Unclear	Unclear	2	Low
MacMa- hon1988	Not met	Unclear	Unclear	Not met	Unclear	Not met	Unclear	0	Low
McArthur1991	Unclear	Unclear	Unclear	Unclear	Met	Met	Met	3	Moderate
Mc- Cann1984	Unclear	Unclear	Not met	Unclear	Not met	Met	Unclear	1	Low
Roth1987	Unclear	Unclear	Met	Unclear	Met	Not met	Unclear	2	Low
Smith1984	Unclear	Unclear	Met	Unclear	Unclear	Met	Met	3	Moderate

WHAT'S NEW

Last assessed as up-to-date: 22 May 2006.

Date	Event	Description
1 November 2008	Amended	Converted to new review format.

HISTORY

Protocol first published: Issue 3, 2003

Review first published: Issue 3, 2006

Date	Event	Description
23 May 2006	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

The reviewers made the following contributions:

Link with editorial base and coordinate contributions from co-reviewers; LL.

Draft protocol; LL with contributions from all.

Run search; LVN.

Identify relevant titles and abstracts from searches, i.e. broad search; LL, LVN and EE.

Obtain copies of trials; LL and LVN.

Select which trials to include; LL and LVN with EE as arbitrator when necessary.

Extract data from trials; LL and LVN.

Enter data into RevMan; LL and LVN.

Carry out analysis; LL, LVN and KBH.

Interpret analysis; LL and LVN.

Draft final review; LL with contributions from all

Update Review; LL and LVN.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- Norwegian Knowledge Centre for the Health Services, Norway.

External sources

- None, Norway.

INDEX TERMS

Medical Subject Headings (MeSH)

Adolescent; Anxiety [prevention & control; *therapy]; Depression [prevention & control; *therapy]; Exercise [*physiology; psychology]; Randomized Controlled Trials as Topic; Relaxation Therapy; Yoga

MeSH check words

Child; Humans