Appendix 1 Search strategies

PubMed

#1 "Exercise"[Mesh]

#2 Search (Physical Activity [Title/Abstract]) OR (Activities, Physical [Title/Abstract]) OR (Physical Activities [Title/Abstract]) OR (Exercise, Physical [Title/Abstract]) OR (Exercises, Physical [Title/Abstract]) OR (Physical Exercise [Title/Abstract]) OR (Physical Exercises [Title/Abstract]) OR (Acute Exercise [Title/Abstract]) OR (Acute Exercises [Title/Abstract]) OR (Exercise, Acute [Title/Abstract]) OR (Exercises, Acute [Title/Abstract]) OR (Exercise, Isometric [Title/Abstract]) OR (Exercises, Isometric [Title/Abstract]) OR (Isometric Exercises[Title/Abstract]) OR (Exercise, Aerobic [Title/Abstract]) OR (Aerobic Exercise [Title/Abstract]) OR (Exercises, Aerobic [Title/Abstract]) OR (Exercise Trainings [Title/Abstract]) OR (Training, Exercise [Title/Abstract]) OR (Trainings, Exercise [Title/Abstract])

#3 "Asthma"[Mesh]

#4 ((Asthmas[Title/Abstract]) OR (Bronchial Asthma[Title/Abstract])) OR (Asthma, Bronchial[Title/Abstract])

#5 "Asthma, Occupational"[Mesh]

#6 ((Asthmas, Occupational[Title/Abstract]) OR (Occupational Asthma[Title/Abstract])) OR (Occupational Asthmas[Title/Abstract])

#7 "Asthma, Exercise-Induced"[Mesh]

#8 ((((((((((Asthma, Exercise Induced[Title/Abstract]) OR (Exercise-Induced Asthma[Title/Abstract])) OR (Asthmas, Exercise-Induced[Title/Abstract])) OR (Exercise Induced Asthma[Title/Abstract])) OR (Exercise-Induced Asthmas[Title/Abstract])) OR (Bronchospasm, Exercise-Induced[Title/Abstract])) OR (Bronchospasm, Exercise Induced[Title/Abstract])) OR (Bronchospasms, Exercise-Induced[Title/Abstract])) OR (Exercise-Induced Bronchospasms[Title/Abstract])) OR (Exercise-Induced Bronchospasm[Title/Abstract])) OR (Exercise Induced Bronchospasm[Title/Abstract])

#9 ("Exercise"[Mesh]) OR (Search (Physical Activity [Title/Abstract]) OR (Activities, Physical [Title/Abstract]) OR (Physical Activities [Title/Abstract]) OR (Exercise, Physical [Title/Abstract]) OR (Exercises, Physical [Title/Abstract]) OR (Physical Exercise [Title/Abstract]) OR (Physical Exercises [Title/Abstract]) OR (Acute Exercise [Title/Abstract]) OR (Acute Exercises [Title/Abstract]) OR (Exercise, Acute [Title/Abstract]) OR (Exercises, Acute [Title/Abstract]) OR (Exercise, Isometric [Title/Abstract]) OR (Exercises, Isometric [Title/Abstract]) OR (Isometric Exercises[Title/Abstract]) OR (Exercise, Aerobic [Title/Abstract]) OR (Aerobic Exercise [Title/Abstract]) OR (Exercises, Aerobic [Title/Abstract]) OR (Exercise Trainings [Title/Abstract]) OR (Training, Exercise [Title/Abstract]) OR (Trainings, Exercise [Title/Abstract]))

#10 ((((("Asthma"[Mesh]) OR (((Asthmas[Title/Abstract]) OR (Bronchial Asthma[Title/Abstract])) OR (Asthma, Bronchial[Title/Abstract]))) OR ("Asthma, Occupational"[Mesh])) OR (((Asthmas, Occupational[Title/Abstract]) OR (Occupational Asthma[Title/Abstract])) OR (Occupational Asthmas[Title/Abstract]))) OR ("Asthma, Exercise-Induced"[Mesh])) OR ((((((((((Asthma, Exercise Induced[Title/Abstract]) OR (Exercise-Induced Asthma[Title/Abstract])) OR (Asthmas, Exercise-Induced[Title/Abstract])) OR (Exercise Induced Asthma[Title/Abstract])) OR (Exercise-Induced Asthmas[Title/Abstract])) OR (Bronchospasm, Exercise-Induced[Title/Abstract])) OR (Bronchospasm, Exercise Induced[Title/Abstract])) OR (Bronchospasms, Exercise-Induced[Title/Abstract])) OR (Exercise-Induced Bronchospasms[Title/Abstract])) OR (Exercise-Induced Bronchospasm[Title/Abstract])) OR (Exercise Induced Bronchospasm[Title/Abstract]))

#11 ((("Exercise"[Mesh]) OR (Search (Physical Activity [Title/Abstract]) OR (Activities, Physical [Title/Abstract]) OR (Physical Activities [Title/Abstract]) OR (Exercise, Physical [Title/Abstract]) OR (Exercises, Physical [Title/Abstract]) OR (Physical Exercise [Title/Abstract]) OR (Physical Exercises [Title/Abstract]) OR (Acute Exercise [Title/Abstract]) OR (Acute Exercises [Title/Abstract]) OR (Exercise, Acute [Title/Abstract]) OR (Exercises, Acute [Title/Abstract]) OR (Exercise, Isometric [Title/Abstract]) OR (Exercises, Isometric [Title/Abstract]) OR (Isometric Exercises[Title/Abstract]) OR (Exercise, Aerobic [Title/Abstract]) OR (Aerobic Exercise [Title/Abstract]) OR (Exercises, Aerobic [Title/Abstract]) OR (Exercise Trainings [Title/Abstract]) OR (Training, Exercise [Title/Abstract]) OR (Trainings, Exercise [Title/Abstract]))) AND ((((((("Asthma"[Mesh]) OR (((Asthmas[Title/Abstract]) OR (Bronchial Asthma[Title/Abstract])) OR (Asthma, Bronchial[Title/Abstract]))) OR ("Asthma, Occupational"[Mesh])) OR (((Asthmas,

Occupational[Title/Abstract]) OR (Occupational Asthma[Title/Abstract])) OR (Occupational Asthmas[Title/Abstract]))) OR ("Asthma, Exercise-Induced"[Mesh])) OR (((((((((((Asthma, Exercise Induced[Title/Abstract]) OR (Exercise-Induced Asthma[Title/Abstract])) OR (Asthmas, Exercise-Induced[Title/Abstract])) OR (Exercise Induced Asthma[Title/Abstract])) OR (Exercise-Induced Asthmas[Title/Abstract])) OR (Bronchospasm, Exercise-Induced[Title/Abstract])) OR (Bronchospasm, Exercise Induced[Title/Abstract])) OR (Bronchospasms, Exercise-Induced[Title/Abstract])) OR (Exercise-Induced Bronchospasms[Title/Abstract])) OR (Exercise-Induced Bronchospasm[Title/Abstract])) OR (Exercise Induced Bronchospasm[Title/Abstract])))) AND ((randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized[tiab] OR placebo[tiab] OR clinical trials as topic[mesh:noexp] OR randomly[tiab] OR trial[ti]) NOT (animals [mh] NOT (humans [mh] AND animals[mh])))

#12 ((("Exercise"[Mesh]) OR (Search (Physical Activity [Title/Abstract]) OR (Activities, Physical [Title/Abstract]) OR (Physical Activities [Title/Abstract]) OR (Exercise, Physical [Title/Abstract]) OR (Exercises, Physical [Title/Abstract]) OR (Physical Exercise [Title/Abstract]) OR (Physical Exercises [Title/Abstract]) OR (Acute Exercise [Title/Abstract]) OR (Acute Exercises [Title/Abstract]) OR (Exercise, Acute [Title/Abstract]) OR (Exercises, Acute [Title/Abstract]) OR (Exercise, Isometric [Title/Abstract]) OR (Exercises, Isometric [Title/Abstract]) OR (Isometric Exercises[Title/Abstract]) OR (Exercise, Aerobic [Title/Abstract]) OR (Aerobic Exercise [Title/Abstract]) OR (Exercises, Aerobic [Title/Abstract]) OR (Exercise Trainings [Title/Abstract]) OR (Training, Exercise [Title/Abstract]) OR (Trainings, Exercise [Title/Abstract]))) AND ((((((("Asthma"[Mesh]) OR (((Asthmas[Title/Abstract]) OR (Bronchial Asthma[Title/Abstract])) OR (Asthma, Bronchial[Title/Abstract]))) OR ("Asthma, Occupational"[Mesh])) OR (((Asthmas, Occupational[Title/Abstract]) OR (Occupational Asthma[Title/Abstract])) OR (Occupational Asthmas[Title/Abstract]))) OR ("Asthma, Exercise-Induced"[Mesh])) OR (((((((((((Asthma, Exercise Induced[Title/Abstract]) OR (Exercise-Induced Asthma[Title/Abstract])) OR (Asthmas, Exercise-Induced[Title/Abstract])) OR (Exercise Induced Asthma[Title/Abstract])) OR (Exercise-Induced Asthmas[Title/Abstract])) OR (Bronchospasm, Exercise-Induced[Title/Abstract])) OR (Bronchospasm, Exercise Induced[Title/Abstract])) OR (Bronchospasms, Exercise-Induced[Title/Abstract])) OR (Exercise-Induced Bronchospasms[Title/Abstract])) OR (Exercise-Induced Bronchospasm[Title/Abstract])) OR (Exercise Induced Bronchospasm[Title/Abstract])))) AND (cohort studies[mesh:noexp] OR longitudinal studies[mesh:noexp] OR follow-up studies[mesh:noexp] OR prospective studies[mesh:noexp] OR retrospective studies[mesh:noexp] OR cohort[TIAB] OR longitudinal[TIAB] OR prospective[TIAB] OR retrospective[TIAB])

Embase

#1 'exercise'/exp

#2 'physical activity':ab,ti OR 'activities, physical':ab,ti OR 'physical activities':ab,ti OR 'exercise, physical':ab,ti OR 'exercises, physical':ab,ti OR 'physical exercise':ab,ti OR 'physical exercises':ab,ti OR 'acute exercise':ab,ti OR 'acute exercises':ab,ti OR 'exercise, acute':ab,ti OR 'exercises, acute':ab,ti OR 'exercise, isometric':ab,ti OR 'exercises, isometric':ab,ti OR 'isometric exercises':ab,ti OR 'exercise, aerobic':ab,ti OR 'exercise trainings':ab,ti OR 'training, exercise':ab,ti OR 'trainings, exercise':ab,ti

#3 'asthma'/exp

#4 'asthmas':ab,ti OR 'bronchial asthma':ab,ti OR 'asthma, bronchial':ab,ti OR 'asthmas, occupational':ab,ti OR 'occupational asthmas':ab,ti OR 'asthma, exercise induced':ab,ti OR 'exercise induced asthma':ab,ti OR 'bronchospasm, exercise-induced':ab,ti OR 'bronchospasm, exercise induced':ab,ti OR 'bronchospasms, exercise-induced':ab,ti OR 'exercise-induced bronchospasm':ab,ti OR 'exercise induced bronchospasm':ab,ti

#5 'crossover procedure':de OR 'double-blind procedure':de OR 'randomized controlled trial':de OR 'single-blind procedure':de OR random*:de,ab,ti OR factorial*:de,ab,ti OR crossover*:de,ab,ti OR ((cross NEXT/1 over*):de,ab,ti) OR placebo*:de,ab,ti OR ((doubl* NEAR/1 blind*):de,ab,ti) OR ((singl* NEAR/1 blind*):de,ab,ti) OR assign*:de,ab,ti OR allocat*:de,ab,ti OR volunteer*:de,ab,ti

#6 'cohort analysis'/exp OR 'longitudinal study'/exp OR 'prospective study'/exp OR 'follow up'/exp OR cohort*:ab,ti

#7 #1 OR #2

#8 #3 OR #4

#9 #5 AND #7 AND #8

#10 #6 AND #7 AND #8

Web of Science

TS=(Asthmas OR Bronchial Asthma OR Asthma, Bronchial OR Asthmas, Occupational OR Occupational Asthmas OR Asthma, Exercise Induced OR Exercise Induced Asthma OR Bronchospasm, Exercise-Induced OR Bronchospasm, Exercise Induced OR Bronchospasm, Exercise Induced OR Bronchospasms, Exercise-Induced OR Exercise-Induced Bronchospasm OR Exercise Induced Bronchospasm) AND TS=(Physical Activity OR Activities, Physical OR Physical Activities OR Asthmas, Occupational OR Physical Exercise OR Acute Exercise OR Acute Exercises OR Exercise, Acute OR Exercises, Acute OR Exercise, Isometric OR Exercise, Isometric OR Exercises, Isometric OR Isometric Exercises OR Exercise, Aerobic OR Aerobic Exercise OR Exercises, Aerobic OR Exercise Trainings Training, Exercise Trainings, Exercise) AND TS=(clinical trial* OR research design OR comparative stud* OR evaluation stud* OR controlled trial* OR follow-up stud* OR prospective stud* OR random* OR placebo* OR single blind* OR double blind*)

Publications	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Cochrane, 1990	L	L	U	U	L	U	H
Farid, 2005	L	L	U	U	L	U	U
Gonçalves, 2008	L	U	U	U	L	U	L
Mendes, 2010	L	U	U	U	L	L	L
Mendes, 2011	L	U	U	H	L	L	L
Boyd, 2012	L	U	U	H	L	U	H
Scott, 2012	L	L	U	H	L	L	L
França-Pinto, 2014	L	L	U	H	L	L	L
Toennesen, 2017	L	L	L	H	L	L	L
Freitas, 2016	L	L	L	H	L	L	L
Refaat, 2015	L	U	U	H	U	U	H
Turner, 2011	L	L	L	H	L	L	U
Shaw, 2011	L	L	L	H	U	U	U
Coelho, 2017	L	L	U	H	L	L	L
Freitas, 2018	L	L	L	H	H	U	L
Ma, 2015	L	L	L	H	L	L	L
Meyer, 2015	L	L	U	L	L	L	L
Shawa, 2009	U	L	U	H	L	L	H

Legend:
- Low risk (green)
- Unclear risk (yellow)
- High risk (red)

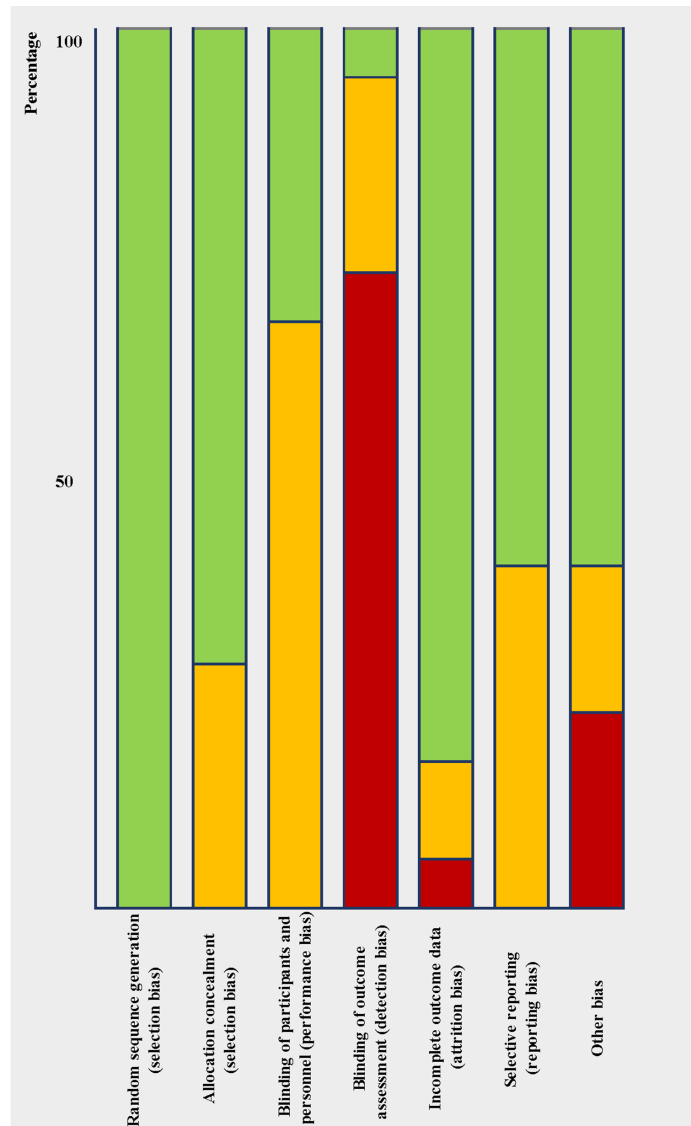**Figure S1** Risk of bias for individual quality.

Figure S2 Risk of bias for summary quality. Green part, low risk; yellow part, unclear risk; red part, high risk.

Methodological Quality of the Selected Studies According to the NOS

Study	Selection				Comparability		Exposure	
	Representativeness of the exposed cohort	Selection of the none exposed cohort	Ascertainment of exposure	Demonstration that outcome of interest was not present at start of study	Comparability of cohorts on the basis of the design or analysis	Assessment of outcome	Was follow-up long enough for outcomes to occur	Adequacy of follow up of cohorts
Beckett, 2001	★	★	★	★	★	★	★	N/A
Benet, 2011	★	N/A	★	★	★★	★	★	N/A
Huovinen, 2003	★	★	N/A	★	★★	★	★	N/A
Lucke, 2007	★	★	N/A	★	★	★	★	N/A

Figure S3 Newcastle-Ottawa Scale for Quality of the included studies. This table identifies "high" quality choices with a "star." A study can be awarded a maximum of 1 star for each numbered item within the Selection and Exposure categories. A maximum of 2 stars can be given for Comparability. ★, yes; N/A, not applicable.
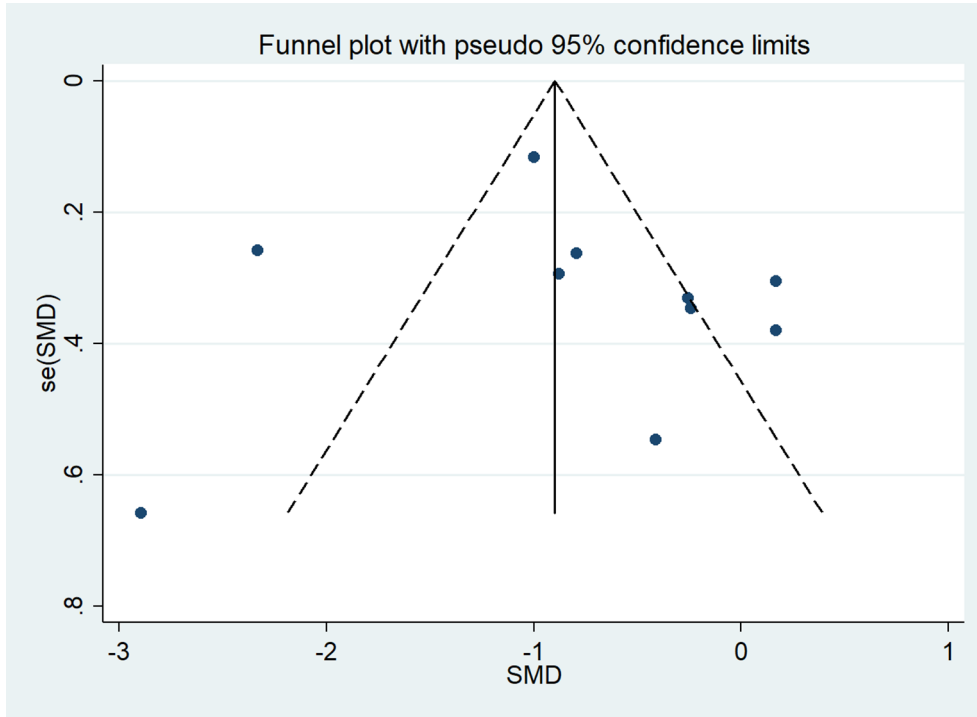
Figure S4 HRQOL plus ACG funnel plot. ACQ, Asthma Control Questionnaire; HRQoL, Health related quality of life; SMD, Standard mean differences.
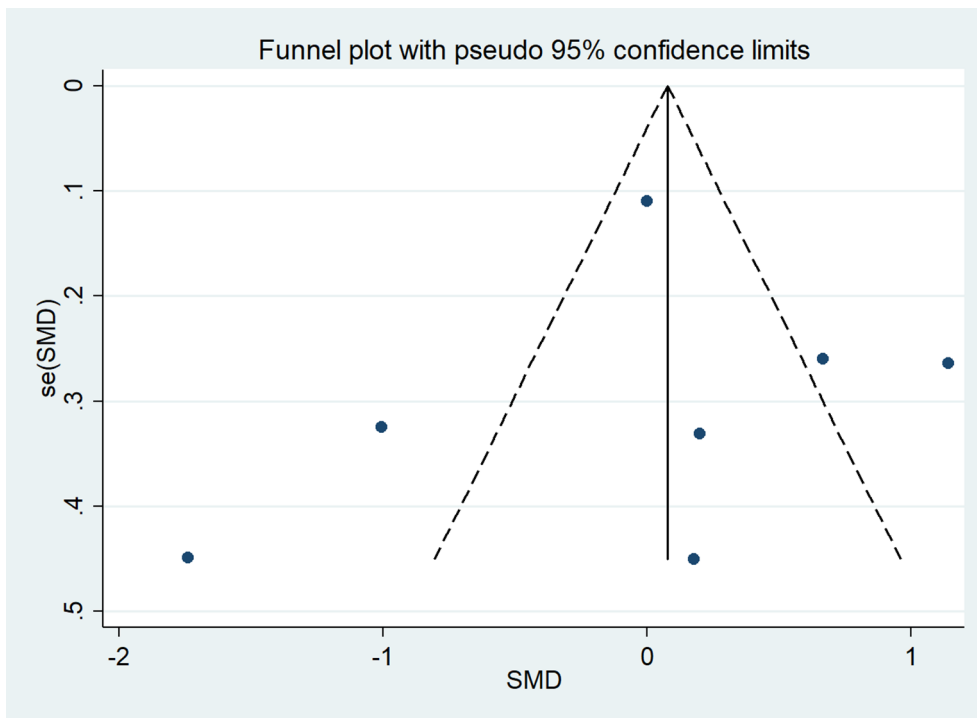

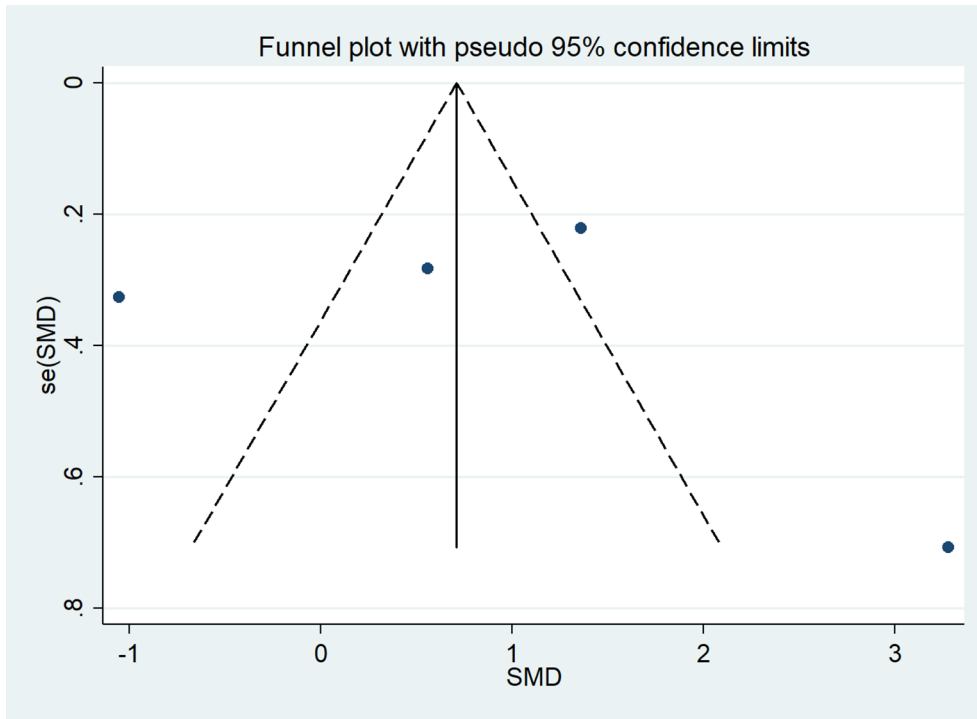**Figure S5** AQLQ funnel plot. AQLQ, asthma-related quality of life questionnaire; SMD, standard mean differences.

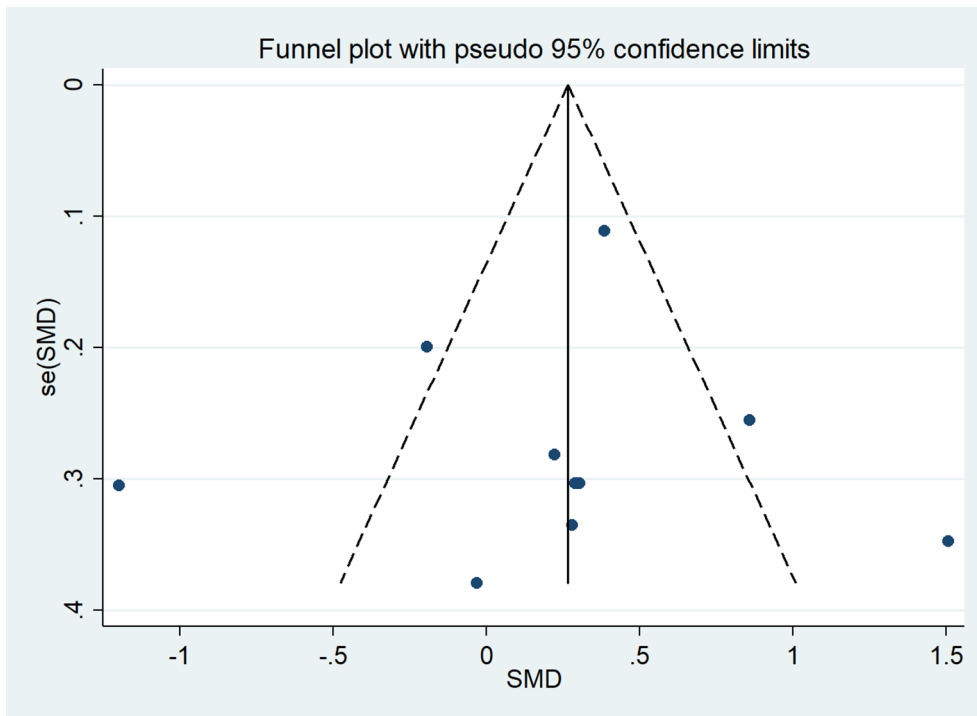**Figure S6** Asthma free symptom funnel plot. SMD, standard mean differences.

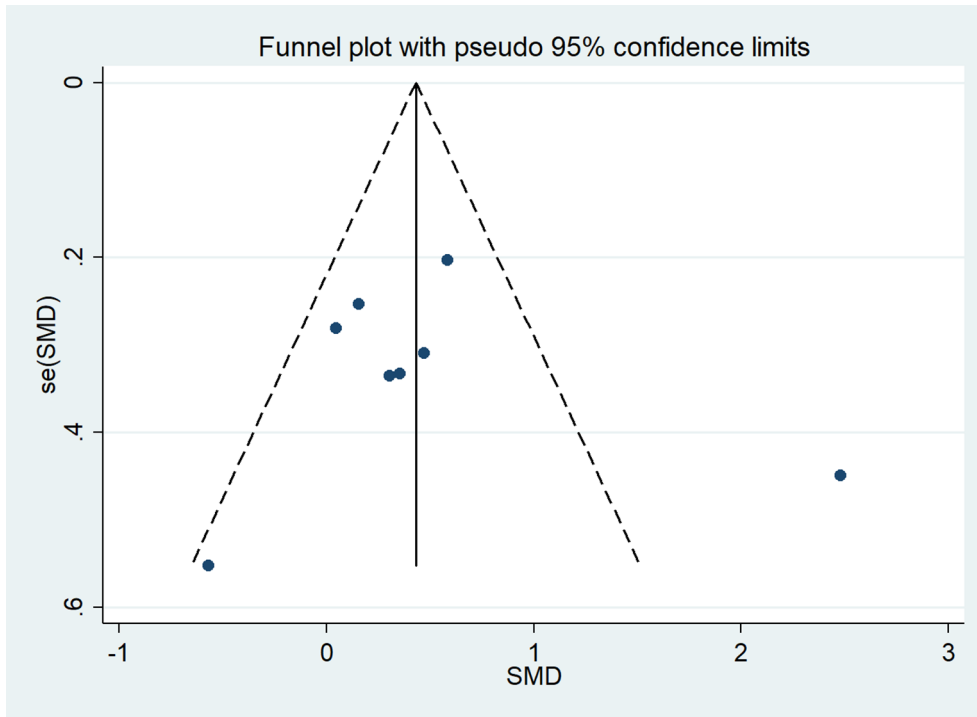**Figure S7** FEV$_1$ funnel plot. FEV$_1$, forced expiratory volume in one second (L); SMD, standard mean differences.

https://dx.doi.org/10.21037/atm-22-1170

Figure S8 FEV$_1$%, pred funnel plot. FEV$_1$/pred, FEV$_1$ as a percentage of the predicted value; SMD, standard mean differences.
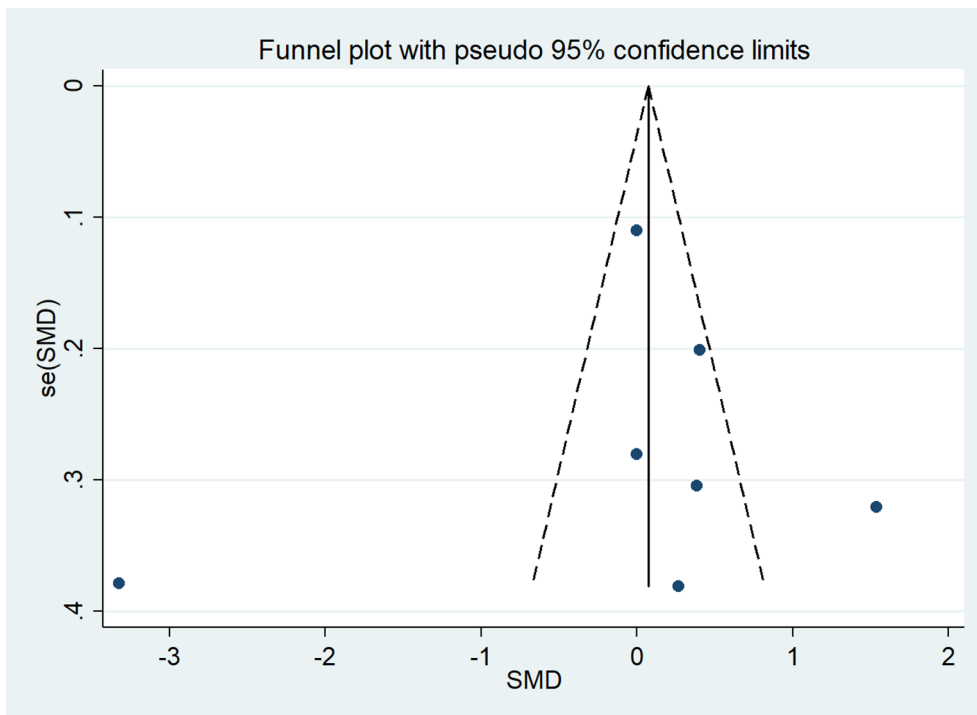
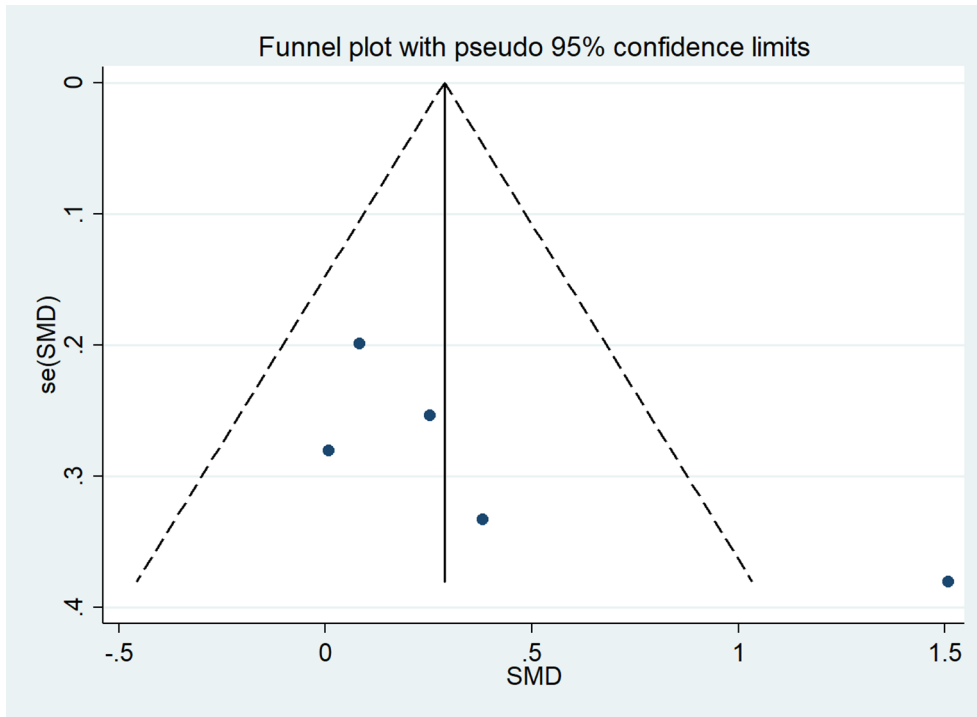**Figure S9** FVC funnel plot. FVC, forced vital capacity (L); SMD, standard mean differences.

Figure S10 FVC%, pred funnel plot. FVC/pred, FVC as a percentage of the predicted value; SMD, Standard mean differences.
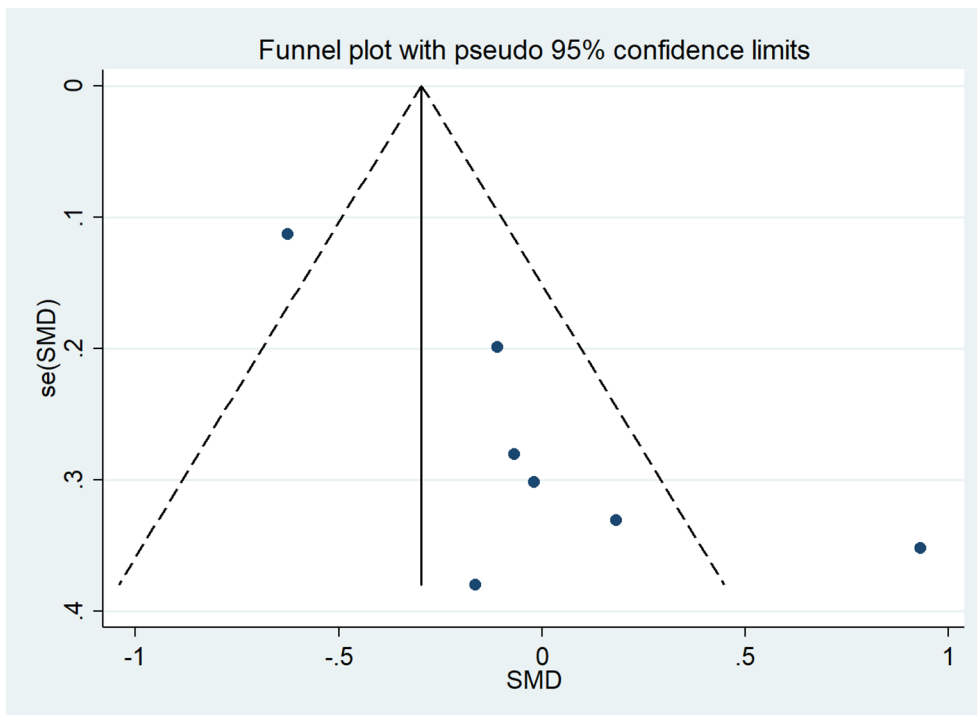

Figure S11 FEV$_1$/FVC funnel plot. FEV$_1$, forced expiratory volume in one second (L); FVC, forced vital capacity (L); SMD, standard mean differences.
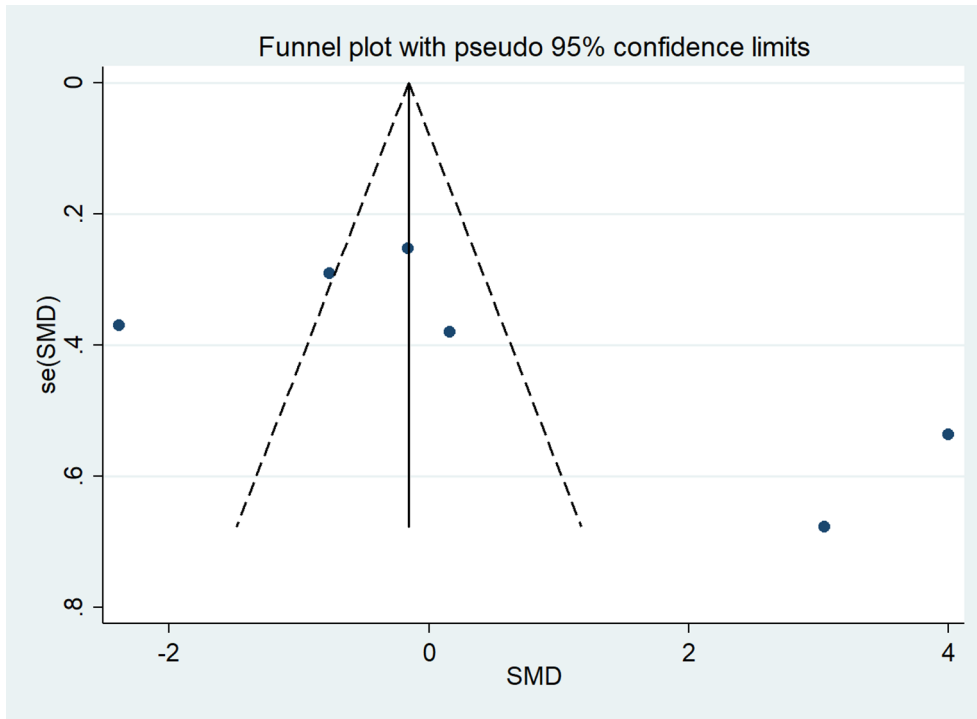
Figure S12 FeNO funnel plot. FeNO, fractional exhaled nitric oxide; SMD, standard mean differences.
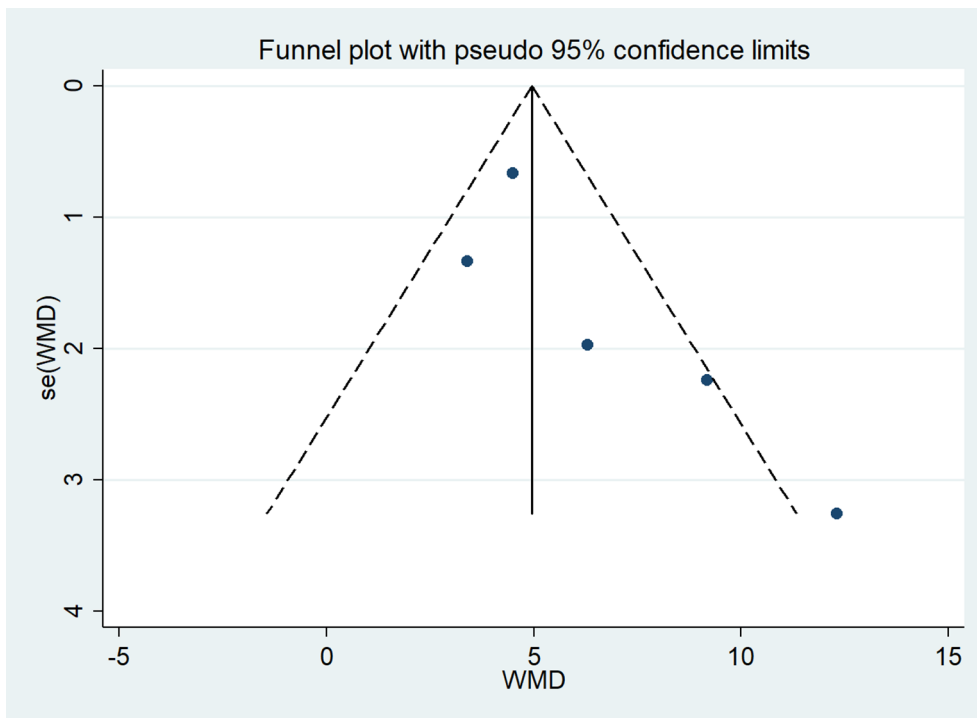

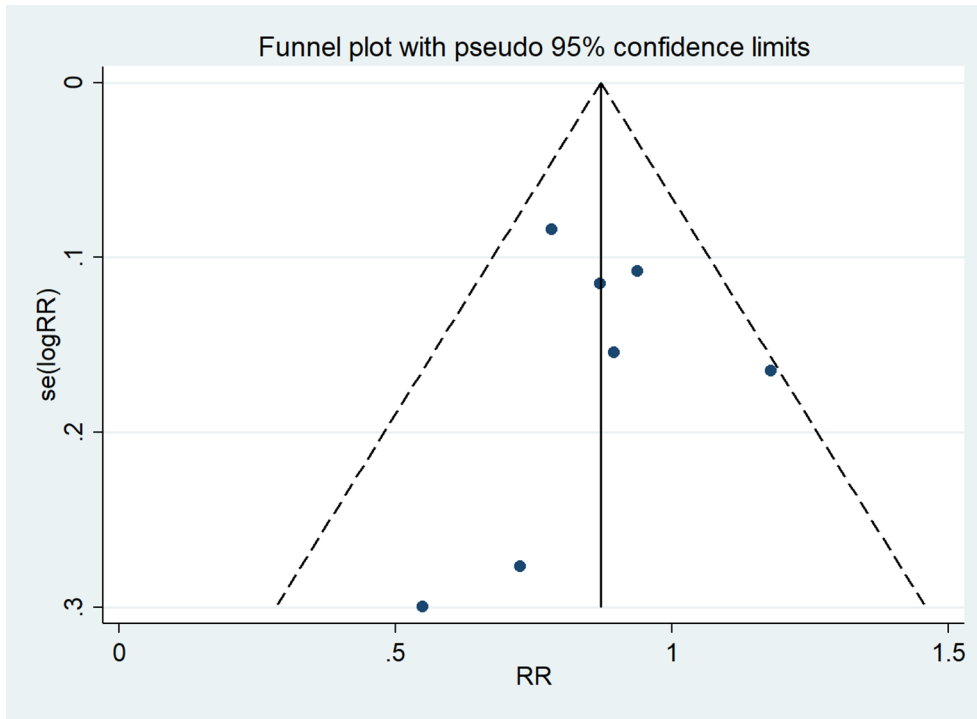**Figure S13** VO$_2$Max funnel plot. VO$_2$max, maximal oxygen uptake; WMD, weighted mean differences.

Figure S14 Observational studies funnel plot. RR risk ratio.