NKR astma PICO 4 Physical activity for asthma in children

Characteristics of studies

Characteristics of included studies

Altintas 2003

Methods	
Participants	
Interventions	
Outcomes	
Identification	
Notes	See Beggs, 2013 for Risk of Bias

Risk of bias table

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	
Allocation concealment (selection bias)	Unclear risk	
Blinding of participants and personnel (performance bias)	Unclear risk	
Blinding of outcome assessment (detection bias)	Unclear risk	
Incomplete outcome data (attrition bias)	Unclear risk	
Selective reporting (reporting bias)	Unclear risk	
Other bias	Unclear risk	

Andrade 2014

Methods	**Study design:** Randomized controlled trial **Study grouping:** Parallel group **Open Label:** YES
Participants	**Baseline Characteristics** exercise group (intervention) ● *Mean age in years (SD)*: 11,7 (2,3) ● *Male (female)*: 6(4) ● *BMI, mean (SD)*: 20.9 (6.1) no exercise (control) ● *Mean age in years (SD)*: 11.4 (2.3) ● *Male (female)*: 9(8) ● *BMI, mean (SD)*: 18.7 (3.9) **Included criteria:** The study selection criteria took into consideration the classification defined by the Global Initiative for Asthma, forced expiratory volume in 1 s (FEV1) below 80% of the predicted value and absence of any exacerbation or change in medication in the preceding 30 days. **Excluded criteria:** Patients with cardiovascular disease, lung disease or any musculoskeletal disorder that could hamper evaluation or the performance of physical activity
Interventions	**Intervention Characteristics** exercise group (intervention) ● *Description*: 3 times a week. Electric treadmill. 5 min stretching, 10 min warm-up, 20/30 min training. 5 min cool-down. ● *Duration (weeks)*: 6 ● *Length of follow up (weeks)*: no exercise (control) ● *Description*: ● *Duration (weeks)*: ● *Length of follow up (weeks)*:

Outcomes	*Continuous*: ● FEV1 (L) ● PAQLQ-Symptom score (higher=better) ● PAQLQ total score (higher=better)
Identification	**Country:** Brazil **Authors name:** Andrade, 2014 **Institution:** Instituto de Medicina Integral **Email:** ftliviabandrade@gmail.com Ambrosino Leite, 92 ap.204, Grac¸as, 52011-230 Recife, PE, Brazil.
Notes	

Risk of bias table

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	
Allocation concealment (selection bias)	Low risk	
Blinding of participants and personnel (performance bias)	High risk	
Blinding of outcome assessment (detection bias)	High risk	blinding not mentioned, problably not done.
Incomplete outcome data (attrition bias)	Low risk	Fig. 1 adresses drop outs
Selective reporting (reporting bias)	Low risk	
Other bias	Low risk	

Basaran 2006

Methods	**Study design:** Randomized controlled trial **Study grouping:** Parallel group

Participants	**Baseline Characteristics** physical activity intervention ● *Mean age in years (SD)*: 10.35 (2.2) ● *Gender, N=male (%)*: 64.5 ● *Mean duration of asthma in years (SD)*: 5.42 (3.3) control: activity as usual ● *Mean age in years (SD)*: 10.45 (2.1) ● *Gender, N=male (%)*: 64.5 ● *Mean duration of asthma in years (SD)*: 4.80 (2.7) **Included criteria:** Not described **Excluded criteria:** Not described
Interventions	**Intervention Characteristics** physical activity intervention ● *Description*: Group E underwent a submaximal aerobic training designed as amoderately intensive basketball training program including both lowerand upper extremity activities. During the 8-week training program thesessions were performed 3 times a week (Monday, Wednesday andFriday) for one hour in each session. A typical session in the gymnasiumstarted with warm-up and callisthenics (15 min) followed by submaximalbasketball training (30 /35 min), cool-down and flexibility exercises(10 min). Except daily routines, specific exercise training was not encouragedin group C. A regular home respiratory exercise program consistingof relaxation and breathing exercises was advised to both groups. ● *Duration (weeks)*: 8 ● *Follow up (weeks)*: 0 control: activity as usual ● *Description*: Home respiratory exercise program ● *Duration (weeks)*: 8 ● *Follow up (weeks)*: 0
Outcomes	*Continuous*: ● Mean quality of life score (higher=better) ● Daily dose Budesonide in microgram ● asthma control score

	● symptom score ● FEV1, liter ● PEF, liter/min ● Daily dose Fluticasone in microgram ● FEV1%predicted ● FVC% ● FEV1/FVC ● PEF (%) *Dichotomous*: ● Maximal FEV1% decline after mannitol challenge test ● Maximal FEV1 % decline after exercise challenge test, 6 min. run ● Maximal FEV1% decline after Metacholin challenge test ● Maximal FEV1 decline% after Cold Air Challenge Test *Adverse Events*: ● serious adverse events ● No. of acute asthma attacks during physical activity
Identification	**Country:** Turkey **Authors name:** Basaran, 2006 **Institution:** Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Cukurova Unirversity **Email:** sbasaran@cu.edu.tr **Address:** Sibel Basaran, Department ofPhysical Medicine and Rehabilitation, Faculty of Medicine,Cukurova University, TR-01330 Adana, Turkey.
Notes	

Risk of bias table

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Comment: Not described
Allocation concealment (selection bias)	Unclear risk	Comment: Not described
Blinding of participants and personnel (performance bias)	Unclear risk	Comment: Not described
Blinding of outcome assessment (detection bias)	Unclear risk	Comment: Not described
Incomplete outcome data (attrition bias)	High risk	Comment: No flow chart, however dropouts are described
Selective reporting (reporting bias)	Low risk	Comment: No study protocol, however all outcomes are adressed
Other bias	Low risk	

Counil 2003

Methods	**Study design:** Randomized controlled trial **Study grouping:** Parallel group
Participants	**Baseline Characteristics** physical activity intervention ● *Mean age in years (SD)*: 14 ± 0.6 ● *Gender, N=male (%)*: 100 ● *Mean duration of asthma in years (SD)*: control: activity as usual ● *Mean age in years (SD)*: 13.9 ± 0.8 ● *Gender, N=male (%)*: 100 ● *Mean duration of asthma in years (SD)*: **Included criteria:** Inclusion in the study required one month of acclimatization to altitude (1400 m), 6 weeks without anyacute episode of wheezing, one year without emergency departmentvisits or hospitalization for acute asthma, and a basalFEV1 >70% of predicted. The diagnosis of asthma was madeon the basis of the following criteria: (1) personal or familialhistory of allergy; (2) personal history of acute wheezing; (3)reversible airway obstruction documented by lung functiontesting, ie, improvement of 15%, at least in FEV1 and/or 30%in forced expiratory flow25-75 by inhaling a bronchodilatator;(4) positive specific immunoglobulin E to inhaled allergens bya multi-allergen allergosorbent test (Phadiatop, Pharmacia,Uppsala, Sweden) and/or a cutaneous hypersensitivity to oneor several allergens; and (5) no

	evidence of other lung disease. **Excluded criteria:** Asthma exacerbations withoral corticosteroid use and hospitalization for any reason duringthe protocol were exclusion criteria.
Interventions	**Intervention Characteristics** physical activity intervention ● *Description*: The design of the training sessions wasadapted from Gimenez et al.25 The target heart rate was individualizedand corresponded to the AT level. Every 4 minutes,the subject was asked to sprint for 1 minute against thebreaking load corresponding to his MAP. During all sessions,heart rate was continuously monitored with a cardiofrequencymeter (Sport Tester PE 3000, Polar Electro, Kemple, Finland).A training instructor and a pulmonologist supervisedeach session to ensure that the clinical condition was stableand the training procedures were followed. ● *Duration (weeks)*: The training group exercised 3 times weekly for 6weeks, with each session consisting of 45 min0utes of continuouscycling activity. ● *Follow up (weeks)*: 0 control: activity as usual ● *Description*: All subjects underwent clinical examination, anthropometricmeasurements, ECG and spirometry before enteringin the study. They then familiarized themselves with the exercisetesting procedures. Each subject performed one incrementalexercise test and one FV test, with pre- andpostexercise pulmonary function testing. The same evaluationwas repeated when the 6 weeks of training were completed.Testing was done blindly regarding the training groups. Peakflow rates were monitored twice daily. All treatment was givenunder direct medical supervision. ● *Duration (weeks)*: The same evaluationwas repeated when the 6 weeks of training were completed. ● *Follow up (weeks)*: 0
Outcomes	*Continuous*: ● Mean quality of life score (higher=better) ● Daily dose Budesonide in microgram ● asthma control score ● symptom score ● FEV1, liter ● PEF, liter/min ● Daily dose Fluticasone in microgram ● FEV1%predicted

	Dichotomous: ● Maximal FEV1% decline after mannitol challenge test ● Maximal FEV1 % decline after exercise challenge test, 6 min. run ● Maximal FEV1% decline after Metacholin challenge test ● Maximal FEV1 decline% after Cold Air Challenge Test *Adverse Events*: ● serious adverse events ● No. of acute asthma attacks during physical activity
Identification	**Sponsorship source:** Not described **Country:** France **Authors name:** Counil, 2003 **Institution:** Service de Pédiatrie I, Service d'- Exploration Fonctionnelle Respiratoire, Hôpital Arnaud de Villeneuve, and UFR STAPS, Laboratoire Sport Performance Santé, **Email:** fcounil@ chu-montpellier.fr. **Address:** F-P Counil, MD, PhD,Service de Pédiatrie I, 371 Avenue duDoyen Gaston Giraud, 34295 Montpellier,Cedex 5, France.
Notes	See Carson, 2013 for Risk of Bias

Risk of bias table

Edenbrandt 1990

Methods	**Study design:** Randomized controlled trial **Study grouping:** Parallel group
Participants	**Baseline Characteristics** physical activity intervention ● *Mean age in years (SD)*: ● *Gender, N=male (%)*: 60 ● *Mean duration of asthma in years (SD)*: control: activity as usual ● *Mean age in years (SD)*:

	● *Gender, N=male (%)*: 66.7 ● *Mean duration of asthma in years (SD)*: **Included criteria:** Not described **Excluded criteria:** Not described
Interventions	**Intervention Characteristics** physical activity intervention ● *Description*: Taught huffing, a cough-tecnique also known as the forced expiratory technique. Emphasis was placed on the correct use of the bronchodilator spray and its use before physical activity. An asthma school was arranged for all parents and those children who were older than 11 years. The children in the training group were divided according to age into two groups for the physical training. The training was led by a physiotherapist and a physical education instructor and was held once a week for one year except during school-holidays. The children used bronchodilators before training. The physical training began with 10 min of gradually intensified warming up followed by 10-15 min of 45 sec intense training alternated with 30 sec rest (circuit training). This was followed in turn by various games e.g. relay racing. The session ended with free swimming. ● *Duration (weeks)*: 12 weeks ● *Follow up (weeks)*: 0 control: activity as usual ● *Description*: ● *Duration (weeks)*: 12 weeks ● *Follow up (weeks)*: 0
Outcomes	*Continuous*: ● Mean quality of life score (higher=better) ● Daily dose Budesonide in microgram ● asthma control score ● symptom score ● FEV1, liter ● PEF, liter/min ● Daily dose Fluticasone in microgram ● FEV1%predicted ● FEV1 rest

	Dichotomous: ● Maximal FEV1% decline after mannitol challenge test ● Maximal FEV1 % decline after exercise challenge test, 6 min. run ● Maximal FEV1% decline after Metacholin challenge test ● Maximal FEV1 decline% after Cold Air Challenge Test *Adverse Events*: ● serious adverse events ● No. of acute asthma attacks during physical activity
Identification	**Country:** Sweden **Authors name:** Edenbrandt, 1990 **Institution:** Departmen of Clinical Physiology and the Department of Paediatrics **Address:** Departmen of Clinical Physiology and the Department of Paediatrics.University HospitalS-221 85 Lund Sweden
Notes	

Risk of bias table

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Comment: Not described
Allocation concealment (selection bias)	Unclear risk	Comment: Not described
Blinding of participants and personnel (performance bias)	Low risk	Comment: Not described, probably not done, however probably no effect on outcomes
Blinding of outcome assessment (detection bias)	Low risk	Comment: Not described, probably not done, however probably no effect on outcomes
Incomplete outcome data (attrition bias)	Unclear risk	Comment: No flow-chart. Drop-outs are not described.
Selective reporting (reporting bias)	Low risk	Comment: Study protocol not available but all expected outcomes are included.
Other bias	Low risk	

Fanelli 2007

Methods	**Study design:** Randomized controlled trial **Study grouping:** Parallel group
Participants	**Baseline Characteristics** physical activity intervention ● *Mean age in years (SD)*: 11 (2) ● *Gender, N=male (%)*: 57.2 ● *Mean duration of asthma in years (SD)*: 6.4 (2.3) control: activity as usual ● *Mean age in years (SD)*: 10 (2) ● *Gender, N=male (%)*: 64.7 ● *Mean duration of asthma in years (SD)*: 5.9 (2.2) **Included criteria:** (i) asthma diagnosis and graduation of severity according to the Global Initiative for Asthma (GINA) guidelines (15); (ii) under medical treatment for at least 6 months befare the study; and (iii) on a stable phase of the disease-that is, without any recent (15 d) disease exacerbation or change in medication usage. **Excluded criteria:**
Interventions	**Intervention Characteristics** physical activity intervention ● *Description*: Educational program. This program comprised two once-a-week classes, each lasting 2 h. The core activity was based on an educational videotape about the "ABCs of Asthma," with an interactive class to clarify doubts. The program also included lessons on disease pathophysiology, use of medication (relief and maintenance), and a written plan of action in case of worsening of symptoms.Training program. Physical training was performed twice a week for 90 min during 16 wk. The program was divided into four parts: (i) 15 min of warm-up and stretching exercises, (ii) 30 min of aerobic exercise on cycle and/or treadmill, (iii) 30 min ofupper- and lower-limb and abdomen endurance exercises, and (iv) 15 min of cooling down, stretching, and relaxation. Aerobic training was performed at the heart rate (HR) corresponding to two thirds of the difference between the anaerobic threshold (AnT) and the respiratory compensation point (RCP) as obtained in the incremental CPET (see below). This exercise intensity was selected to provide a sufficiently high metabolic/cardiovascular stress (i.e" above AnT) but still sustainable for a 30-min period. There was an initial (eight sessions) build-up period in which training intensity was gradually increased to allow the children to reach the proposed exercise intensity. Intensity was then

	increased by 5% when the child was able to continuously perform the proposed activity for two consecutive days. Respiratory discomfort (modified Borg (6) scale) and HR (by a HR monitor) were followed every I 0 min throughout the aerobic training phase. Upper- and lower-body endurance exercise was performed with free weights at 70% of a I0-maximal repetition test. Participants performed two types of exercise with the upper limbs and two with the lower limbs (three sets of 15 repetitions). In addition, three flexion abdominal exercise sets were also performed (15 repetitions each). ● *Duration (weeks)*: 16 ● *Follow up (weeks)*: 0 control: activity as usual ● *Description*: Educational program. This program comprised two once-a-week classes, each lasting 2 h. The core activity was based on an educational videotape about the "ABCs of Asthma," with an interactive class to clarify doubts. The program also included lessons on disease pathophysiology, use of medication (relief and maintenance), and a written plan of action in case of worsening of symptoms. ● *Duration (weeks)*: 16 ● *Follow up (weeks)*: 0
Outcomes	*Continuous*: ● asthma control score ● symptom score ● FEV1, liter ● FEV1%predicted ● PEF, liter/min ● Daily dose Fluticasone in microgram ● Daily dose Budesonide in microgram ● Mean quality of life score (higher=better) ● PAQLQ *Dichotomous*: ● Maximal FEV1 % decline after exercise challenge test, 6 min. run ● Maximal FEV1% decline after Metacholin challenge test ● Maximal FEV1% decline after mannitol challenge test ● Maximal FEV1 decline% after Cold Air Challenge Test *Adverse Events*:

	● No. of acute asthma attacks during physical activity ● serious adverse events
Identification	**Sponsorship source:** This study was supported by FAPESP grants 2002/08422-7 and Conselho Nacional de Pesquisa (CNPq), Brazil. J. A. Neder, M. A. Martins, and C. R. F. Carvalho are established investigators of the CNPq. **Country:** Brazil **Authors name:** Fanelli, 2007 **Institution:** School of Medicine, University of Sao Paulo **Email:** cscarval@usp .br. **Address:** Prof. Celso R. F. Carvalho, School of Medicine, University of Sao Paulo, Department of Clinical Medicine, Av. Dr. Amaldo 455, sala 1216, 01246-903, Sao Paulo, SP, Brazi
Notes	**Continuous outcomes:** *Tina Povlsen* PAQLQ numbers a taken from figure 2. See Carson, 2013 for Risk of Bias

Risk of bias table

Latorre Roman 2014

Methods	**Study design:** Randomized controlled trial **Study grouping:** Parallel group **Open Label:** YES
Participants	**Baseline Characteristics** intervention: 12 week in-door exercise program ● *mean age in years (SD)*: 11.55 (1.01) ● *BMI, mean (SD)*: 19.69 (3.2) control: no exercise ● *mean age in years (SD)*: 11.51 (1.42) ● *BMI, mean (SD)*: 21.39 (4.78) **Included criteria:** **Excluded criteria:**

Interventions	**Intervention Characteristics** intervention: 12 week in-door exercise program ● *Description*: ● *Duration*: ● *Length of follow up (weeks)*: control: no exercise ● *Description*: ● *Duration*: ● *Length of follow up (weeks)*:
Outcomes	*Continuous*: ● FEV1(L) ● PAQLQ-symptom score (higher=better) ● Total PAQLQ-score (higher=better)
Identification	**Sponsorship source:** none stated **Country:** Spain **Comments:** none **Authors name:** Pedro Angel Latorre-Roman **Address:** University of Jaen, Jaen, Spain
Notes	

Risk of bias table

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	Not described
Allocation concealment (selection bias)	Unclear risk	Not described
Blinding of participants and personnel (performance bias)	High risk	Not possible
Blinding of outcome assessment (detection bias)	Unclear risk	Not described, hence problably not done
Incomplete outcome data (attrition bias)	Low risk	Fig.1 adresses drop outs

Selective reporting (reporting bias)	Low risk	pre-described outcomes of interest equals reportet
Other bias	Low risk	

Matsumoto 1999

Methods	**Study design:** Randomized controlled trial **Study grouping:** Parallel group
Participants	**Baseline Characteristics** physical activity intervention ● *Mean age in years (SD)*: 10.5 (0.9) ● *Gender, N=male (%)*: 87.5 ● *Mean duration of asthma in years (SD)*: control: activity as usual ● *Mean age in years (SD)*: 9.9 (1.0) ● *Gender, N=male (%)*: 87.5 ● *Mean duration of asthma in years (SD)*: **Included criteria:** Asthma diagnosed ac- cording to the ATS criteria14 who had been admitted to hospital for treatment participated in the study. **Excluded criteria:** Not described?
Interventions	**Intervention Characteristics** physical activity intervention ● *Description*: Before commencing the training programmethe work rate and corresponding heart rate at125% of LT were assessed in each subjectusing the swimming ergometer. The heart ratewas continuously monitored by radiometryand the swimming speed was regularly noted atthis intensity in a series of 25 m “crawls”. Itwas therefore possible for subjects to controltheir swimming speed by being informed of thetime taken to swim every 25 m. The trainingintensity was thus set to 125% of LT for eachsubject individually. During the six week trainingperiod the training group swam in a heatedindoor pool (30℃) for two 15 minute periodson six days of the week. A 10 minute break wastaken between the two periods. Once a weekblood lactate concentrations and heart ratewere measured in each subject after the first 15minute period to ensure that the trainingintensity remained at 125% of the subject’s LT.The training intensity was increased wherenecessary ● *Duration (weeks)*: 6

	● *Follow up (weeks)*: 0 control: activity as usual ● *Description*: ● *Duration (weeks)*: 6 weeks ● *Follow up (weeks)*: 0
Outcomes	*Continuous*: ● asthma control score ● symptom score ● FEV1, liter ● FEV1%predicted ● PEF, liter/min ● Daily dose Fluticasone in microgram ● Daily dose Budesonide in microgram ● Mean quality of life score (higher=better) *Dichotomous*: ● Maximal FEV1 % decline after exercise challenge test, 6 min. run ● Maximal FEV1% decline after Metacholin challenge test ● Maximal FEV1% decline after mannitol challenge test ● Maximal FEV1 decline% after Cold Air Challenge Test *Adverse Events*: ● No. of acute asthma attacks during physical activity ● serious adverse events
Identification	**Sponsorship source:** This study was supported by the Pollution-related HealthDamage Compensation and Prevention Association of Japan. **Country:** Japan **Authors name:** Matsumoto, 1999 **Institution:** Division of Pediatrics, National Minami Fukuoka Chest Hospital **Address:** Fukuoka University, 45-1-7 Nanakuma, Fukuoka 814-0180, Japan

Notes	**Continuous outcomes:** *Elisabeth Ginnerup-Nielsen* Kpascal See Carson, 2013 for Risk of Bias

Risk of bias table

Moreira 2008

Methods	**Study design:** Randomized controlled trial **Study grouping:** Parallel group **Open Label:** **Cluster RCT:**
Participants	**Baseline Characteristics** physical activity intervention ● *Mean age in years (SD)*: 12.9(3.4) ● *Gender, N=male (%)*: 11 ● *Mean duration of asthma in years (SD)*: 4.4(2.2) control: activity as usual ● *Mean age in years (SD)*: 12.5(3.5) ● *Gender, N=male (%)*: 9 ● *Mean duration of asthma in years (SD)*: 4.9(1.8) **Included criteria:** **Excluded criteria:**
Interventions	**Intervention Characteristics** physical activity intervention ● *Description*: The exercise group undertook submaximal aerobic exercisedesigned as a moderately intensive training programmeincluding both lower and upper extremity activities. Duringthe 12-week training programme, between February and May2005, the sessions were held twice a week, for 50 min persession. All sessions were carried out in an indoor gymnasium.Subjects were instructed to use b2-agonists before the trainingor, if necessary, during the session. A typical session startedwith a warm-up period (10 min) with arm and leg exercise.This was followed by submaximal training (30–35 min),including aerobic exercises, strength training, and somebalance and

	coordination exercises, and a cool-down period(7–10 min). In order to offer an enjoyable training session,various recreational games were played. ● *Duration (weeks)*: 12 ● *Follow up (weeks)*: 0 control: activity as usual ● *Description*: The control groupsubjects continued their usual daily routine. ● *Duration (weeks)*: 12 ● *Follow up (weeks)*: 0
Outcomes	*Continuous*: ● asthma control score ● symptom score ● FEV1, liter ● FEV1%predicted ● PEF, liter/min ● Daily dose Fluticasone in microgram ● Daily dose Budesonide in microgram ● Mean quality of life score (higher=better) ● PD20,metacholin (Provocative Dose of metacholin causing a 20% fall in FEV1 (higher dose=better) ● PAQLQ ● FEV1%pred *Dichotomous*: ● Maximal FEV1 % decline after exercise challenge test, 6 min. run ● Maximal FEV1% decline after Metacholin challenge test ● Maximal FEV1% decline after mannitol challenge test ● Maximal FEV1 decline% after Cold Air Challenge Test *Adverse Events*: ● No. of acute asthma attacks during physical activity ● serious adverse events

Identification	**Sponsorship source:** A. Moreira holds a grant from theFinnish Centre for InternationalMobility (Helsinki, Finland) and afellowship from the EuropeanAcademy of Allergy and ClinicalImmunology. **Country:** Portugal **Authors name:** Moreira, 2008 **Institution:** Dept of Immunology and, Biostatistics and Medical Informatics. Faculty of Medicine **Email:** andremoreira@med.up.pt **Address:** A. MoreiraServic¸o e Laborato´rio de ImunologiaFaculdade de Medicina daUniversidade do PortoAl. Prof. Hernaˆni Monteiro4202 PortoPortugal
Notes	See Carson, 2013 for Risk of Bias

Risk of bias table

Onur 2011

Methods	**Study design:** Randomized controlled trial **Study grouping:** Parallel group
Participants	**Baseline Characteristics** physical activity intervention ● *Mean age in years (SD)*: 9.8 (1.8) ● *Gender, N=male (%)*: ● *Mean duration of asthma in years (SD)*: control: activity as usual ● *Mean age in years (SD)*: 9.8 (1.8) ● *Gender, N=male (%)*: ● *Mean duration of asthma in years (SD)*: **Included criteria:** regularly participated inexercise and/or were part of a sports team were excludedfrom the study. The diagnosis of asthma was based on historyof recurrent cough and wheezing with prolonged expirationtime which demonstrated clinical reversibility with a shortacting beta-2 agonist bronchodilator therapy **Excluded criteria:** Those children who stated that they regularly participated in exercise and/or were part of a sports team were excludedfrom the study. Immunocompromised patients, patients with a history of chronic inflammation/rheumatological disorder, and patients with autoimmunediseases were excluded.

Interventions	**Intervention Characteristics** physical activity intervention ● *Description*: received the pharmacological treatment and was assignedto an exercise programme carried out by the Physiotherapyand Rehabilitation Department. Children exercisedtwice a week for an hour on a bicycle for eight weeks.The rate of exercise was determined according to the resting heart rate of the children. Their submaximal heart ratewas determined as 50% higher than their resting heart rate.Their target heart rate during exercise was determinedas 80% of the submaximal heart rate. The pedalling raterequired to reach the target heart rate was determinedusing a pulse oximeter during exercise. During the eightweek exercise programme, 15 minutes of warm-up exercisewas followed by 45 minutes of cycling at the target heartrate. ● *Duration (weeks)*: 8 ● *Follow up (weeks)*: 0 control: activity as usual ● *Description*: pharmacologicaltreatment for eight weeks. ● *Duration (weeks)*: 8 ● *Follow up (weeks)*: 0
Outcomes	*Continuous*: ● asthma control score ● symptom score ● FEV1, liter ● FEV1%predicted ● PEF, liter/min ● Daily dose Fluticasone in microgram ● Daily dose Budesonide in microgram ● Mean quality of life score (higher=better) ● FVC % predicted *Dichotomous*: ● Maximal FEV1 % decline after exercise challenge test, 6 min. run ● Maximal FEV1% decline after Metacholin challenge test ● Maximal FEV1% decline after mannitol challenge test ● Maximal FEV1 decline% after Cold Air Challenge Test

	Adverse Events: ● No. of acute asthma attacks during physical activity ● serious adverse events
Identification	**Country:** Turkey **Authors name:** Onur, 2011 **Institution:** Celal Bayar University, Faculty of Medicine, Department of Biochemistry, **Email:** ece.onur@bayar.edu.tr
Notes	

Risk of bias table

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	Quote: "The patient group was randomly divided into two equal groups." Comment: Not clear how
Allocation concealment (selection bias)	Unclear risk	Comment: Not described
Blinding of participants and personnel (performance bias)	Unclear risk	Comment: Probably not blinded
Blinding of outcome assessment (detection bias)	Low risk	Comment: Not described. Problably not done. However problably no effect on outcomes
Incomplete outcome data (attrition bias)	Low risk	Comment: Dropouts not described but it seems as though there are
Selective reporting (reporting bias)	Low risk	Comment: No study protocol, however all outcomes are reported
Other bias	Low risk	

vanVeldhoven 2001

Methods	**Study design:** Randomized controlled trial **Study grouping:** Parallel group
Participants	**Baseline Characteristics** physical activity intervention ● *Mean age in years (SD)*: 10.5 (1.2) ● *Gender, N=male (%)*: 70 ● *Mean duration of asthma in years (SD)*: control: activity as usual ● *Mean age in years (SD)*: 10.7 (1.2) ● *Gender, N=male (%)*: 75 ● *Mean duration of asthma in years (SD)*: **Included criteria:** age between 8 and 13 years; clinically diagnosed asthma; either suffer- ing from EIB, by a fall of 10% of FEV1 after exercise (as known by a physician) and/or fear of exercise as observed by a general practitioner, a classroom teacher or by parents having observed exercise avoidance behaviour. **Excluded criteria:**
Interventions	**Intervention Characteristics** physical activity intervention ● *Description*: The physical exercise programme consisted of group exercises twice a week for one hour in a gymnasium24 and one 20-minute exercise session per week at home, within a three-month period.25 Premedication (usually inhaled ß2-agonist) was taken before training as prescribed by the child's paediatrician. Occasional episodes of wheezing following exer- cise were relieved by inhalation of salbutamol. The lessons in the gymnasium started with 10 minutes warming-up, followed by 20 minutes of fitness training (a) and 15–20 minutes of differ- ent physical activities (b). Before or after the exercise, explanation and information was given to the children about asthma and exercise to improve coping behaviour with asthma (c). ● *Duration (weeks)*: 12 ● *Follow up (weeks)*: 0 control: activity as usual ● *Description*: did not receive any extra care (or treatment). ● *Duration (weeks)*: 12 ● *Follow up (weeks)*: 0

Outcomes	*Continuous*: ● asthma control score ● symptom score ● FEV1, liter ● FEV1%predicted ● PEF, liter/min ● Daily dose Fluticasone in microgram ● Daily dose Budesonide in microgram ● Mean quality of life score (higher=better) ● EIB fall % ● FVC ● FEV1/FVC *Dichotomous*: ● Maximal FEV1 % decline after exercise challenge test, 6 min. run ● Maximal FEV1% decline after Metacholin challenge test ● Maximal FEV1% decline after mannitol challenge test ● Maximal FEV1 decline% after Cold Air Challenge Test *Adverse Events*: ● No. of acute asthma attacks during physical activity ● serious adverse events
Identification	**Sponsorship source:** We are grateful to MJM Kaashoek, PHC Klijn, J Meys, AI Scholte for their contribution to the study. **Country:** Holland **Authors name:** vanVeldhoven 2001 **Institution:** Department of Educational Sciences, Faculty of Social Sciences, Utrecht University **Email:** N.vanveldhoven@fss.uu.nl **Address:** NHMJ van Veldhoven, Utrecht University, Faculty of Social Sciences, Department of Edu- cational Sciences, Heidelberglaan 1, 3584 CS Utrecht, The Netherlands
Notes	See Carson, 2013 for Risk of Bias

Risk of bias table

Varray 1995

Methods	**Study design:** Randomized controlled trial
Participants	**Baseline Characteristics** physical activity intervention ● *Mean age in years (SD)*: 10.3 ● *Gender, N=male (%)*: 77.8 ● *Mean duration of asthma in years (SD)*: control: activity as usual ● *Mean age in years (SD)*: 11.7 ● *Gender, N=male (%)*: 77.8 ● *Mean duration of asthma in years (SD)*: **Included criteria:** (1): Clinical: family history of asthma and/or personal history of eczema, conjunctivitis or rhinitis caused by a known allergen.(2): Allergic: all the children showed a cutaneous hypersensitivity to one or several allergens.(3): immunological blood IgE levels were determined by the paper radioimmunoabsorbent test (PRIST): Any values above 150 UI/ml were considered abnormal. **Excluded criteria:**
Interventions	**Intervention Characteristics** physical activity intervention ● *Description*: Indoor swimming - pool. Aerobic training. ● *Duration (weeks)*: 12 ● *Follow up (weeks)*: 0 control: activity as usual ● *Description*: ● *Duration (weeks)*: 12 ● *Follow up (weeks)*: 0

Outcomes	*Continuous*: ● asthma control score ● symptom score ● FEV1, liter ● FEV1%predicted ● PEF, liter/min ● Daily dose Fluticasone in microgram ● Daily dose Budesonide in microgram ● Mean quality of life score (higher=better) ● VO2 max *Dichotomous*: ● Maximal FEV1 % decline after exercise challenge test, 6 min. run ● Maximal FEV1% decline after Metacholin challenge test ● Maximal FEV1% decline after mannitol challenge test ● Maximal FEV1 decline% after Cold Air Challenge Test *Adverse Events*: ● No. of acute asthma attacks during physical activity ● serious adverse events
Identification	**Country:** France **Authors name:** Varray,1995 **Institution:** Laboratoire, sport sante development, UFR STAPS **Address:** Laboratoire, sport sante development, UFR STAPS700 Avenue du Pic Saint Loup, 34090 Montpellier. France
Notes	See Carson, 2013 for Risk of Bias

Risk of bias table

Wang 2009

Methods	**Study design:** Randomized controlled trial
Participants	**Baseline Characteristics** physical activity intervention ● *Mean age in years (SD)*: ● *Gender, N=male (%)*: 66.7 ● *Mean duration of asthma in years (SD)*: ● *Mean age in years (95%CI)*: 10 (9-11) control: activity as usual ● *Mean age in years (SD)*: ● *Gender, N=male (%)*: 66.7 ● *Mean duration of asthma in years (SD)*: ● *Mean age in years (95%CI)*: 10 (9.11)
Interventions	**Intervention Characteristics** physical activity intervention ● *Description*: During the 6-week training period, the experimentalgroup performed the following swimming routinein a non-chlorinated outdoor pool (26℃, 95% CI:24–28): 10-min warm-up including breathing exercisesin water, 30-min swimming training and 10-mincool-down including breathing exercises in water. For beginners, swimming trainingwas kicking and for experienced swimmers it was freestyleor breaststroke, and the physical work capacitywas set at 65% of the peak heart rate. ● *Duration (weeks)*: 6 ● *Follow up (weeks)*: 0 control: activity as usual ● *Description*: the control group received no specificintervention. ● *Duration (weeks)*: 6 ● *Follow up (weeks)*: 0
Outcomes	*Continuous*: ● asthma control score ● symptom score ● FEV1, liter

	● FEV1%predicted ● PEF, liter/min ● Daily dose Fluticasone in microgram ● Daily dose Budesonide in microgram ● Mean quality of life score (higher=better) ● VO2 max ● FEV1 (%) ● PEF (L/min) ● FVC (%) ● FEV1/FVC (%) *Dichotomous*: ● Maximal FEV1 % decline after exercise challenge test, 6 min. run ● Maximal FEV1% decline after Metacholin challenge test ● Maximal FEV1% decline after mannitol challenge test ● Maximal FEV1 decline% after Cold Air Challenge Test *Adverse Events*: ● No. of acute asthma attacks during physical activity ● serious adverse events
Identification	
Notes	See Carson, 2013 for Risk of Bias

Risk of bias table

Footnotes

Characteristics of excluded studies

Ahmaidi 1993

Reason for exclusion	Wrong study design

Chang 2008

Reason for exclusion	Wrong intervention

Dean 1988

Reason for exclusion	Wrong intervention

Farid 2005

Reason for exclusion	Adult population

Fitch 1986

Reason for exclusion	Wrong setting

Flapper 2006

Reason for exclusion	Wrong study design

Girodo 1992

Reason for exclusion	Adult population

Goncalves 2008

Reason for exclusion	Adult population

Graff Lonnevig 1980

Reason for exclusion	Wrong study design

Henriksen 1983

Reason for exclusion	Wrong setting

Holzer 1984

Reason for exclusion	Controlled trial

Huang 1989

Reason for exclusion	Controlled trial

King 1989

Reason for exclusion	Controlled trial

Lima 2008

Reason for exclusion	Wrong intervention

Mendes 2010

Reason for exclusion	Adult population

Mendes 2011

Reason for exclusion	adult population

Neder 1999

Reason for exclusion	Controlled trial

Orenstein 1985

Reason for exclusion	Controlled trial

Sabina 2005

Reason for exclusion	Adult population

Sidiropoulou 2007

Reason for exclusion	Wrong study design

Silva 2006

Reason for exclusion	Wrong study design

Silva 2013

Reason for exclusion	Wrong study design

Sly 1972

Reason for exclusion	Controlled trial

Svenonius 1983

Reason for exclusion	Wrong patient population

Swann 1983

Reason for exclusion	Wrong study design

Varray 1991

Reason for exclusion	Wrong intervention

Vempati 2009

Reason for exclusion	Wrong study design

Weisgerber 2003

Reason for exclusion	Wrong intervention

Weisgerber 2009

Reason for exclusion	Wrong study design

Wicher 2010

Reason for exclusion	Wrong intervention

Footnotes

Characteristics of studies awaiting classification

Footnotes

Characteristics of ongoing studies

Footnotes

References to studies

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[Empty]

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Data and analyses

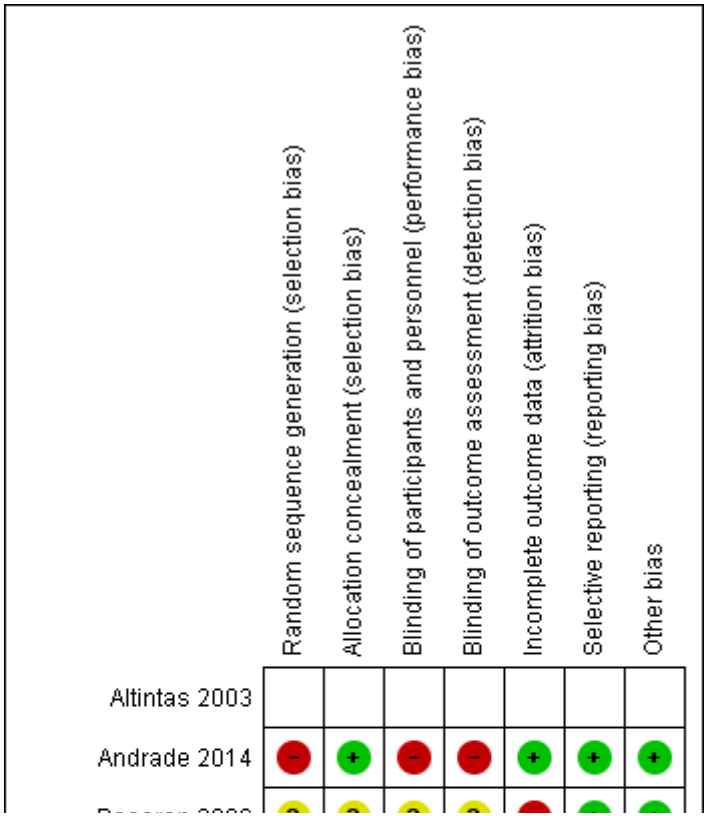
1 physical activity intervention vs control: activity as usual

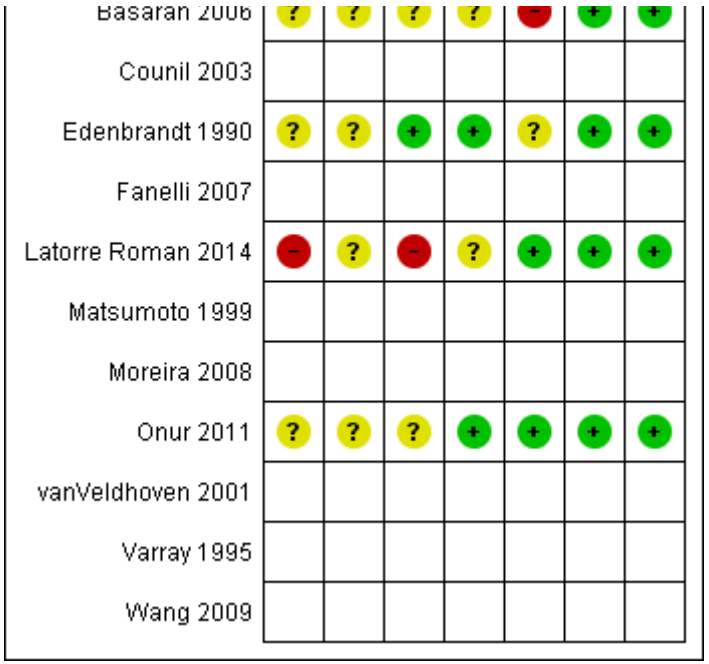
Outcome or Subgroup	Studies	Participants	Statistical Method	Effect Estimate
1.1 Symptomer (PAQLQ-sub scale -symptoms (higher=better))	4		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.1.2 End of trial	4	221	Mean Difference (IV, Random, 95% CI)	1.11 [0.13, 2.10]
1.3 Livskvalitet PAQLQ total	5		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.3.2 End of trial	5	259	Mean Difference (IV, Random, 95% CI)	1.15 [0.36, 1.95]
1.4 FEV1, liter	5		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.4.1 End of trial	5	240	Mean Difference (IV, Random, 95% CI)	0.26 [-0.16, 0.68]
1.5 FEV1%predicted	9		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.5.1 End of trial	9	293	Mean Difference (IV, Random, 95% CI)	-0.53 [-2.75, 1.68]
1.6 PEF L/min	2		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.6.1 Absolute	2	77	Mean Difference (IV, Random, 95% CI)	28.01 [-70.77, 126.79]
1.7 PEF (%)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
1.7.1 Longest follow up (end of trial)	1	58	Mean Difference (IV, Fixed, 95% CI)	0.90 [-7.27, 9.07]
1.10 Reduced daily dose of budesonide	1	38	Risk Ratio (M-H, Fixed, 95% CI)	2.23 [0.86, 5.75]
1.12 FEV1/FVC	3		Mean Difference (IV, Random, 95% CI)	Subtotals only
1.12.1 Longest follow up (end of trial)	3	135	Mean Difference (IV, Random, 95% CI)	-1.67 [-4.29, 0.96]

1.16 PD20,metacholin (Provocative Dose of metacholin causing a 20% fall in FEV1 (higher dose=better)	1	27	Mean Difference (IV, Fixed, 95% CI)	0.28 [-0.82, 1.38]
1.16.1 change	1	27	Mean Difference (IV, Fixed, 95% CI)	0.28 [-0.82, 1.38]
1.28 EIB fall %	2	63	Mean Difference (IV, Random, 95% CI)	2.78 [-1.59, 7.14]
1.28.1 End of trial	2	63	Mean Difference (IV, Random, 95% CI)	2.78 [-1.59, 7.14]

Figures

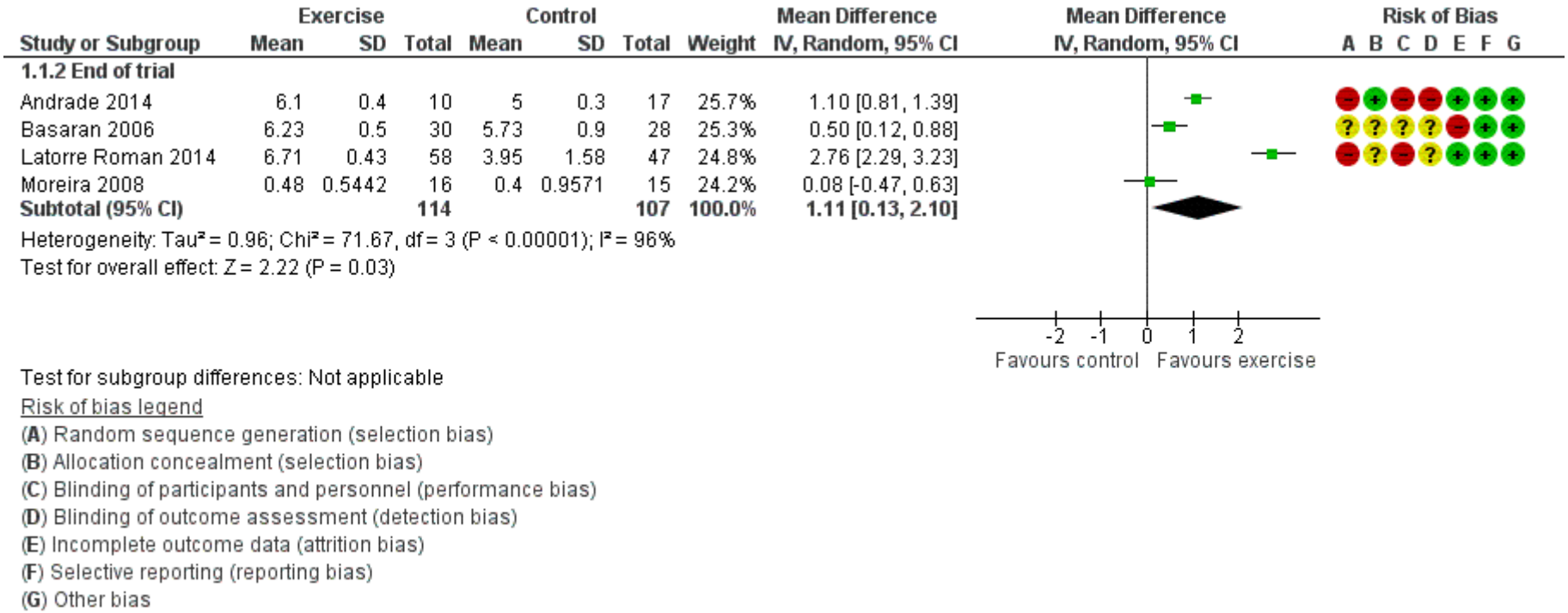
Figure 1





Risk of bias summary: review authors' judgements about each risk of bias item for each included study.

Figure 2 (Analysis 1.1)

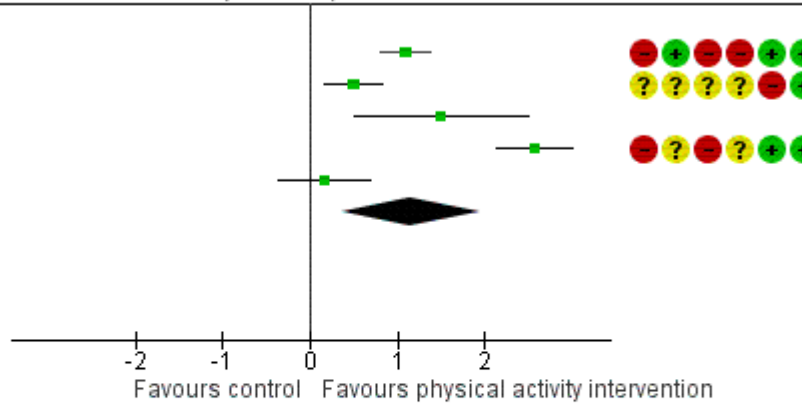


Forest plot of comparison: 1 physical activity intervention vs control: activity as usual, outcome: 1.1 Symptomer (PAQLQ-sub scale -symptoms (higher=better)).

Figure 4 (Analysis 1.3)

Study or Subgroup	Exercise Mean	SD	Total	Control Mean	SD	Total	Weight	Mean Difference IV, Random, 95% CI
1.3.2 End of trial								
Andrade 2014	6.2	0.4	10	5.1	0.3	17	21.5%	1.10 [0.81, 1.39]
Basaran 2006	6.23	0.4	30	5.73	0.8	28	21.3%	0.50 [0.17, 0.83]
Fanelli 2007	2.25	0.75	21	0.75	2	17	16.4%	1.50 [0.50, 2.50]
Latorre Roman 2014	6.72	0.38	58	4.15	1.5	47	20.7%	2.57 [2.13, 3.01]
Moreira 2008	0.61	0.67346939	16	0.45	0.82004494	15	20.1%	0.16 [-0.37, 0.69]
Subtotal (95% CI)			**135**			**124**	**100.0%**	**1.15 [0.36, 1.95]**

Heterogeneity: Tau² = 0.75; Chi² = 68.27, df = 4 (P < 0.00001); I² = 94%
Test for overall effect: Z = 2.83 (P = 0.005)

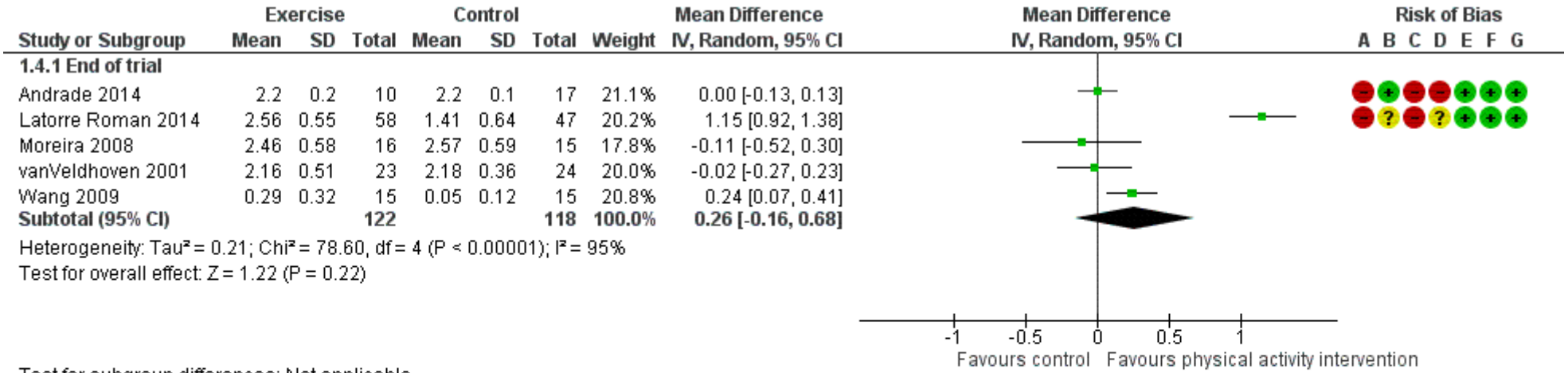


Test for subgroup differences: Not applicable

Risk of bias legend
(**A**) Random sequence generation (selection bias)
(**B**) Allocation concealment (selection bias)
(**C**) Blinding of participants and personnel (performance bias)
(**D**) Blinding of outcome assessment (detection bias)
(**E**) Incomplete outcome data (attrition bias)
(**F**) Selective reporting (reporting bias)
(**G**) Other bias

Forest plot of comparison: 1 physical activity intervention vs control: activity as usual, outcome: 1.3 Livskvalitet PAQLQ total.

Figure 5 (Analysis 1.4)



Test for subgroup differences: Not applicable

Risk of bias legend

(**A**) Random sequence generation (selection bias)
(**B**) Allocation concealment (selection bias)
(**C**) Blinding of participants and personnel (performance bias)
(**D**) Blinding of outcome assessment (detection bias)
(**E**) Incomplete outcome data (attrition bias)
(**F**) Selective reporting (reporting bias)
(**G**) Other bias

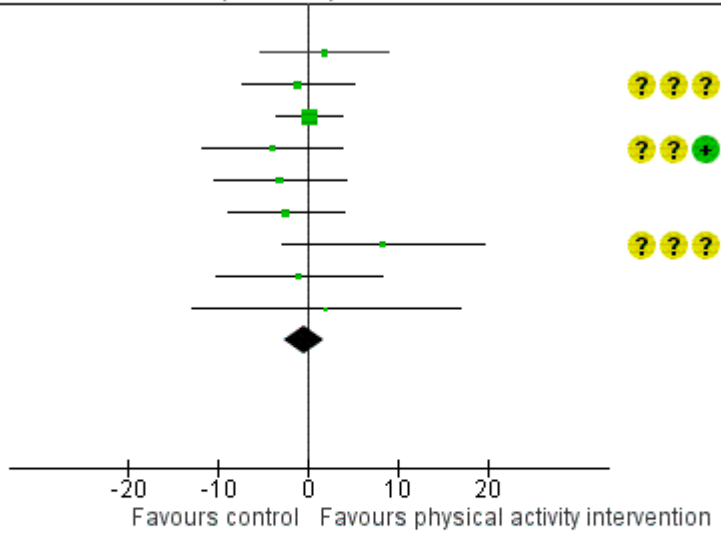
Forest plot of comparison: 1 physical activity intervention vs control: activity as usual, outcome: 1.4 FEV1, liter.

Figure 6 (Analysis 1.5)

Study or Subgroup	Exercise Mean	Exercise SD	Exercise Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.5.1 End of trial								
Altintas 2003	5	12.19	13	3.2	5.13	13	9.5%	1.80 [-5.39, 8.99]
Basaran 2006	90.2	12.1	30	91.4	12.2	28	12.5%	-1.20 [-7.46, 5.06]
Counil 2003	96.7	2.3	7	96.6	4.3	7	37.5%	0.10 [-3.51, 3.71]
Edenbrandt 1990	-5	15	20	-1	10	21	7.9%	-4.00 [-11.84, 3.84]
Matsumoto 1999	4.8	7	8	8	8	8	9.0%	-3.20 [-10.57, 4.17]
Moreira 2008	1.68	9.6122449	16	4.13	8.59565181	15	11.9%	-2.45 [-8.86, 3.96]
Onur 2011	96	11.4	15	87.7	19.2	15	3.8%	8.30 [-3.00, 19.60]
vanVeldhoven 2001	97	13	23	98	19	24	5.7%	-1.00 [-10.27, 8.27]
Wang 2009	107	19.76011911	15	105	21.73613102	15	2.2%	2.00 [-12.87, 16.87]
Subtotal (95% CI)			**147**			**146**	**100.0%**	**-0.53 [-2.75, 1.68]**

Heterogeneity: Tau² = 0.00; Chi² = 4.63, df = 8 (P = 0.80); I² = 0%

Test for overall effect: Z = 0.47 (P = 0.64)



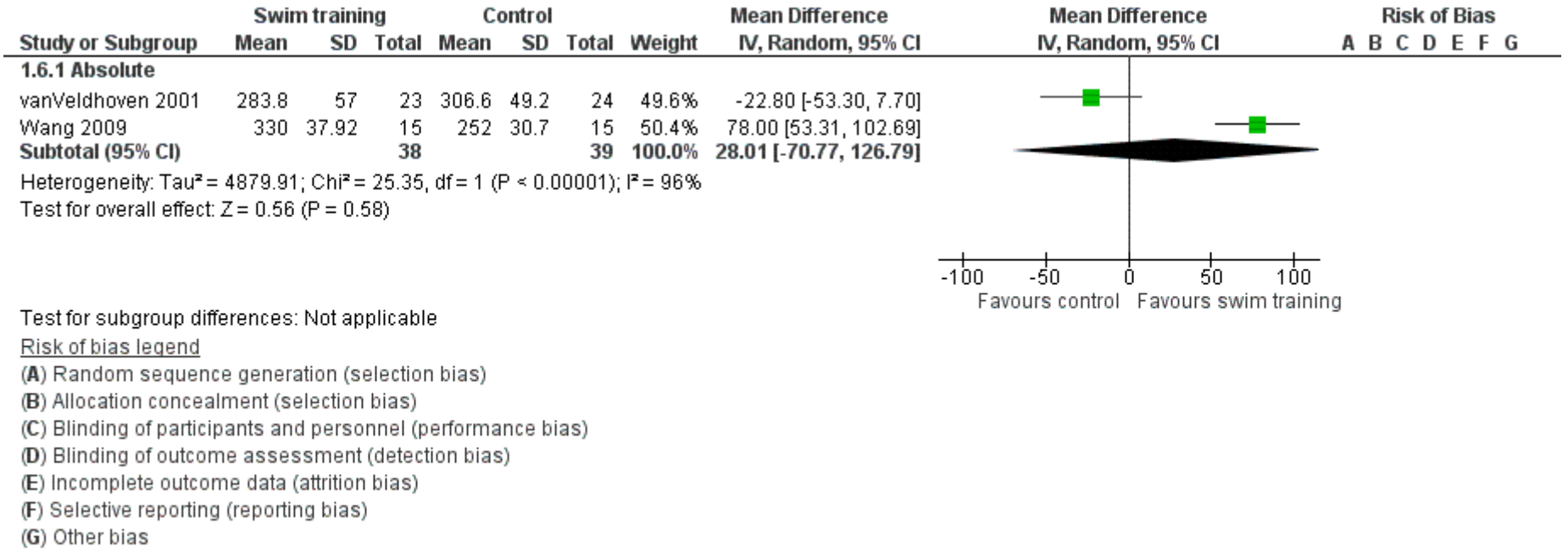
Test for subgroup differences: Not applicable

Risk of bias legend

(**A**) Random sequence generation (selection bias)
(**B**) Allocation concealment (selection bias)
(**C**) Blinding of participants and personnel (performance bias)
(**D**) Blinding of outcome assessment (detection bias)
(**E**) Incomplete outcome data (attrition bias)
(**F**) Selective reporting (reporting bias)
(**G**) Other bias

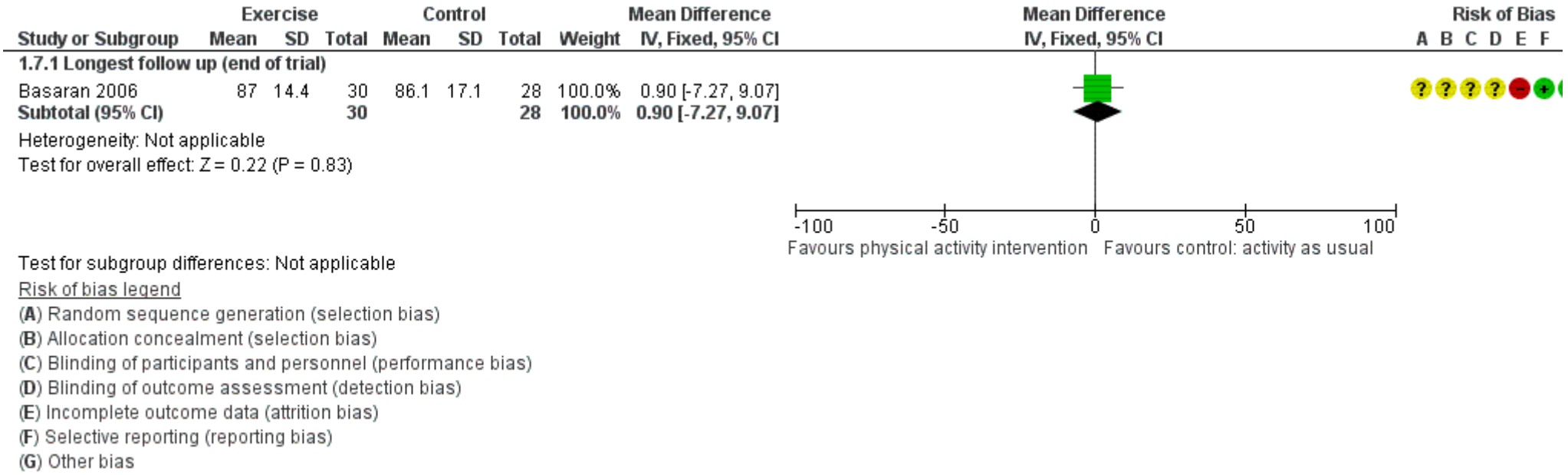
Forest plot of comparison: 1 physical activity intervention vs control: activity as usual, outcome: 1.5 FEV1%predicted.

Figure 7 (Analysis 1.6)



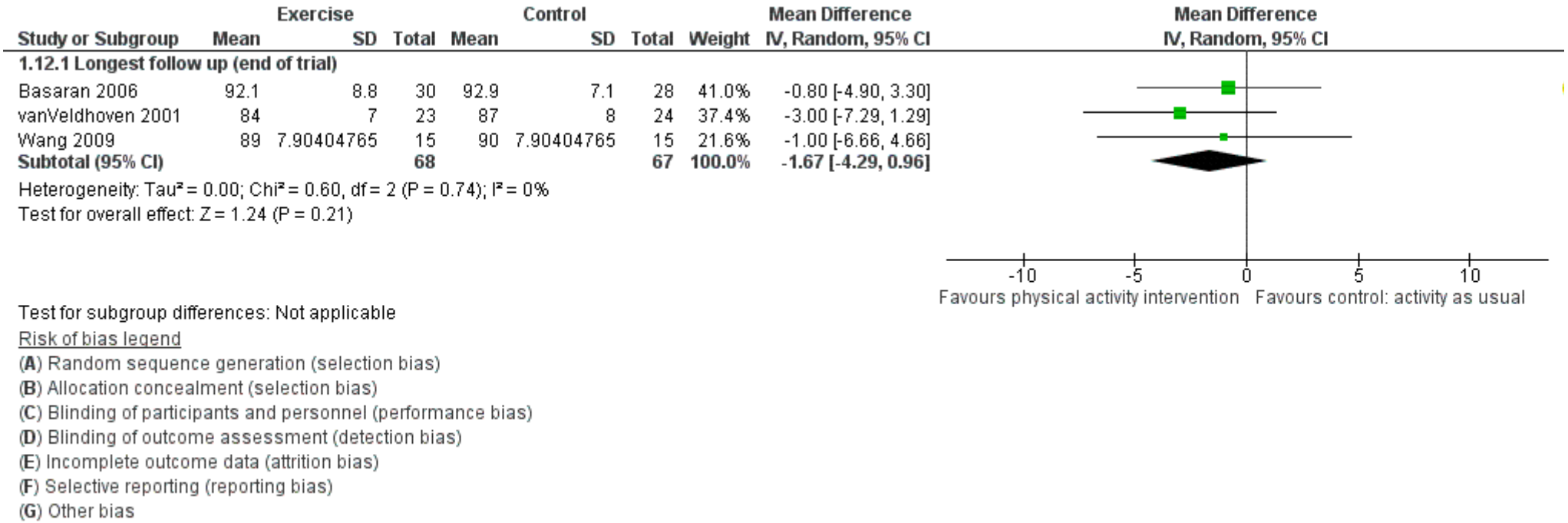
Forest plot of comparison: 1 physical activity intervention vs control: activity as usual, outcome: 1.6 PEF L/min.

Figure 8 (Analysis 1.7)



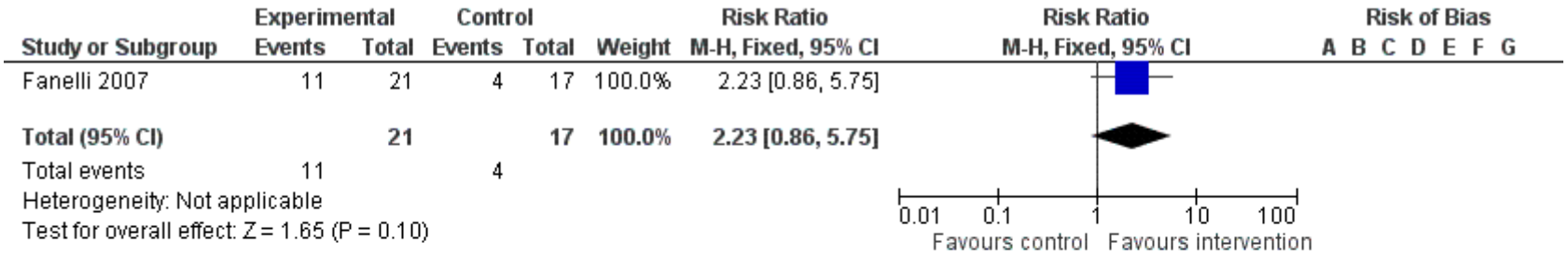
Forest plot of comparison: 1 physical activity intervention vs control: activity as usual, outcome: 1.7 PEF (%).

Figure 11 (Analysis 1.12)



Forest plot of comparison: 1 physical activity intervention vs control: activity as usual, outcome: 1.12 FEV1/FVC.

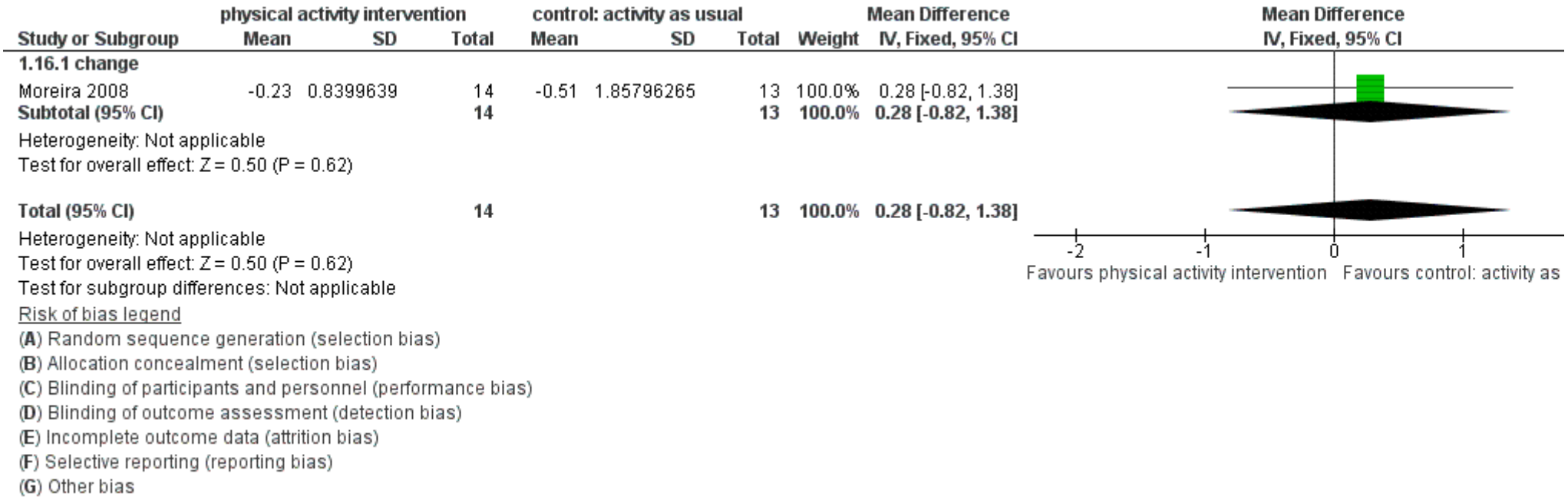
Figure 12 (Analysis 1.10)



Risk of bias legend
(**A**) Random sequence generation (selection bias)
(**B**) Allocation concealment (selection bias)
(**C**) Blinding of participants and personnel (performance bias)
(**D**) Blinding of outcome assessment (detection bias)
(**E**) Incomplete outcome data (attrition bias)
(**F**) Selective reporting (reporting bias)
(**G**) Other bias

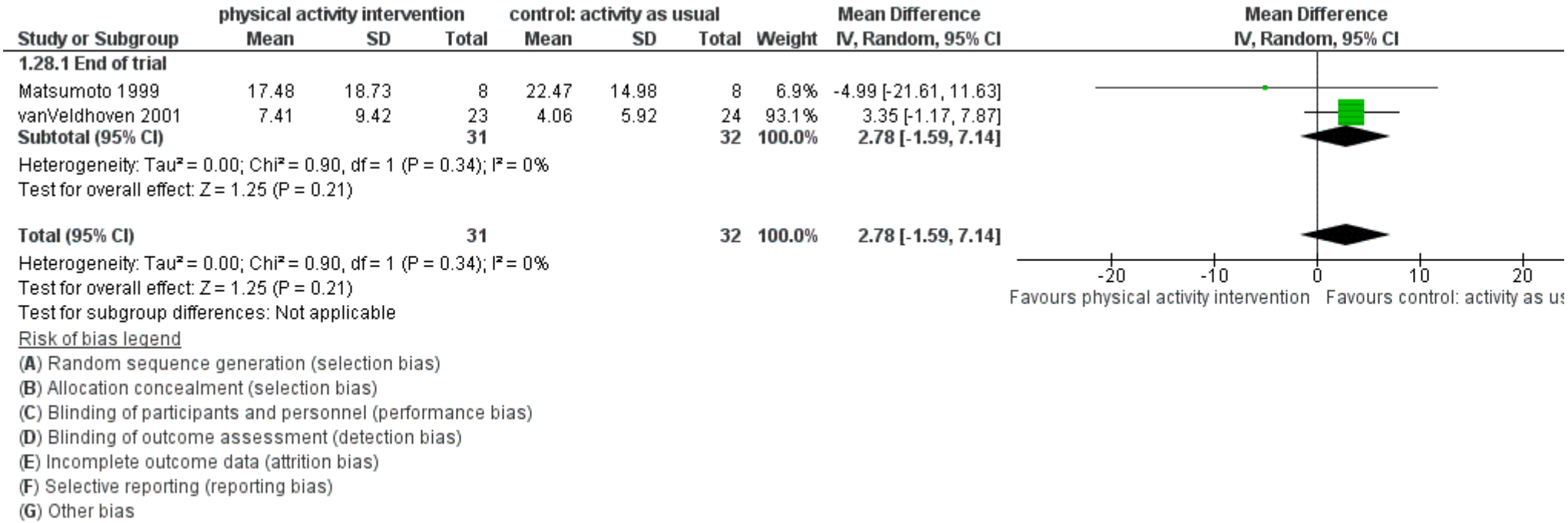
Forest plot of comparison: 1 physical activity intervention vs control: activity as usual, outcome: 1.10 Reduced daily dose of budesonide.

Figure 13 (Analysis 1.16)



Forest plot of comparison: 1 physical activity intervention vs control: activity as usual, outcome: 1.16 PD20,metacholin (Provocative Dose of metacholin causing a 20% fall in FEV1 (higher dose=better).

Figure 14 (Analysis 1.28)



Forest plot of comparison: 1 physical activity intervention vs control: activity as usual, outcome: 1.28 EIB fall %.

Sources of support

Internal sources

- No sources of support provided

External sources

- No sources of support provided