INPLASY PROTOCOL

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None declared.

The correlation between air pollution, fine particulate matter (PM2.5) exposure and gestational diabetes: A meta-analysis and systematic review

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Review question / Objective: **Previous studies suggest an association between exposure to air pollution and gestational diabetes mellitus. However, the question of whether pregnant women's exposure to fine particulate matter contributes to their development of GDM is unresolved. As new scientific evidence is generated. We performed a systematic review and meta-analysis to assess current evidence on thisassociation.**
Information sources: **We have carried out a comprehensive and systematic search of the Pubmed , Cochrane , Embase , Web of science in the form of subject words and free words, and the search will end on April 1, 2022.**

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 29 September 2022 and was last updated on 29 September 2022 (registration number INPLASY202290123).

INTRODUCTION

Review question / Objective: **Previous studies suggest an association between exposure to air pollution and gestational diabetes mellitus. However, the question of whether pregnant women's exposure to fine particulate matter contributes to their development of GDM is unresolved. As new scientific evidence is generated. We performed a systematic review and meta-analysis to assess current evidence on thisassociation.**

Condition being studied: **Diabetes diagnosed during the second or third trimester of pregnancy but not evident before pregnancy is known as gestational**

diabetes mellitus (GDM). GDM is a dangerous and often-ignored condition that endangers the health of pregnant women and children.

GDM is associated with a significant increase in neonatal and maternal morbidity and mortality, and its occurrence is 16.7 %(1) . Pregnancy-related problems, such as high blood pressure, an overweight baby, and difficult delivery, are prevalent in women with gestational diabetes. Approximately half of women with a history of GDM will develop type 2 diabetes 5 to 10 years after delivery, especially after age 35. In addition, GDM increases the risk of cardiovascular and kidney disease, and to some extent increases, the risk of gestational hyperglycemia and postpartum depression. When the blood sugar levels of pregnant women rise, excess sugar easily crosses the placenta, inducing hyperglycemia in the fetus, which can lead to fetal lung maturation delay and dyspnea syndrome after birth. At the same time, the fetus is compelled to accumulate too much sugar and consume more oxygen, which can lead to fetal hypoxia; on the other hand, too much sugar will be converted to fat in the fetus, causing the fetus to gain weight and become a giant. Studies have shown that gestational diabetes may be associated with a variety of factors, such as high maternal body mass index (BMI), low education level, poor family economic status, etc. In recent years, exposure to air pollutants during pregnancy has also been recognized as an important risk factor.

In the atmosphere, inhalable particulate matter with aerodynamic equivalent diameter of 2.5 μg is called PM2.5 (fine particulate matter). PM2.5, a type of atmospheric suspended particle, has recently become the focus of air pollution research. Its major constituents include various pollutants, water-soluble salt ions, heavy metals, etc. Due to the small volume, PM2.5 in the bronchiole deposited on the wall influences gas exchange in the lungs, and some finer PM2.5 alveolar components can penetrate into the blood, overflow distribution, and damage other parts of the body. It also impacts oxidative stress, endothelial function, and inflammation, all of which contribute to insulin resistance, a link that is especially significant in women.

Many studies have shown that people exposed to air pollution are more likely to develop diabetes. To some extent, some studies have also demonstrated that exposure to air pollution is related with GDM, but owing to a lack of literature, they cannot further explain its relationship, the second is the relationship between exposure to fine particulate matter and the occurrence of GDM. At present, systematic studies are still lacking. In order to address the two problems mentioned above, we conducted a meta-analysis to evaluate the relationship between exposure to air pollution and fine particulate matter during pregnancy and GDM.

METHODS

Search strategy: We have carried out a comprehensive and systematic search of the Pubmed , Cochrane , Embase , Web of science in the form of subject words and free words, and the search will end on April 1, 2022.and the subject words were Diabetes, Gestational [Mesh], Air Pollution [Mesh], Particulate Matter [Mesh]. Free words were Diabetes, pregnancy-induced; Diabetes, Pregnancy Induced; Pregnancy - Induced Diabetes; Gestational Diabetes; Gestational Diabetes Mellitus; Gestational Diabetes Mellitus; Air Pollution. Pollution, the Air; Air Quality; Ultrafine Fibers; Ultrafine Fiber; Fiber, Ultrafine; The fizzy Particulate Matter; Particulate Matter, fizzy; Ambient Particulate Matter; Particulate Matter, Ambient; Ultrafine Particulate Matter; Ultrafine Particulate Matter; Ultrafine Particles; Particles Ultrafine; Ultrafine Particle; Ultrafine Particle; PM2.5; Ambient particle pollution. There were no restrictions on study designs. We also searched through the reference lists of the eligible studies to find the relevant studies. After deduplication, two investigators independently checked the eligibility of studies by screening the titles and abstracts and then potentially eligible studies were extracted as full texts. Any discrepancies were resolved by group discussion.

Participant or population: The research population object of our systematic review is the patient who has completely recorded the exposure of fine particles during the whole pregnancy and the incidence of gestational diabetes mellitus.

Intervention: Our systematic review focused on cohort study. The observation group was exposed to high-dose PM2.5.

Comparator: Our systematic review focused on cohort study. The control group was exposed to high-dose PM2.5.

Study designs to be included: The types of studies included in our systematic review are case-control study, cohort study and cross-sectional study.PM2.5.

Eligibility criteria: Studies were considered eligible for inclusion if they matched the following criteria: (1) reported and evaluated the relationship between air pollution and fine particulate matter and GDM; (2) clarified the clinical outcome of GDM (including studies on multiple diseases); (3) used the concentration of air pollutants and fine particulate matter to measure exposure to heavy air pollution; (4) avoided limiting the inclusion of people from different parts of the world; (5) used the concentration of air pollutants and fine particulate matter to measure exposure to heavy air pollution; and (6) written in English.Exclusion criterion included: (1) animal studies/review studies/letter studies/proceedings; (2) type 1 diabetes/ type 2 diabetes/specific diabetes studies; (3) quantitative studies of traffic density or access to major roads and green space and surrounding environment, but no pollution data; (4) studies evaluating only whether diabetes status changes the relationship between air pollution and birth outcomes; and (5) studies with a sample size of less than 1000. Two researchers independently reviewed studies that might qualify, and if there were any discrepancies, they resolved them through group discussions.

Information sources: We have carried out a comprehensive and systematic search of the Pubmed , Cochrane , Embase , Web of science in the form of subject words and free words, and the search will end on April 1, 2022.

Main outcome(s): Classification variables: OR (odds ratio/odds ratio), RR (relative risk), RD (difference in rate). OR and RR are most commonly used, among which RR is more recommended when studying RCT OR cohort studies. In case control studies, only OR can be used.The primary outcome of our systematic review was the OR of high dose PM2.5 to the risk of gestational diabetes mellitusWe have carried out a comprehensive and systematic search of the Pubmed , Cochrane , Embase , Web of science in the form of subject words and free words, and the search will end on April 1, 2022.

Additional outcome(s): None.

Quality assessment / Risk of bias analysis: Effect estimates were extracted from the fully adjusted models. Newcastle-Ottawa Scale (NOS) was used to evaluate the quality of included studies separately for cohort and case-control studies. The Newcastle-Ottawa Scale (NOS) for Assessing the Quality of Non-randomized Studies in Meta-Analysis table developed by G. Wells et al. was used to assess the methodological quality of the study. The NOS table scores articles from three dimensions, with a total of eight questions, including choice of case groups and control groups (two questions), Comparability (one question), and Exposure (three questions). Each question was scored on a scale of "0" to "2", representing "low quality" and "high quality" respectively. The studies were scored from 0 to 10, and studies with a score of 5 or above were eligible for inclusion in the meta-analysis.

Strategy of data synthesis: The outcomes indicators of our systematic review are: OR (odds ratio/odds ratio), RR (relative risk), RD (difference in rate). OR and RR are most commonly used, among which RR is more recommended when studying RCT OR

cohort studies. In case control studies, only OR can be used.
If both the single-pollutant model and the multi-pollutant model are reported, we will extract the impact estimates from the non-pollutant model. Due to differences in study design, site, and ethnicity, the expected inconsistencies in the study were applied to the random-effects model to obtain the pooled effect estimates. When the same air pollutant was combined with two or more exposure windows, a single variable was selected.
Model selection was chosen based on the heterogeneity. Data were combined using a random-effects model if I2>50%; Otherwise, a fixed-effects model was used.

Subgroup analysis: We conduct subgroup analysis on the types, races and regions of air pollutants.

Sensitivity analysis: In this meta-analysis, we used a one-by-one elimination method for sensitivity analysis. Due to the significant heterogeneity among these studies, a random-effect model was used.

Country(ies) involved: China.

Keywords: Air pollution, Fine particulate matter, Gestational diabetes, Meta-analysis, Systematic review.

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