

Increasing maternal weight is an independent risk factor for fetal heart defects

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Objective

To assess and quantify the association between maternal overweight and obesity, and the risk of congenital heart defects (CHDs) in offspring.

Methods

We conducted database searches on PubMed, Medline, Embase, and Scopus up to March 2023, using relevant combinations of keywords. Only full-length manuscripts written in English language and published in peer-reviewed journals were screened. Bibliographies of relevant papers were also examined. Observational studies reporting the incidence of CHD according to body mass index (BMI) were finally included. A random-effects meta-analysis model was performed to estimate pooled effects applying a restricted maximum likelihood estimation method to compute between-study variabilities. When the assumption of study homogeneity was reasonable, a fixed-effects model with Mantel–Haenszel method was used and reported. The systematic review was performed according to the Preferred Reporting Item for Systematic Reviews and Meta-analysis (PRISMA) and the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) guidelines. The study protocol was prospectively registered on the publicly accessible database PROSPERO with the registration ID CRD42023405393.

Results

A total of N=31 studies were included in the systematic review, and a total of N=20 studies were available for quantitative synthesis, collecting 4,861,693 patients and 86,136 CHDs. The analysis revealed a firm and progressive increase in the risk of congenital heart defects with increasing maternal weight. Maternal overweight was associated with a 1.05 odds ratio (OR) [95% CI, 1.03-1.08], low heterogeneity ($I^2=14.13\%$), and a slightly significant publication bias (Egger's = 0.0328). For maternal obesity (BMI > 30 kg/m²), we found a higher risk of CHD with an OR equal to 1.42 [95% CI, 1.18-1.70], despite higher heterogeneity ($I^2=97.94\%$) and no significant publication bias (Egger's = 0.8880). To decrease statistical and clinical heterogeneity, we stratified the results according to the degree of maternal obesity. The analysis showed that moderate obesity (BMI=30-35 kg/m²) increased the risk of CHD with an OR of 1.15 [95% CI, 1.11-1.20] and low heterogeneity ($I^2=47.69\%$). Notably, severe obesity (BMI > 35 kg/m²) was associated with a progressively increased odd for CHD, with a OR of 1.39 [95% CI, 1.27-1.53], despite higher heterogeneity ($I^2=74.39\%$).

Conclusion

The risk of CHDs in offspring increases gradually with each progressive increase in maternal BMI above the threshold for normal weight. Given the challenges of conducting future prospective intervention studies aimed at preventing CHD through pre-pregnancy weight optimization, action should be taken today based upon current evidence: pre-conceptional weight control should be recommended as a mandatory measure with the potential to reduce the risk of CHD.