Biomolecules and Biomedicine
ISSN: 2831-0896 (Print) | ISSN: 2831-090X (Online)
Journal Impact Factor® (2024): 2.2
CiteScore® (2024): 5.2
www.biomolbiomed.com | blog.bjbms.org

SUPPLEMENTAL DATA

Childhood obesity and allergic rhinitis: A meta-analysis

Xinxin Xing, Sihao Zhu, Guang Zhou, Yubo Ma, Hai Wang*

Department of Pediatrics II, the First Affiliated Hospital of Heilongjiang University of Chinese Medicine, Harbin, China

*Correspondence to Hai Wang: drwanghaihlj23@hotmail.com

Full article is available at the following link: Childhood obesity and allergic rhinitis: A meta-analysis

Supplemental file 1. PRISMA checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	4-5
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	5
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	6-7
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	5-6
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	6 and Supplemental File 1
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved,	7-8, Figure 1

Section and Topic	Item #	Checklist item	Location where item is reported
		whether they worked independently, and if applicable, details of automation tools used in the process.	
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	7-8
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	7-8
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	7-8
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	7, Table 2
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	8-9
Synthesis	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g.	8-9

Section and Topic	Item #	Checklist item	Location where item is reported
methods		tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	8-9
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	8-9
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	8-9
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	8-9
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	8-9
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	12, Figure 6
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	8-9 (Methods), Supplemental Table 1

Section and Topic	Item #	Checklist item	Location where item is reported
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	9, Figure 1
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	9, Figure 1
Study characteristics	17	Cite each included study and present its characteristics.	9-10, Table 1
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	10, Table 2
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	10-11, Figures 2–5
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	10-12, Figures 2–5
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	10-12, Figures 2–5

Section and Topic	Item #	Checklist item	Location where item is reported
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	10-12, Figures 2–5
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	10-12, Figures 2–5
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	12, Figure 6
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	11, Supplemental Table 1
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	12-16
	23b	Discuss any limitations of the evidence included in the review.	12-16
	23c	Discuss any limitations of the review processes used.	12-16
	23d	Discuss implications of the results for practice, policy, and future research.	12-16
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	5 (PROSPERO CRD420251108821)
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	5 (PROSPERO CRD420251108821)
	24c	Describe and explain any amendments to information provided at registration or in the	5 (PROSPERO

Section and Topic	Item #	Checklist item	Location where item is reported
		protocol.	CRD420251108821)
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	17 (Funding)
Competing interests	26	Declare any competing interests of review authors.	17 (Conflicts of interest)
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	17 (Data availability)

Supplemental file 2. Detailed search strategy for each database

PubMed

("Obesity"[Mesh] OR "Overweight"[Mesh] OR "Body Mass Index"[Mesh] OR obesity[tiab] OR obese[tiab] OR overweight[tiab] OR "body mass index"[tiab] OR BMI[tiab]) AND ("Rhinitis, Allergic"[Mesh] OR "Allergic Rhinitis"[tiab] OR "Atopic Rhinitis"[tiab] OR "Allergic Rhinitides"[tiab] OR "Atopic Rhinitides"[tiab]) AND ("Child"[Mesh] OR "Adolescent"[Mesh] OR "Pediatrics"[Mesh] OR children[tiab] OR pediatric[tiab] OR paediatric[tiab] OR adolescents[tiab])

Filters: Humans, English

Date range: Inception to May 26, 2025

Embase

('obesity'/exp OR 'overweight'/exp OR 'body mass index'/exp OR obesity:ti,ab OR obese:ti,ab OR overweight:ti,ab OR 'body mass index':ti,ab OR BMI:ti,ab) AND ('allergic rhinitis'/exp OR 'allergic rhinitis':ti,ab OR 'atopic rhinitis':ti,ab OR 'allergic rhinitides':ti,ab OR 'atopic rhinitides':ti,ab) AND ('child'/exp OR 'adolescent'/exp OR 'pediatrics'/exp OR children:ti,ab OR pediatric:ti,ab OR paediatric:ti,ab OR adolescents:ti,ab)

Limits: Humans, English

Date range: Inception to May 26, 2025

Web of Science

TS=("obesity" OR "obese" OR "overweight" OR "body mass index" OR "BMI") AND TS=("allergic rhinitis" OR "atopic rhinitis" OR "allergic rhinitides" OR "atopic rhinitides") AND TS=("children" OR "pediatric" OR "paediatric" OR "adolescents")

Document types: Article

Language: English

Timespan: Inception to May 26, 2025

Supplemental file 3. Details of modified NOS for cross-sectional studies

Newcastle-Ottawa Scale adapted for cross-sectional studies

Selection: (Maximum 4 stars)

1) Representativeness of the sample:

a) Truly representative of the average in the target population. * (all subjects or random sampling)

b) Somewhat representative of the average in the target population. * (non-random sampling)

c) Selected group of users.

d) No description of the sampling strategy.

2) Sample size:

a) Justified and satisfactory. *

b) Not justified.

3) Non-respondents:

a) Comparability between respondents and non-respondents characteristics is established, and the response rate is satisfactory. *

b) The response rate is unsatisfactory, or the comparability between respondents and non-respondents is unsatisfactory.

c) No description of the response rate or the characteristics of the responders and the non-responders.

4) Ascertainment of the exposure (risk factor):

a) Validated measurement tool. *

b) Non-validated measurement tool, but the tool is available or described.*

c) No description of the measurement tool.

Comparability: (Maximum 2 stars)

1) The subjects in different outcome groups are comparable, based on the study design or analysis. Confounding factors are controlled.

a) The study controls for the most important factor (select one). *

b) The study control for any additional factor. *

Outcome: (Maximum 3 stars)

1) Assessment of the outcome:

a) Independent blind assessment. **

b) Record linkage. **

c) Self report. *

d) No description.

2) Statistical test:

a) The statistical test used to analyze the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p value). *

b) The statistical test is not appropriate, not described or incomplete.

This scale has been adapted from the Newcastle-Ottawa Quality Assessment Scale for cohort studies to perform a quality assessment of cross-sectional studies for the systematic review, “Are Healthcare Workers’ Intentions to Vaccinate Related to their Knowledge, Beliefs and Attitudes? A Systematic Review”.

We have not selected one factor that is the most important for comparability, because the variables are not the same in each study. Thus, the principal factor should be identified for each study.

In our scale, we have specifically assigned one star for self-reported outcomes, because our study measures the intention to vaccinate. Two stars are given to the studies that assess the outcome with independent blind observers or with vaccination records, because these methods measure the practice of vaccination, which is the result of true intention.

Supplemental table 1. GRADE evidence profile: Association between childhood obesity and allergic rhinitis (AR).

Outcome	No. of studies (datasets)	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Overall certainty of evidence
Association between childhood obesity and AR	15 studies (23 datasets)	Cross-sectional	Not serious (all NOS ≥7)	Not serious (low heterogeneity, I^2 = 24%, τ^2 = 0.00)	Not serious (direct AR outcomes)	Serious (effect close to null, CI includes no effect)	Not serious (Egger's test p=0.43)	⊕⊕OO Low

The certainty of evidence was assessed using the GRADE (Grading of Recommendations Assessment, Development and Evaluation) framework. This approach evaluates five domains: risk of bias, inconsistency, indirectness, imprecision, and publication bias. Evidence from observational studies begins at 'Low' certainty and may be downgraded or upgraded depending on study limitations. For this study, downgrades were applied only for imprecision. Other domains were not considered serious concerns.

• Risk of bias: Not downgraded, as all included studies scored ≥7 on the modified Newcastle–Ottawa Scale (NOS), indicating high quality.

• Inconsistency: Not downgraded, as between-study heterogeneity was low (I^2 = 24%; τ^2 = 0.00).

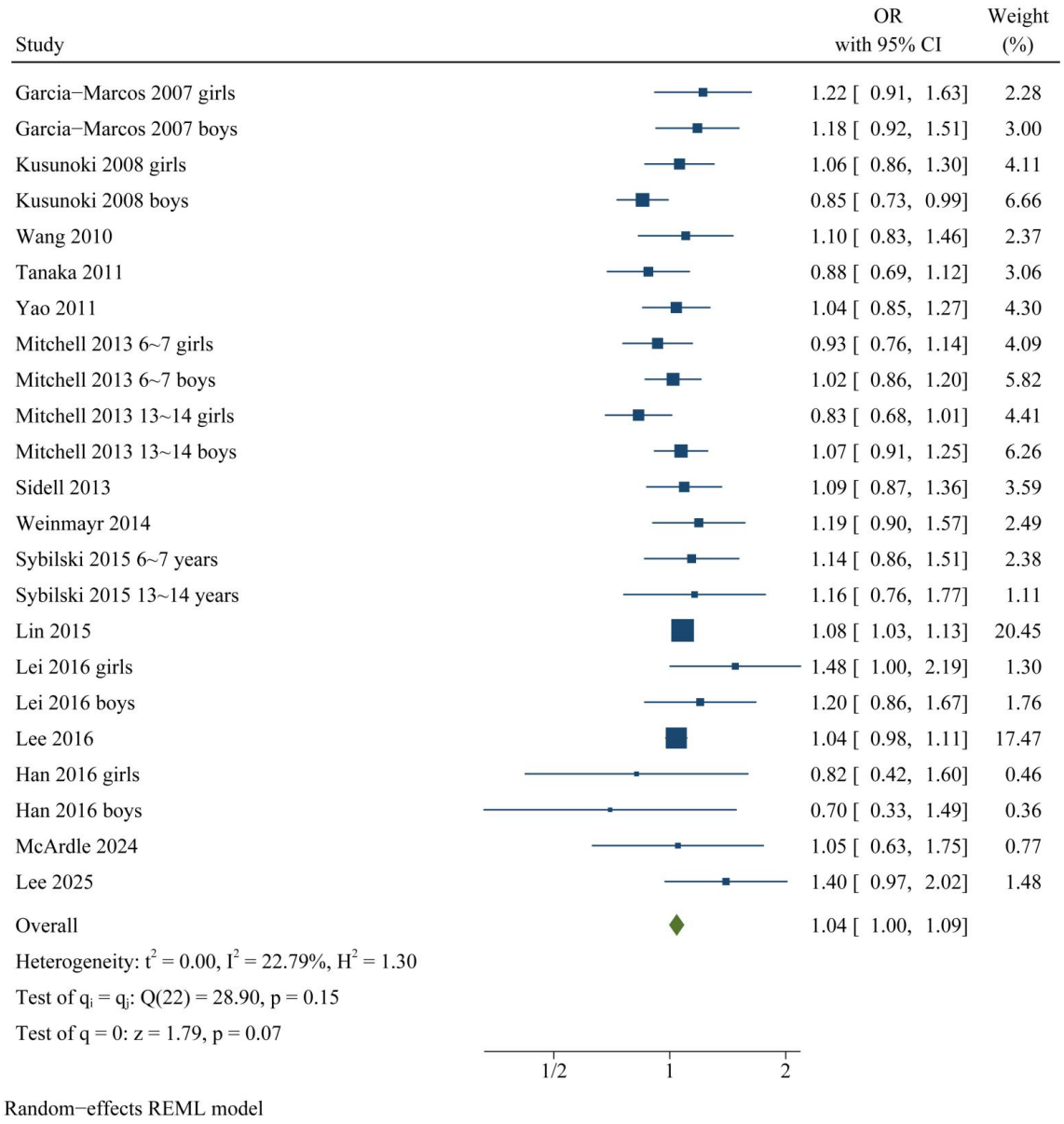
• Indirectness: Not downgraded, as studies directly assessed childhood obesity (BMI-defined) and allergic rhinitis outcomes.

• Imprecision: Downgraded, as the pooled effect estimate was very close to null and the confidence interval included both no association and potential risk.

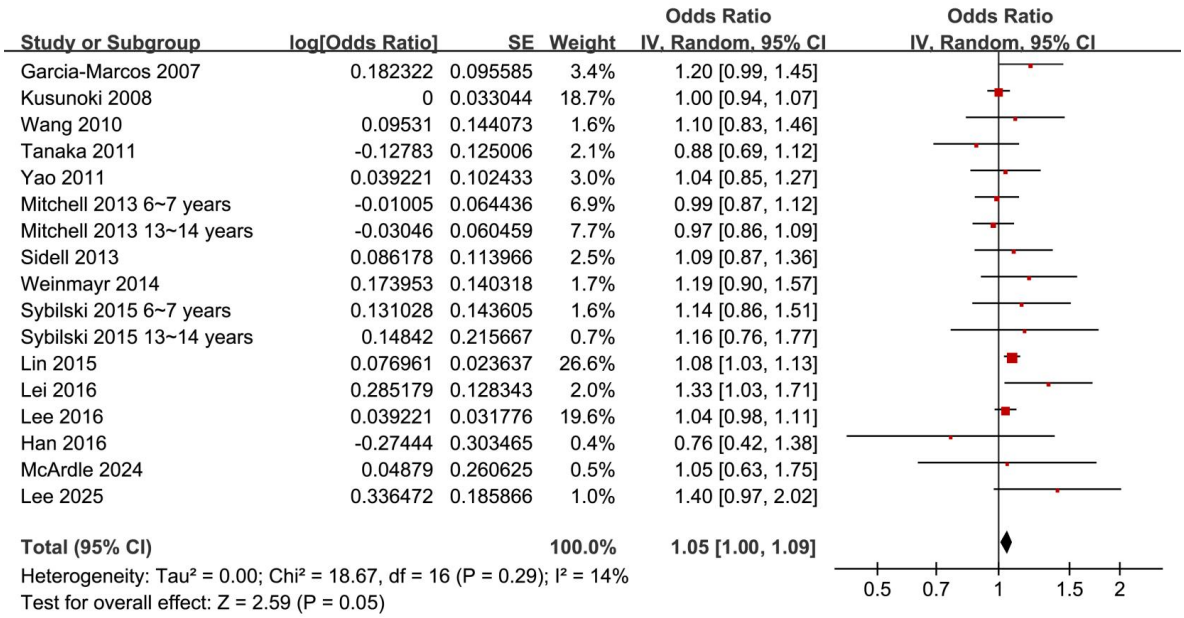
• Publication bias: Not downgraded, as funnel plots appeared symmetrical and Egger's test did not indicate bias (p = 0.43).

• Overall certainty: Rated as Low because evidence was derived exclusively from cross-sectional observational studies and further downgraded for imprecision.

Abbreviations: AR: Allergic rhinitis; CI: Confidence interval; I^2: Inconsistency index; τ^2: Between-study variance; NOS: Newcastle–Ottawa Scale.



Supplemental figure 1. Forest plot of the association between obesity and allergic rhinitis (AR) in children using the REML model. Sensitivity analysis with the random-effects REML model showed results consistent with the main analysis (OR: 1.04, 95% CI: 1.00–1.09, $p = 0.07$), with low heterogeneity ($I^2 = 28\%$). Abbreviations: OR: Odds ratio; CI: Confidence interval; REML: Restricted maximum likelihood; I^2: Inconsistency index; τ^2: Between-study variance; H^2: Heterogeneity statistic.



Supplemental figure 2. Forest plot of pooled analysis collapsing sex-stratified datasets into single study-level effect sizes. Results were consistent with the main analysis (adjusted OR: 1.05, 95% CI: 1.00–1.09, $p = 0.05$; $I^2 = 14\%$). Abbreviations: OR: Odds ratio; CI: Confidence interval; I^2: Inconsistency index; τ^2: Between-study variance; H^2: Heterogeneity statistic.