Pesticide exposure and child growth in low- and middle-income countries: a systematic review

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Background

- Pesticides are widely used in agricultural and residential settings globally.
- Evidence from high-income countries shows that prenatal exposure to organochlorines is associated with adverse birth outcomes, but prenatal exposure to organophosphates is not (Longnecker et al. 2001, Ouidir et al. 2020, Reiss et al. 2015, de Araujo et al. 2016).
- Limited evidence on the effects of pesticides on child growth in low- and middle-income countries (LMICs).
Objective

• To systematically review and synthesize the evidence on the associations between pesticide exposure and child growth in children <5 years of age in LMICs
Methods

• Searched 10 electronic databases from inception through November 2021 with no language restriction
• Two independent researchers screened studies using Covidence, extracted data, and assessed certainty of the evidence
Methods: inclusion criteria

- Conducted in a LMIC
- Assessed children <5 years of age
- Evaluated self-reported or measured prenatal (at any time during pregnancy) or postnatal exposure to pesticides
- Measured at least one anthropometric measure of child linear or ponderal growth, and/or one of six birth outcomes
Methods: exclusion criteria

- Conducted in a high-income country
- Assessed children >5 years of age
- Animal studies, case-control studies, simulation studies, case reports, case studies, opinions, editorials, commentaries, letters, conference abstracts, ecological studies, reviews, and systematic reviews
- Focusing solely on insecticide-treated bednets for malaria prevention
Methods: data analysis

- Data summarized narratively by outcome and pesticide type
- Summarized evidence on adjusted outcomes
- Summarized author-reported effect measures
- Meta-analysis not conducted due to heterogeneity
- Risk of bias and quality of the evidence assessed using GRADE
Results
929 total records identified from search of 10 databases

10 additional records identified from other sources

939 total records identified

286 duplicate records removed

653 records screened

595 records excluded

58 full-text articles assessed for eligibility

27 articles excluded
14 wrong study design
5 no pesticides assessed
5 no child growth outcomes assessed
2 could not recover full text
1 not a low- or middle-income country

31 articles included in the systematic review
Study locations

Studies published between 2003 and 2022
Study designs

- Prospective cohorts, 11
- Cross-sectional, 20
Method of exposure assessment

- Biomarkers, 23
- Self-reported, 8
- Blood, 12
- Placenta, 2
- Breastmilk, 2
- Urine, 8
Types of pesticides assessed

All studies assessed prenatal exposure

- Organochlorines: 17 studies
- Organophosphates: 9 studies
- Pyrethroids: 4 studies
- Carbamates: 4 studies
- Not specified: 4 studies
Outcomes assessed

- Birth weight: 24 studies
- Birth length: 15 studies
- Low birth weight: 9 studies
- Preterm birth: 6 studies
- Small-for-gestational age: 3 studies
- Body mass index Z-score: 2 studies
- Height: 2 studies
- Length-for-age Z-score: 2 studies
- Weight-for-age Z-score: 2 studies
- Weight-for-length Z-score: 2 studies
- Body mass index: 1 study
- Large-for-gestational age: 1 study
- Overweight: 1 study
- Stunting: 1 study
- Term low birth weight: 1 study
- Weight: 1 study
Key findings

• Mixed associations between prenatal pesticide exposure and birth weight and birth length

Exposure to:
• Organochlorines
• Organophosphates
• Pyrethroids
• Carbamates

Child growth:
• Birth weight
• Birth length
• Low birth weight
• Preterm birth
Key findings

- Prenatal exposure to *some* pesticide may be associated with low birth weight and preterm birth

Exposure to:
- Organophosphates
- Carbamates

Child growth:
- Low birth weight
- Preterm birth
Limitations

• Many studies at serious risk of bias; “very low” certainty of the evidence
• Limitations include:
  • Incomplete toxicology picture
  • Exposure assessed at a single time point during pregnancy
  • No studies in Sub-Saharan Africa, Central America, Caribbean, or Asia Pacific
  • Small sample sizes
  • Participants recruited at a single location
  • Subgroup analyses only by child sex
  • Causal impacts not examined
Conclusions

- Mixed associations between prenatal pesticide exposure and child growth among children <5 years of age in LMICs
- More studies with complete toxicology of commonly used pesticides in LMICs assessing chronic and acute exposure in comparable populations of pregnant women and children are needed to better understand if, and how, pesticides may influence child growth
Thank you!

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