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Anxiety and Gestational Diabetes Mellitus: Systematic Review and Meta-Analysis of Prevalence and Prospective Relationships

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Short Report

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Abstract

Purpose: Anxiety is one of the most common psychological disturbances during pregnancy and has been increasingly recognized as a potential risk factor for gestational diabetes mellitus (GDM). This systematic review and meta-analysis aimed to examine prevalence and the relationship between anxiety and GDM, assess the impact of GDM on maternal quality of life (QoL).

Methods

A comprehensive literature search was conducted in PubMed, Google Scholar, and the Cochrane Database without date restrictions. Search terms combined synonyms for "anxiety" and "gestational diabetes." Two independent reviewers screened and extracted data using Rayyan software. Eligible studies included community- or hospital-based original research that quantitatively assessed anxiety symptoms or disorders in women with GDM or vice versa. Data were pooled using a random-effects model due to substantial heterogeneity.

Results

A total of 19 studies were included in this review. The pooled prevalence was 24% (95% CI: 14%–39%). The pooled analysis revealed a significant positive association between anxiety and GDM (OR = 1.46, 95% CI: 1.11–1.94; P = 0.0076; I^2 = 98.0%). Women with GDM had higher anxiety levels compared to those without GDM. Early-pregnancy anxiety was associated with an increased incidence of GDM, particularly among younger and nulliparous women. Furthermore, prenatal exposure to GDM was linked to elevated anxiety and internalizing symptoms in offspring.

Conclusion

This meta-analysis demonstrates a significant bidirectional association between anxiety and GDM. Pregnant women with GDM are more likely to experience anxiety, and elevated anxiety levels in early pregnancy may increase the risk of developing GDM. These findings suggest that there must be integrated psychological screening and intervention in antenatal care to improve both maternal and fetal outcomes.

Introduction

Gestational diabetes mellitus (GDM) is diagnosed for the first time during pregnancy in women who did not previously have type 1 or type 2 diabetes (**Amarnath S et al., 2021**; Mao et al., 2017; **Murray and Reynolds, 2020**). The prevalence of GDM varying within the country, from 3.8% in Kashmir to 6.3% in Mysore, and as high as 17.9% in Tamil Nadu. The prevalence rates as high as 35% from Punjab and 41% from Lucknow have been reported**(Mithal, Bansal, and Kalra, 2015**). India, being the most populous country in the world, shows the prevalence of GDM ranging from 3 to 35%. (Arora et al., 2015; Kalra P et al., 2013).

Pregnancy-related HRQoL is influenced by a number of factors, such as social integration, pregnancy acceptance, family dynamics, maternal role understanding, and childbirth preparation **(**Boutib et al., 2023). Diabetes is a mental and emotional illness that raises the risk of acquiring a number of psychiatric disorders **(de Groot, Golden, and Wagner, 2016).** In patients with type 1 or type 2 diabetes, the risk of depression occurs twice as often as that of healthy populations **(**Ali et al., 2006; Anderson et al., 2001; Brown et al., 2005). The relationship between anxiety and gestational diabetes mellitus (GDM) is less clear.

Gestational diabetes mellitus (GDM) could lead to a number of physical, psychological, and social-related complications that greatly impact the quality of life (QOL) among affected mothers **(**Alia et al., 2019; **Mithal, Bansal, and Kalra, 2015)**. Evaluating these factors, including HRQoL in pregnant women, can serve as a strong basis for promoting maternal health **(Jomeen and Martin, 2012a).** Much of the research shows the significant difference in the quality-of-life score between the GDM and healthy populations (**Qendresa** Beka et al., 2018; Brown et al., 2005; **Huang et al., 2015;** Kozhimannil 2009; Pace et al., 2018; C. A. Wilson et al., 2020a). However, some of the research shows there was no significant difference between the GDM and healthy populations **(**Katon et al., 2011; Keskin et al., 2015).

The risk of GDM causes a fourfold increase in significant risks and potential complications for the mother, such as preeclampsia, hypertension, excessive amniotic fluid, premature rupture of membranes, cesarean delivery, and mental health challenges like depression (**Choudhury and Devi Rajeswari, 2021; Yang and Wu, 2022**). Furthermore, when these women become pregnant again, the recurrence of GDM is seen in 33–69% of cases (**Ikoh Rph and Tang Tinong, 2023**). For babies born to mothers with GDM, there is a heightened risk of being large for gestational age, experiencing intrauterine growth restriction, hypoglycemia, hyperbilirubinemia, and neonatal respiratory distress syndrome, often requiring a longer stay in the neonatal intensive care unit (Bamehrez, 2023).

The quality of life for women with gestational diabetes is influenced by a variety of factors, including medical, social, and psychological aspects. In the context of GDM, quality of life refers to the individual's overall well-being, including physical health, mental health, social functioning, and the ability to manage the condition (Ansarzadeh et al., 2020). The aim of this review was to determine the longitudinal association between gestational diabetes and anxiety by systematically searching for and reviewing studies that investigated either anxiety as a risk factor for incident gestational diabetes in adults aged 18 or older or diabetes as a risk factor for incident anxiety in adults aged 18 or older.

Methods

This study was a systematic review and meta-analysis designed to estimate the association of anxiety with gestational diabetes mellitus. The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency, rigor,

and reproducibility in the research process. For the present study, a comprehensive literature search strategy was employed using PubMed and other databases, including Google Scholar and Cochrane. There were no restrictions on publication date, and only English studies were reviewed. Search terms relating to synonyms of ‘anxiety’ and ‘gestational diabetes’ were searched in databases including PubMed (United States National Library of Medicine, Bethesda, MD, USA) and Google Scholar.

Eligibility criteria

Inclusion criteria

1. Community or hospital-based studies.
2. Original published articles and short communications.
3. Studies providing the association of anxiety and GDM
4. Studies that reported risk factors, or outcomes of GDM without reference to GDM prevalence

Exclusion criteria

1. Overviews, editorials, other review papers, or method protocols without results
2. Studies that did not report quantitative measures of QoL status.
3. Molecular or genetic studies, animal studies, Invitro studies.
4. Studies that did not differentiate between GDM and type 1 and/or type 2 diabetes
5. Studies which have not reported screening methods
6. Experimental studies
7. Three authors independently examined search results for inclusion. Disagreements, if any, were settled by consensus with a fourth author.

Search strategy

“The PubMed database was searched using the following predefined search strategy: ("Diabetes, Gestational"[MeSH Major Topic] OR "gestational diabetes" [Title/Abstract] OR "pregnancy-induced diabetes"[Title/Abstract] OR GDM[Title/Abstract]) AND ("Anxiety"[MeSH Major Topic] OR "Anxiety Disorders"[MeSH Major Topic] OR anxiety[Title/Abstract] OR anxious[Title/Abstract] OR PTSD[Title/Abstract] OR "post traumatic stress disorder"[Title/Abstract] OR "post-traumatic stress disorder"[Title/Abstract] OR OCD[Title/Abstract] OR "obsessive compulsive disorder"[Title/Abstract] OR "obsessive-compulsive disorder" [Title/Abstract] OR phobia[Title/Abstract] OR phobias[Title/Abstract] OR "panic disorder"[Title/Abstract] OR panic[Title/Abstract] OR "generalised anxiety" [Title/Abstract] OR "generalized anxiety"[Title/Abstract] OR "generalised anxiety disorder"[Title/Abstract] OR "generalized anxiety disorder"[Title/Abstract] OR GAD[Title/Abstract] OR agoraphobia[Title/Abstract] OR neurosis[Title/Abstract] OR neuroses[Title/Abstract])

We examined the first 30 pages in google scholar (search terms: "Gestational diabetes mellitus" AND "anxiety" AND "anxiety disorder"). A total of 300 number article selected from the google scholar. Two independent authors conducted all bibliographic searches. After the exclusion of duplicates, HK screened the titles. If the eligibility of a relevant article could not be identified initially from the title, we extracted the full text. Another investigator (RK) screened a random sample of the articles using the Rayyan software in order to confirm consistency in the study selection process (Ouzzani et al., 2016)(http://rayyan.qcri.org, accessed on 26 Oct 2025). Articles not directly relevant to the subject were excluded.

Study Selection

To evaluate the association of anxiety with gestational diabetes, eligible studies were prospective studies that assessed the incidence of gestational diabetes in people aged 18 or over who were assessed for the presence of anxiety at baseline. Only studies that examined Type 1 and Type 2 diabetes were included. Included studies were required to assess anxiety symptoms (as defined by elevated anxiety symptoms on a validated scale) or anxiety disorders (as assessed by diagnostic interview or clinical diagnosis). In this review, anxiety was defined as the anxiety disorders included in Diagnostic and Statistical Manual (DSM) version IV or V; version V excludes post-traumatic stress disorder (PTSD) and obsessive–compulsive disorder (OCD), whereas version IV includes these disorders.

Data analysis

A random-effects meta-analysis was conducted to synthesize prevalence estimates and risk associations (odds ratio) across studies, using DerSimonian and Laird methodology. Heterogeneity was quantified with the I^2 statistic, with values > 50% considered substantial. Publication bias was assessed visually by funnel plot inspection and quantitatively using Egger’s test. Sensitivity analyses were performed by sequentially excluding each study to evaluate the robustness of pooled estimates. All statistical analyses were conducted using https://metaanalysisonline.com/. Statistical significance was defined as a p-value < 0.05. As this study involved analysis of published data only, no institutional ethics approval was required.

Results

Following a predesigned literature retrieval strategy, 706 articles were retrieved, including 122 repeated articles. After reviewing the titles and briefs, another 546 were excluded, thus reviewing 38 articles in detail. Finally, we included 19 studies for discussion. The remaining 19 studies were excluded because they

were not consistent with our research content. The literature screening process and the results are shown in Fig. 1. (Table 1)

Prevalence of anxiety in GDM

A total of eight studies comprising 3,584 participants were included to assess the prevalence of anxiety among women with GDM. Using a random-effects model with the inverse variance method and logit transformation, the pooled prevalence was 24% (95% CI: 14%–39%). Substantial heterogeneity was observed ($p < 0.01$), with an I^2 value of 98%, indicating that most of the variability across studies was due to between-study heterogeneity rather than chance. (Fig. 2)

Studies of the association between anxiety and GDM

Nineteen studies including, n = 114896 participants were included in the analysis of the association between anxiety and Gestational Diabetes Mellitus (GDM). A total of 19 studies were included in the final meta-analysis. Using a random-effects model with the inverse-variance method, the pooled OR was 1.41 (95% CI: 1.11–1.94), indicating a statistically significant association between anxiety and gestational diabetes mellitus (GDM) ($p < 0.05$).

Significant heterogeneity was observed among the included studies ($p < 0.01$), with an I^2 value of 98%, suggesting that most of the variability across studies was due to heterogeneity rather than random sampling error. **(**Fig. 3**)**

A funnel plot was visually inspected to assess for potential publication bias or small-study effects. Additionally, Egger's test was conducted to statistically evaluate funnel plot asymmetry. Egger's test did not indicate significant asymmetry ($p = 0.0988$), potentially indicating publication bias or small-study effects. **(**Fig. 4**)**

Table 1
Characteristics of studies include in the study

S.No.	Author (Year); Country	Study	Baseline Sample	Study Design	Anxiety Measurement	Total GDM	GDM (Anxiety)	Statistical Analysis	Results (Odd Ratio (95% CI)
1	Q. Beka *et al*.,(Q. Beka et al. 2018)	Canadian province of Alberta	N = 373674	Retrospective	Classification of Diseases and Related Health Problems 10th Revision (ICD-10-CM and ICD-10-CA) and the corresponding disorders in ICD-9-CM	NR	NR	Logistic regression	1.10, 95% CI 1.06–1.14).
2	Mary Byrn *et al* (**Byrn and Penckofer 2015)**	Loyola University Chicago	N = 135	A cross sectional	The Speilberger State Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch Jacobs, Lushene, & Vagg, 1977) scale is a 40-item tool that measures a person's current level of anxiety (state anxiety) and a person's general and long-standing anxiety (trait anxiety).	65	13	Chi-squared analysis, t tests, multiple regression, and logistic regression	3.79 (95% CI [CI] [1.07,13.45]
3	Claire A Wilson et al (Wilson et al., 2020)	UK's Born in Bradford cohort.	N = 12,239	Prospective longitudinal cohort	ICD-10 diagnostic groups F32 and F33 depressive episodes and re current depressive disorders and F41 anxiety disorders	NR	NR	Multivariable robust Poisson and logistic regression	0.91; 95% CI 0.73–1.12).
4	Eynav Accortt *et al* **(Accortt et al., 2022)**	Los Angeles, CA	N = 82	Prospective cohort study	The OASIS is a 5-item measure that assesses frequency and severity of anxiety	NR	NR	logistic regression	OR 3.58, 95% CI 1.03–12.44
5	Jesus Serrano-Lomelin(**Serrano-Lomelin et al., 2024)**	Alberta, Canada	N = 18,381	Prospective Case control		NR	NR	logistic regression	2.18, 95% CI (1.43–3.31).
6	Kai Wei L et al (**Lee et al. 2020)**	Malaysia	N = 526	Prospective Cross sectional	Asian DQoL	NR	NR	Multiple logistic regression	6.934, 95% [CI] 2.280–21.081
7	Munda A et al **(Munda, Fekonja, and Pongrac Barlovič 2021)**	Ljubljana, Slovenia	N = 180	longitudinal cohort study	STAI	77	18	Chi square test	3.38 (95% CI:1.38–8.31)
8	M Nirmala Priyadarshanie (Priyadarshanie et al. 2023)	Sri Lanka	N = 221	Prospective cohort study	International Classification of Diseases and Related Health Problems-10 (ICD-10) criteria [	10	9	logistic regression	12.6 (95% CI = 1.5–107.2)
9	Phyllis Ohene-Agyei(Ohene-Agyei et al. 2024)	New Zealand	N = 414	Prospective cohort study	6- item Spielberger State–Trait	414	70	logistic regression analyses	OR 0.93; 95% CI 0.87–0.99

S.No.	Author (Year); Country	Study	Baseline Sample	Study Design	Anxiety Measurement	Total GDM	GDM (Anxiety)	Statistical Analysis	Results (Odd Ratio (95% CI)
					Anxiety Inventory				
10	Rebecca Walmer(Walmer et al. 2015)	Massachusetts	N = 18,109	Prospective cohort study	International Classification of Diseases, Ninth Revision (ICD-9)	NR	NR	Repeated measures logistic regression models	1.14 [0.83, 1.57]
11	Syed Shahzad Hasan(Hasan et al. 2013)	Malaysia.	N = 320	Prospective Case Control study	SF-36	NR	NR	Chi square test, logistic regression	1.00 (0.28–3.52)
12	Xun Zeng(Zeng et al. 2023)	China	N = 406	Prospective cohort study	Self-rating anxiety scale (SAS)	NR	NR	logistic regression analysis	2.537(95% CI,0.146to 4.928)
13	Hsieh et al 2025(Hsieh et al. 2025)	USA	N = 2,310	Prospective cohort study	Pregnancy Specific Anxiety Scale (PSAS)	NR	NR	logistic regression	1.52, 95% CI: 1.04–2.23`
14	Pathirana MM 2023 (Pathirana et al. 2023)	New Zealand	N = 1363	Prospective cohort study	New Zealand	NR	NR	logistic regression	STAI-6 score
15	Ruohomaki A(Ruohomäki et al. 2018)	Finland.	N = 1066	Prospective cohort study	Edinburgh Postnatal Depression Scale (EPDS)	1066	110	logistic regression	2.23, 95% CI 1.23–4.05
16	Hemavathy et al (Hemavathy et al. 2025a)	India	N = 2141	Prospective cohort study	GAD-7 (score ≥ 7) scales	474	100	logistic regression	aOR = 1.36, 95% CI:1.03–1.79, p = 0.03
17	Tang Y *et al* (Tang et al. 2020a)	China	N = 1426	Prospective cohort study	China	1426	596	logistic regression	Anxiety self-rating scale
18.	Shea et al (Shea et al. 2024)	Pennsylvania	N = 55 440	Retrospective study	ICD-10-CM	NR	NR	Logistic regression	2.94(95%CI,2.85–3.03)
19.	Prabhakar MC (**Prabhakar and Halder 2024**)	India	N = 965	Cross sectional study	Kessler Psychological Distress Scale	52	10	logistic regression	0.10; 95% CI 0.05–0.23

Discussion

This systematic review and meta-analysis estimated the prevalence of anxiety and showed a significant association between it and GDM outcomes. Pregnant women with gestational diabetes mellitus (GDM) experienced higher levels of anxiety compared to those without GDM or non-pregnant women. GDM was independently associated with an increased risk of anxiety, even after adjusting for age and pregnancy-related complications(Walmer et al., 2015) (**Qendresa** Beka et al. 2018).

Anxiety in early pregnancy increases the risk of GDM. Pregnant women under 30 years old and nulliparous women are at high risk of anxiety. The incidence of GDM in the early pregnancy anxiety group 33. 6%, respectively(Tang et al. 2020b). Furthermore, women with early-onset GDM demonstrate a higher prevalence of depression and anxiety compared to those with late-onset GDM and women without GDM. These findings highlight the need for early and universal screening for GDM, alongside systematic assessment and support for maternal mental health throughout pregnancy(Hemavathy et al. 2025b). Women with a history of mood or anxiety disorders had a moderately increased risk of developing gestational diabetes (**Qendresa** Beka et al. 2018). Anxiety in early pregnancy increases the risk of GDM. Pregnant women under 30 years old and nulliparous women are at high risk of anxiety (Tang et al. 2020c).

In present study Pooled prevalence in of anxiety in GDM in present study 24.0%. A study conducted in Malaysia found a lower prevalence of anxiety symptoms but higher for depressive symptoms and stress, at 27.9%, 7.4%, and 3.8%, respectively (Lee et al. 2019). Differences in study tools, participant demographics, and country-specific factors may account for the variation in the prevalence rates. There is a lack of research evidence in India.

Women diagnosed with gestational diabetes mellitus (GDM) often face more than just physical challenges. Increasing evidence shows that GDM is linked to higher levels of depression and anxiety during pregnancy. These emotional difficulties can negatively affect a woman's quality of life and may contribute to poorer pregnancy and fetal outcomes (Gong et al. 2021).

In Conclusion this systematic review and meta-analysis demonstrate a significant association between anxiety and gestational diabetes mellitus (GDM). Women with a history of mood or anxiety disorders and those experiencing anxiety in early pregnancy are at higher risk of developing GDM. These findings highlight the importance of early screening and integrated management of psychological health in antenatal care. Addressing anxiety and related

psychosocial factors may help improve maternal well-being, glycemic control, and pregnancy outcomes. Further high-quality studies, particularly from low- and middle-income countries such as India, are needed to strengthen the evidence base and guide targeted interventions.

Declarations

- **If your study is a clinical trial, please provide the necessary registration details**: "Clinical trial number: not applicable."
- **Consent to Participate declaration in the manuscript. Every human participant should provide their consent**: As this study is based on previously published data and does not involve direct participation of human subjects, informed consent is not applicable.
- **Name of the Approval Committee or the Internal Review Board (IRB) in the Ethics Approval declaration in the manuscript:** Since this is a systematic review and meta-analysis of published studies, ethics approval and IRB review were not required.
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- Clinical trial number: not applicable.

Author Contribution

H.K, V.C, BP, TD and RK wrote the main manuscript text All authors reviewed the manuscript.

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Figures

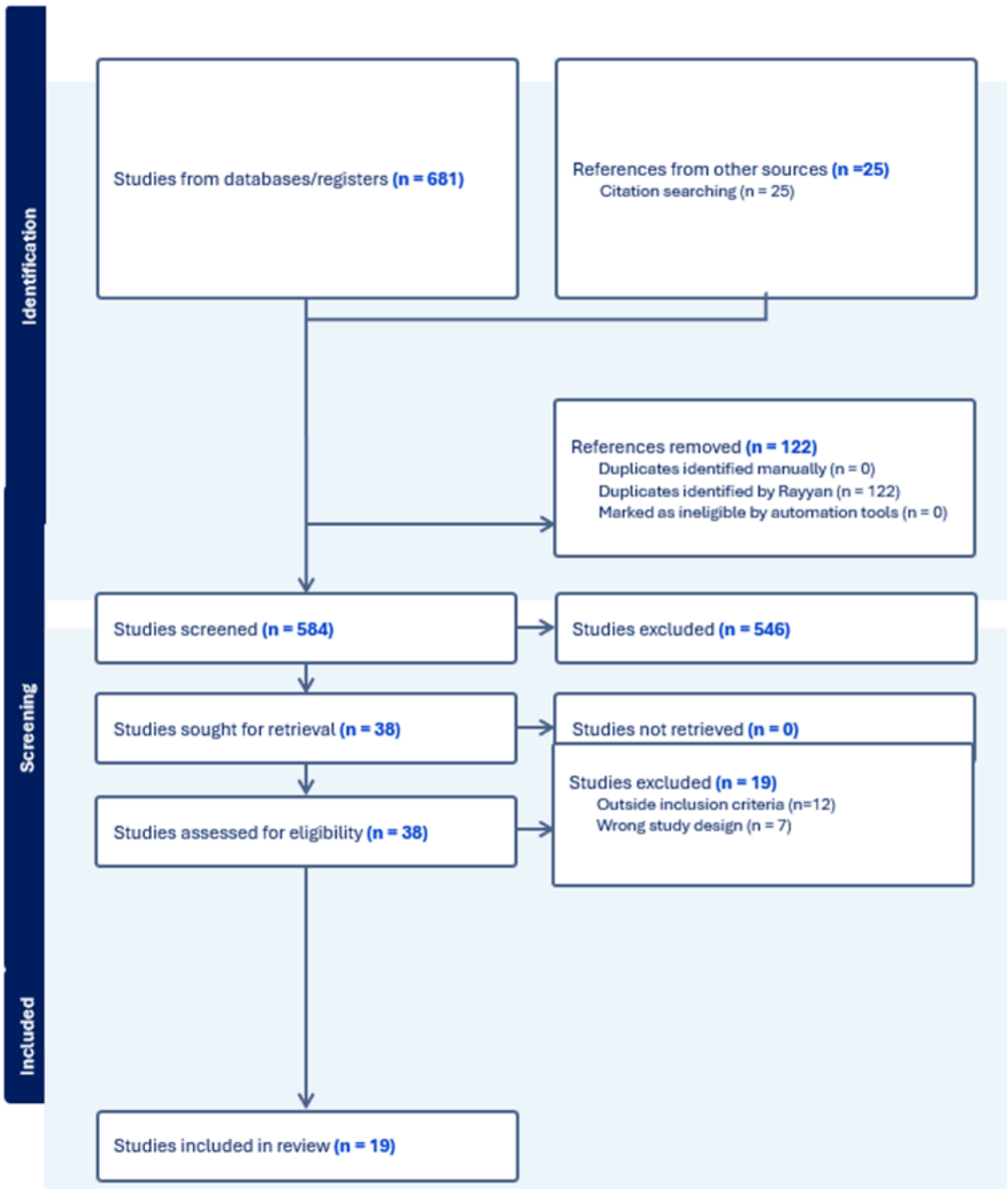


Figure 1

Flow diagram of studies selection in meta-analysis.

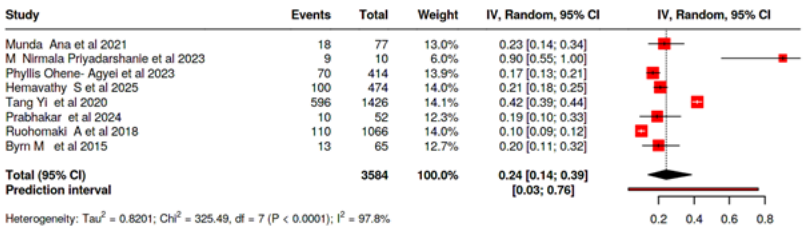


Figure 2

Forest plot of pooled prevalence of Anxiety in GDM using a random-effects model

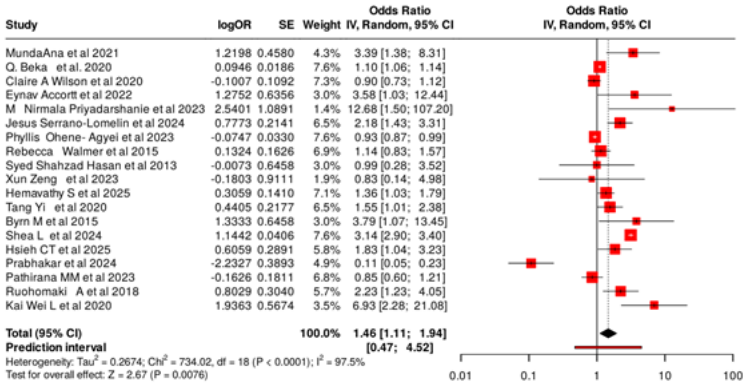


Figure 3

Random effects meta-analysis of studies of the association between anxiety and GDM (19 studies included).

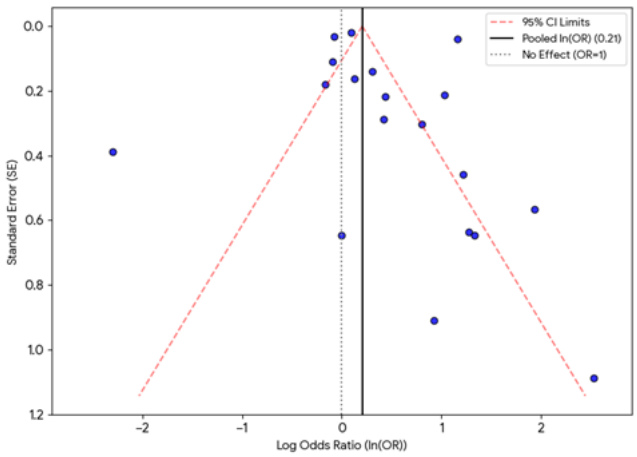


Figure 4

Funnel plot for risk Factor (Odds Ratio)