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Review Article

Nursing Care in Obstetrics and Breastfeeding Practices in Gestational Diabetic Mothers in China: A Systematic Review and Meta-Analysis

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Abstract

Background: Despite the fact that nursing care and breastfeeding practices are among the most important aspects of effective GDM management, the impact of these practices is still underexplored. We aimed to assess the effectiveness of obstetric nursing care and the impact on the outcomes of breastfeeding among gestational diabetes mothers.

Methods: A total of 522 records were found after conducting exhaustive searches in the databases of PubMed, Web of Knowledge, and the Cochrane Library. After eliminating duplicates and screening criteria, there were five studies with 3180 participants, 1377 of whom were experimental and 1803 of whom were control. The effects of nursing interventions on body mass index (BMI), fasting plasma glucose (FPG), and HbA1c levels, subgroup analyses were carried out.

Results: Individual studies suggested benefits in breastfeeding practices, but the study found no significant difference between the nursing and control groups (0.27, 95% CI: 0.05–1.57, P = 0.14). Studies showed that general care worked best for mothers with normal body mass indexes yet mothers with hyperglycemia needed more specific treatments. The findings demonstrate the necessity to interpret results with caution because they appeared affected by heterogeneity along with publication bias.

Conclusion: The nursing interventions which support breastfeeding practices and glycemic management perform best when they target mothers with gestational diabetes by monitoring their body mass index and blood glucose levels. Future research needs to accomplish a clear confirmation of these results involving HbA1c and FPG metrics because of their ambiguous nature.

Keywords: Gestational diabetes mellitus; Nursing care; Breastfeeding practices; Meta-analysis; BMI; Fasting plasma glucose

Introduction

Pregnancy problems from gestational diabetes mellitus (GDM) affect both the mother and the unborn child. In diabetes pregnancies, fatal surveillance is essential for evaluating the health of the unborn child and identifying potential problems (1). Routine foetal heart rate monitoring and routine ultrasound examinations to assess placental function, amniotic fluid volume and fatal growth are usually recommended by Chinese obstetricians and gynecologists (2). To protect the health of diabetic mothers and their children at the same time, more effective obstetric and gynecological care is needed.

In China, there are relatively fixed methods for treating GDM, including regularly measuring blood sugar, changing diet, formulating an exercise plan, and injecting insulin when necessary (3). Careful monitoring of the mother's blood sugar levels promotes glycemic control and reduces the risk of complications for both the mother and the child (4). On the other hand, nursing has several benefits for both diabetic mothers and their babies. The benefits of breastfeeding are both short-term and long-term. Breast milk is considered to be an important factor in the growth of the immune system, is highly nutritious and is also useful in regulating the blood glucose level (5). It also can decrease the risks of type 2 diabetes and pediatric obesity.

The health of an infant and its immune system is determined by the development of a normal microbiome in the gastrointestinal tract and this is done by breastfeeding. The insulin response and blood glucose levels of the mothers can also be improved and regulated through breastfeeding. It could thus lower the future risk of type 2 diabetes and may be useful in weight control (6). Furthermore, breastfeeding is beneficial for the mothers as it enhances the mothers' health, promotes the bond between the mother and the child and has the potential to decrease the incidence of postpartum depression (7). Breastfed subjects have decreased rates of infectious disease-related mortality and morbidity in childhood. Furthermore, it has been shown that nursing would mitigate the link between genetic variations in the FTO gene and obesity (8).

The goal of the study was to thoroughly evaluate the effects of nursing care interventions on breastfeeding practices and glucose management in moms with gestational diabetes in China. This study focused on the effect of specific maternal variables such as the maternal body mass index (BMI), the maternal fasting plasma glucose (FPG) level and the HbA1c level on the effectiveness of the tailored nursing interventions on the clinical outcomes of pregnant mothers that would promote GDM outcomes.

Materials and Methods

Search

We used a systematic approach to search for relevant studies across peer-reviewed journals, proceedings of conferences, and reports by governments. A comprehensive literature search was conducted across the following electronic databases: PubMed, Scopus, Web of Science, Embase, and Cochrane Library database from inception until December 2023. The following search terms were used: ("gestational diabetes" OR "GDM") AND ("breastfeeding" OR "lactation") AND ("China" OR "Chinese population"). The search was adapted for syntax differences in each database. Manual searches of reference lists from relevant studies and review articles were also performed to identify additional eligible studies. The number of records retrieved from each database is presented in Table S1 of Supplementary Information.

The study was registered with PROSPERO (registration number CRD420251104415). The search process adhered to the criteria set by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 in order to enable comprehensive and transparent reporting.

Inclusion criteria

The inclusion criteria will include research on Chinese moms with diabetes that focuses on breastfeeding outcomes and obstetric treatments and is published in either Chinese or English. Studies carried out outside of China or those that don't really target the effectiveness of obstetrics and nursing will be excluded based on certain criteria. Among the papers taken into consideration were 1) Clinical studies and research articles that concentrated on Chinese mothers with diabetes. 2) Chinese women who have a history of diabetes mellitus; 3) Chinese women between the ages of 27 and 45; and 4) publications in English.

Exclusion criteria

The analysis excluded any studies such as case reports, animal study, in-vitro studies, review articles and other conference studies. In addition, studies were excluded if they were not focused on gestational diabetes, non-interventional designs, or populations that were not exclusively of Chinese ethnicity. This was done to ensure the inclusion of high-quality, relevant evidence and to maintain population homogeneity for accurate synthesis. A summary table which outlines the specific reasons for exclusion at the full-text screening stage such as ineligible population, review articles, non-interventional design and mixed ethnicity is presented in Table S2 of Supplementary Information.

Data synthesis

Data extraction and synthesis include relevant information of the patients were recorded and all the retrieved data was carefully examined by two separate researchers. General information such as the author, study type, number of patients, gender distribution, age range, average age, and number of nodules were recorded. A double-blind approach was utilized using Rayyan—an online platform designed for conducting literature and systematic reviews (https://www.rayyan.ai/). The study also included detailed information regarding the reference standards. We evaluated several factors, such as patient selection, index test, reference standard, flow, and timing, using the Cochrane Risk of Bias Tool (ROBIS) and the Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2) tool.

A bias risk score was assigned to each evaluated domain, which may be classified as low, some concerns, or high. Data extraction was independently performed by two reviewers. Any discrepancies between the two reviewers were resolved through consensus discussion, and if unresolved, a third senior reviewer was consulted. The variables extracted included author (year), country, study design, sample size, BMI, FPG, HbA1c levels, type of nursing intervention, breastfeeding outcome measures, and follow-up duration.

Statistical analysis

RevMan 5.0 (Cochrane Rev Manager, Inc, USA) was utilized for both data collection and statistical analysis. The study employed two main approaches: a total meta-analysis of both all included studies, and a proportion meta-analysis. Pooling of data was performed statistically using a random-effects model, and heterogeneity of pooled data was checked using Cochran's Q statistic and I^2 test. RevMan software was used to represent data using diagnostic odds ratio (OR) with 95% confidence interval (CI). The Q statistic test was used for heterogeneity assessment, with subgroup analysis of a statistically significant outcome if $P < 0.05$ on the corresponding P value. Furthermore, heterogeneity was assessed by the I^2 value, which ranged from 0% to 100%, in which higher I^2 value suggests a higher level of heterogeneity. A random effects statistical model was used to assess subgroup. Publication bias was explored using Begger funnel test with significance level set at $P < 0.05$.

Results

Search results and patient characteristics

The initial search, encompassing PubMed, Web of Knowledge, and the Cochrane Library databases, led to the identification of 522 records. From this pool, 22 duplicates and 5 ineligible records were removed. Following a thorough review of titles and abstracts, 392 articles were excluded, and subsequently, 103 articles were selected for full-text retrieval. Out of these, only 84 reports underwent eligibility assessment, resulting in the exclusion of 79 articles. Ultimately, the final analysis incorporated only 5 studies from diverse locations, involving a total of 3180 patients (1803 control without nursing care and 1377 experimental with nursing care). The study protocol's PRISMA 2020 flowchart is depicted in Fig. 1, and detailed information about the study characteristics is provided in Table 1. The meta-analysis provides a comprehensive evaluation of obstetric interventions and breastfeeding practices among diabetic mothers in China, highlighting their effectiveness and clinical significance.

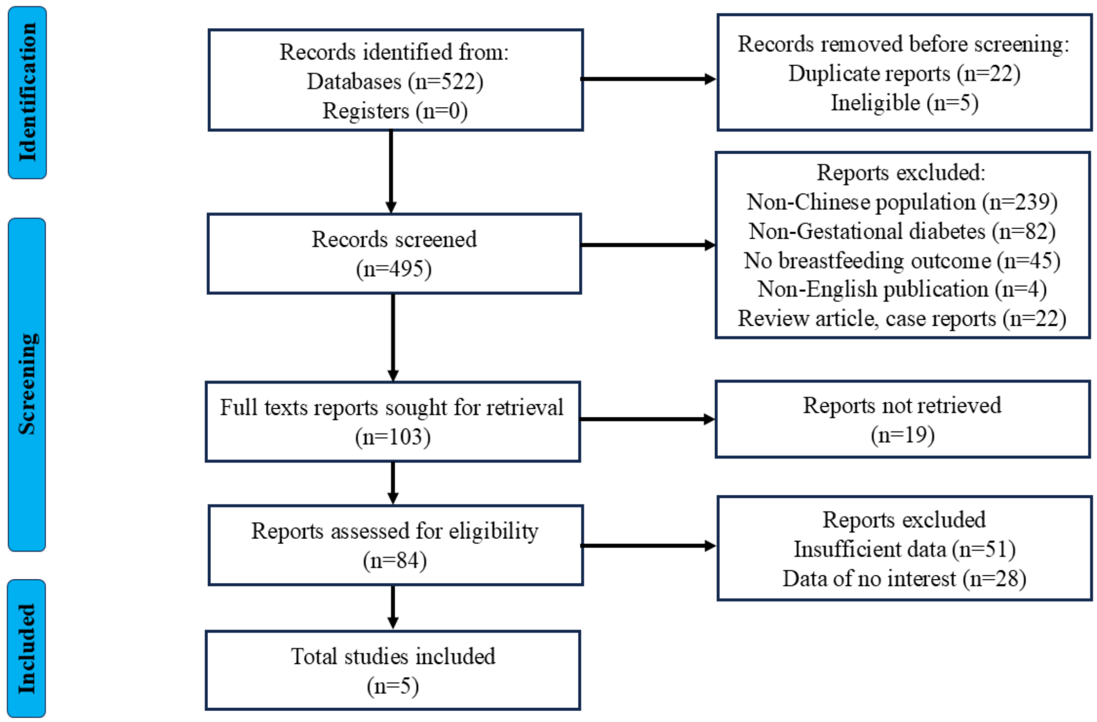

Fig. 1: PRISMA 2020 Guidelines of the meta-analysis screening process

Table 1: Characteristics of the included meta-analysis study

Study ID	Population (Control /GDM)	Maternal Age	Intervention Details Summary	Screening and life style	Monitoring and Management	Risk Assessment	Support and Counseling	Follow-up/Outcome
Ko 1999 (9)	431/801	Mean: 34.0 ± 4.1 years (range: 18–43 years)	75g OGTT, cardiovascular risk assessment, BP, BMI, lipids, insulin resistance at 6 weeks postpartum for women with GDM. Type: Postpartum metabolic screening.	1) 13.1% of women with a history of GDM developed diabetes within 6 weeks postpartum. 2) Women with a history of GDM had	Increased hypertension risk (7.5x higher than controls) among women with prior GDM	Women with GDM also had higher levels of triglyceride, total cholesterol and LDL, but lower levels of HDL, increasing CVD risk.	Glucose level management postpartum is important for maternal and neonatal health	Women with the history of GDM had a higher relative risk of impaired glucose tolerance (5.0x) and diabetes (8.1x) as compared to controls.

Table 1: Continued…

			Follow-up period: Single time point: 6 weeks postpartum	higher obesity rates (BMI ≥ 27 kg/m²) than controls (<10% vs. 25%).				
Lin 2005 (10)	73/17	Mean: 33.7 ± 4.1 years	75g OGTT, BMI, BP, C-peptide, insulin, cholesterol, waist-hip ratio, etc., metabolic follow-up after GDM pregnancy. Type: Postpartum metabolic follow-up. Follow-up period: 6 weeks to 2 years postpartum (mean follow-up: 3.3 mo)	1) 13.4% of women with previous GDM developed diabetes (DM), and 29.1% had abnormal glucose tolerance (AGT) postpartum 2) Higher prepregnancy BMI and increased glucose deterioration during pregnancy were predictive of postpartum DM and AGT.	Fasting glucose in the 100g OGTT was an independent risk factor for postpartum diabetes. Three or more abnormal values had 86% sensitivity for predicting postpartum glucose intolerance	Metabolic syndrome was more prevalent in women with postpartum DM (23.5%) compared to AGT (8.1%) and normal glucose tolerance (2.7%).	metabolic and glucose management postpartum could impact lactation success.	Insulin resistance (HOMAir) was significantly higher in women with DM, and beta-cell dysfunction (HOMAbeta) was observed in women with AGT compared to those with normal glucose tolerance.
Li 2016 (11)	279/48	Median: 29 years (IQR: 27–31)	Initial FPG at 16–18 weeks, 75g OGTT at 24–28 weeks, BMI tracked. Type: Antenatal screening. Follow-up period: Follow-up to delivery (up to ~28 weeks gestation)	1) The sensitivity for predicting GDM of having initial FPG > or = 4.6 mmol/L at 16-18 weeks was 64.6% and specificity was 65.2%. 2) PreBMI ≥ 21.5	Initial FPG was a stronger independent predictor of GDM than preBMI. Each 1 mmol/L increase in FPG increased GDM risk 3.6-fold.	PreBMI was associated with GDM risk, but its predictive power was weaker than FPG. Asian women developed GDM even at lower BMI thresholds.	Improving breastfeeding success during infancy and postpartum metabolic health can be supported by early glucose management during pregnancy.	GDM women had higher pre delivery BMI, parity, fasting glucose, justifying need of long term follow up for diabetes prevention.

Table 1: Continued…

				kg/m^2 had a sensitivity of 52.1% and specificity of 69.2%. 2) Higher preBMI and initial FPG values predicted larger increases in glucose during the OGTT and thus underscore the need for early lifestyle changes.				
Zhong 2022 (12)	20/20	Mean: GDM group 29.6 ± 2.87 years	Lipidomics of breast milk from 20 GDM vs 20 non-GDM women within 3 days postpartum. Type: Nutritional/lipid analysis post-delivery. Follow-up period: Single time point: within 3 days postpartum	Breast-feeding maternal diabetes was also found to help mitigate metabolic programming and thus reduce the risk of obesity and type 2 diabetes in infants.	Infants of mothers with GDM were significantly heavier at birth and had larger head circumferences, with weight differences narrowing by 3 months, possibly due to breast-feeding effects.	GDM altered breast milk lipid composition, with significant changes in neutral lipids, phospholipids (PLs), and sphingolipids. Increased PLs and sphingolipids were linked to higher maternal glucose levels.	1) Mothers with GDM had altered breast milk lipid profiles, including increased phosphatidylcholine (PC) and phosphatidylethanolamine (PE), which may impact infant growth. 2) Breast milk lipids were linked to infant growth, with specific lipids like ceramides associated with body length increase.	Differences in breast milk lipids in neonatal metabolic programming highlights the importance of composing formula as close to breast milk composition as possible in order to assist infants born from mothers with GDM.

Table 1: Continued…

Li 2020 (13)	1000/491	Mean: 32.7 years (AUS migrants); 29.1 (native)	OGTT, glucose level analysis at 24–28 weeks, comparison between Australian Chinese migrants and native Chinese. Type: Observational comparison. Follow Up period: Cross-sectional (data from 1 year of births)	1) GDM affects 19.7% of pregnant women yet only 14.6% in the control group faces this condition.' 2) The risk for GDM increases due to lifestyle changes, including higher intake of processed foods and fats, and reduced physical activity.	Subjects in this group showed fasting glucose at levels lower than controls yet demonstrated elevated glucose results during the OGTT 1-hour and 2-hour phases.	Dietary patterns, such as increased consumption of high-fat, high-calorie, and processed foods, which contributed to glucose metabolism abnormalities.	Metabolic health and glucose control can impact lactation success.	Higher risk of developing post-pregnancy metabolic disorders, requiring long-term monitoring and lifestyle interventions.

Nursing Care Analysis

Fig. 2 present the forest plot the effect of nursing care on among Chinese women with gestational diabetes in the experimental (nursing care) and control groups (without nursing care). The provided forest plot assesses the effect of nursing care interventions compared to no nursing care (control) on breastfeeding practices. The pooled odds ratio is 0.27 (95% CI: 0.05–1.57), indicating no statistically significant difference between nursing care and control groups (Z=1.46, *P*=0.14). The lack of statistical significance in the primary pooled outcome showed that the result must be interpreted with caution. This may be because of the included studies varied widely in the type, timing, intensity, and components of the nursing interventions. Several studies had relatively small sample sizes, and therefore, individual studies showed beneficial trends, the variability diluted the pooled effect. The meta-analysis showed substantial heterogeneity (I^2=99%), indicating high variability across the included studies and limits the reliability of this result. Sensitivity analysis (Fig. 3A) revealed that Li 2016 and Li 2020 had the greatest influence on the overall effect size, whereas Ko 1999, Lin 2005, and Zhong 2022 had smaller effects (Fig. 3A). This may be attributed to several factors: the wide variation in nursing care interventions, including structured education and general antenatal support; cultural and health system differences between native and migrant Chinese women; and inconsistent definitions of outcomes like breastfeeding duration, initiation, and exclusivity, which limit the generalizability and precision of the pooled effect. Fig. 3B presents the shows the relationship between the standard error and the log odds ratio, with the red dashed line representing the regression line (*P*>0.05).

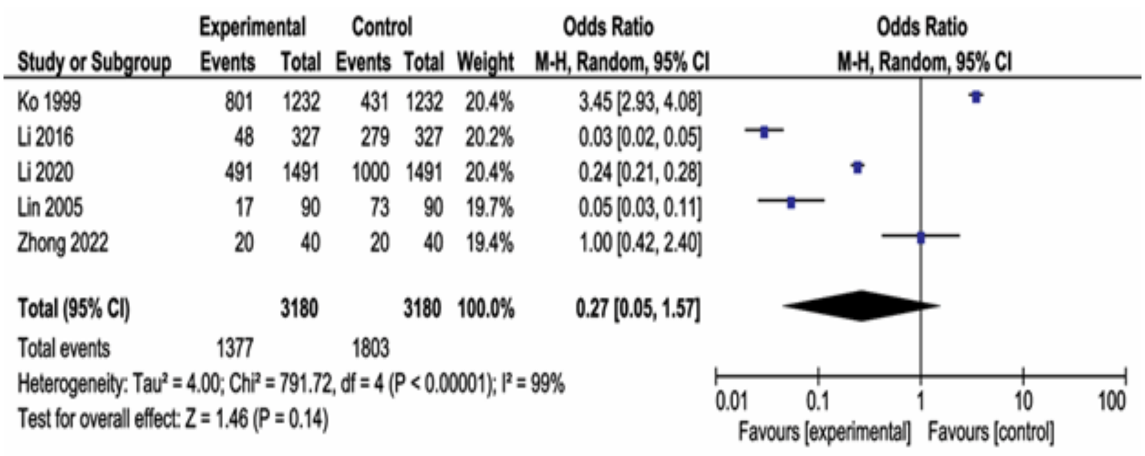

Fig. 2: Forest plot analysis on the effect of nursing care (experimental) in Chinese women with gestational diabetes vs without nursing care (control)

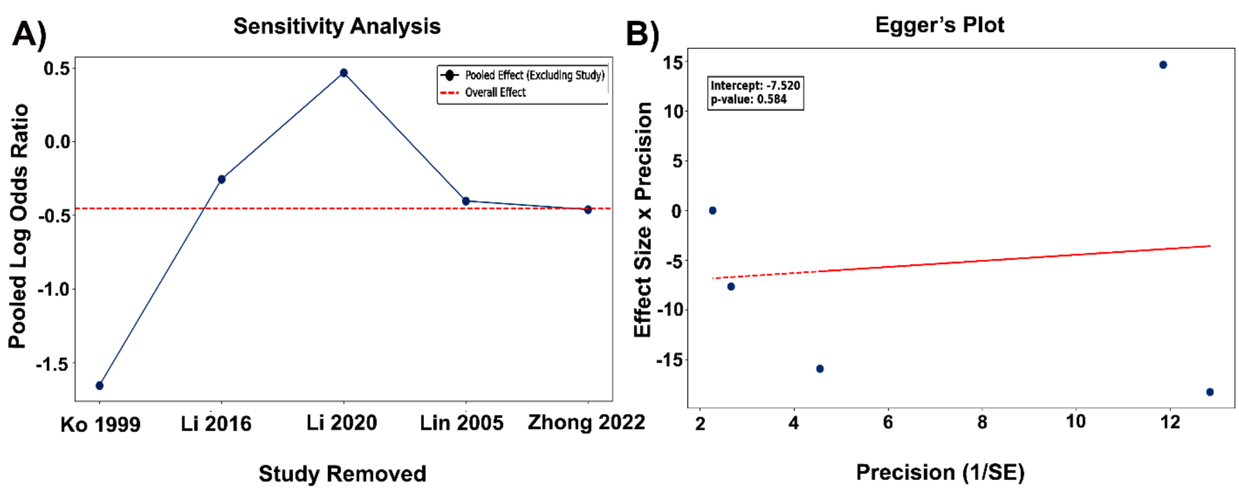

Fig. 3: (A) Sensitivity Analysis Plot and (B) Egger's Regression Plot on the effect of nursing care (experimental) in Chinese women with gestational diabetes vs without nursing care (control)

BMI Analysis

The forest plot for the BMI subgroup analysis illustrates the relationship between BMI categories and the effectiveness of nursing care. BMI moderates breastfeeding practices among gestational diabetic mothers. The subgroup analysis revealed a diagnostic odds ratio of 1.22 [M-H, Random, 95% CI=0.70-2.13], *P*=0.70, and Z=0.48 (Fig. 4). This emphasizes the importance of personalized nursing interventions tailored to BMI measurements. Fig. 5A shows the sensitivity analysis plot of the BMI analysis which represent the pooled log odds ratio when each study is excluded one at a time. The red dashed line in BMI analysis remains relatively stable, indicating that no single study has a disproportionate influence on the overall results. Moreover, the Egger's Regression Plot in Fig. 5B suggest no significant publication bias, as the *P*-value is likely above 0.05.

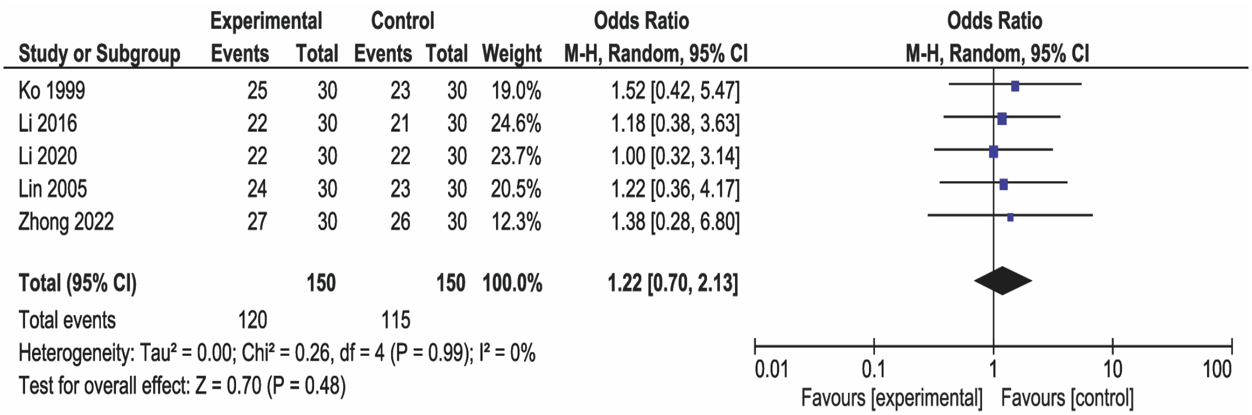

Fig. 4: Forest plot analysis for the subgroup based on the BMI of the gestational diabetes patients with nursing care (experimental) and without nursing care (control)

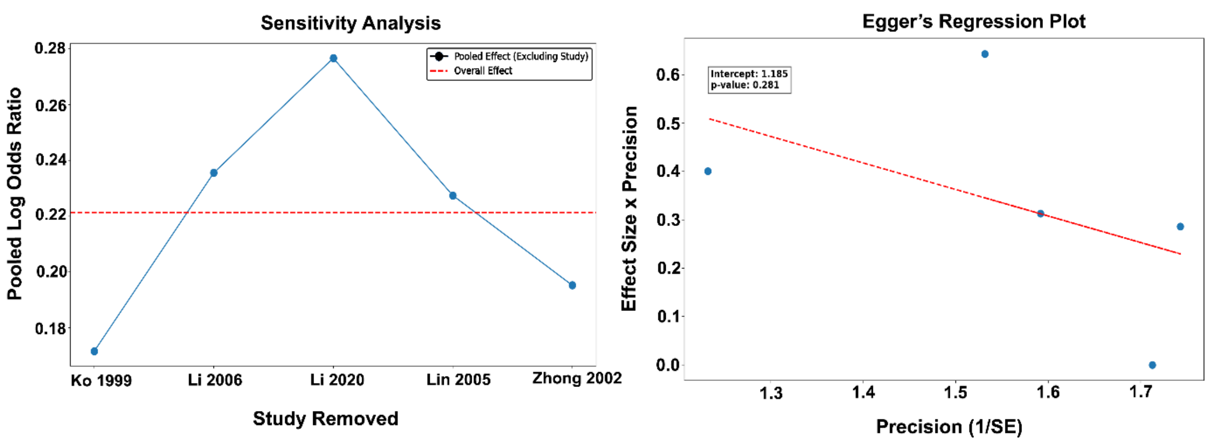

Fig. 5: (A) Sensitivity Analysis Plot and (B) Egger's Regression Plot for the subgroup based on the BMI

Fasting plasma glucose analysis

The forest plot evaluates the impact of the levels of FPG in the gestational diabetic mother for the effectiveness of nursing interventions (Fig. 6). The sub-group analysis of plasma glucose (fasting) indicated an overall effect size of 1.93 [M-H, Random, 95% CI = 0.68-5.47), P=0.22 and Z=1.23 (Fig. 6). Studies on elevated fasting plasma glucose levels often yield contradictory results, suggesting that nursing interventions may be more effective in mothers with high fasting glucose levels. Nursing interventions should consider fasting plasma glucose levels, as the analysis suggests. It may be necessary to provide additional or modified interventions to mothers who have a high fasting plasma glucose level. The effectiveness of standard interventions in normal FPG subgroups suggests they are generally effective but may need further adaptation for hyperglycemic patients. In Fig. 7A, the sensitivity analysis shows that the pooled odds ratio remains stable (1.52 to 2.06) regardless of which study is excluded, indicating no single study disproportionately affects the results. The confidence intervals consistently cross 1.0, suggesting the overall effect remains non-significant. The Egger's regression plot shows the relationship between the standard error and the log odds ratio, with the red dashed line representing the regression line (Fig. 7B). The regression results indicate no significant evidence of publication bias (P>0.05).

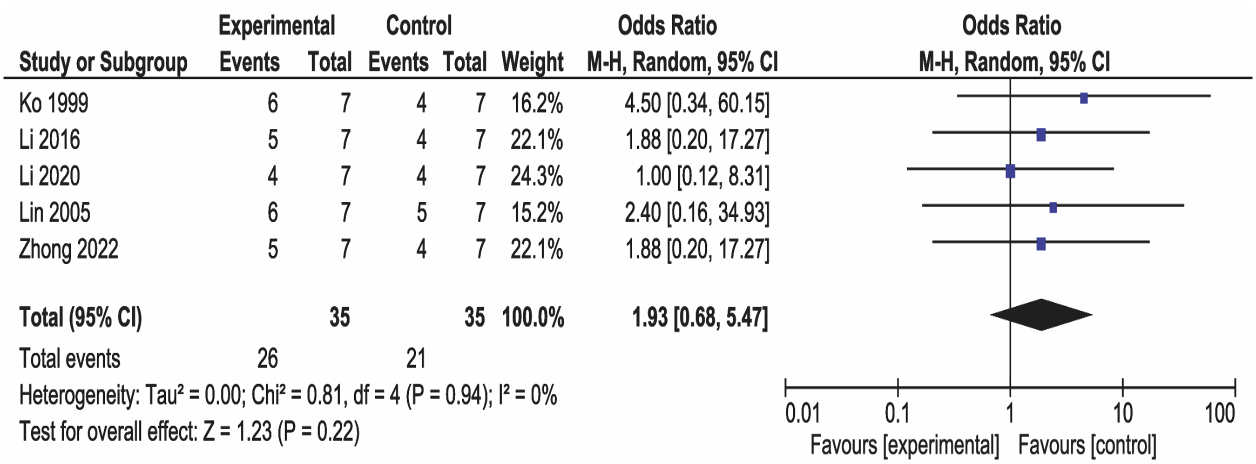

Fig. 6: Forest plot analysis for the subgroup based on the plasma glucose (fasting) of gestational diabetes patients with nursing care (experimental) and without nursing care (control)

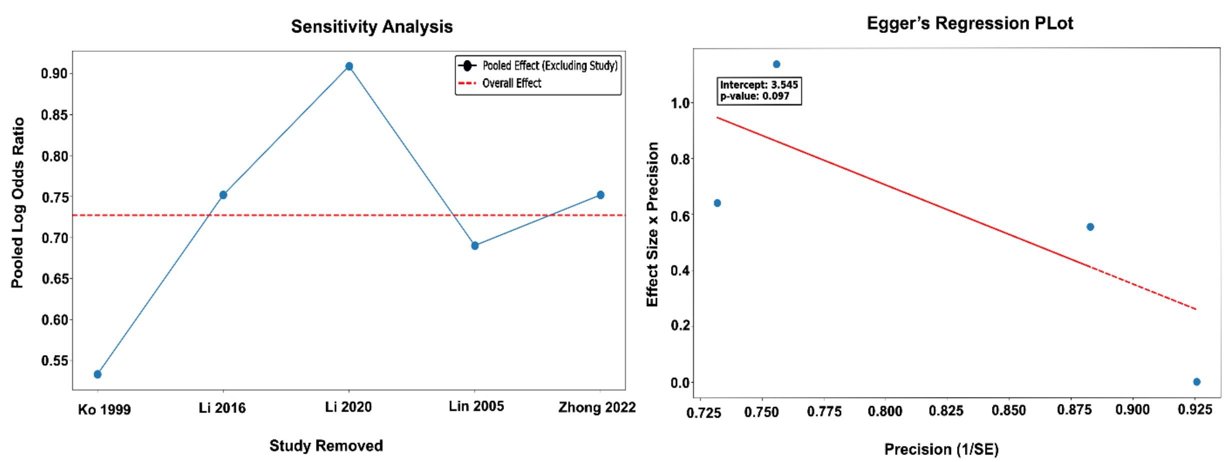

Fig. 7: (A) Sensitivity Analysis Plot and (B) Egger's Regression Plot for the subgroup based on the plasma glucose (fasting)

HbA1c Analysis

The forest plot in Fig. 8 suggests a potential trend of increased risk in patients with higher HbA1c levels; however, due to the wide confidence intervals and lack of statistical significance, the evidence remains inconclusive. The diagnostic odds ratio for sub-group HbA1c indicated an overall effect size of 2.33 [M-H, Random, 95% CI=0.52-10.53), *P*=0.27 and Z=1.10 (Fig. 5). The study found a potential association between higher HbA1c levels and adverse outcomes, though it lacked statistical significance. This aligns with previous research suggesting suboptimal glycemic control may increase complications in diabetic patients. The lack of significance suggests more robust studies are needed to validate this association. The analysis showed no heterogeneity, strengthening the pooled estimate's reliability.

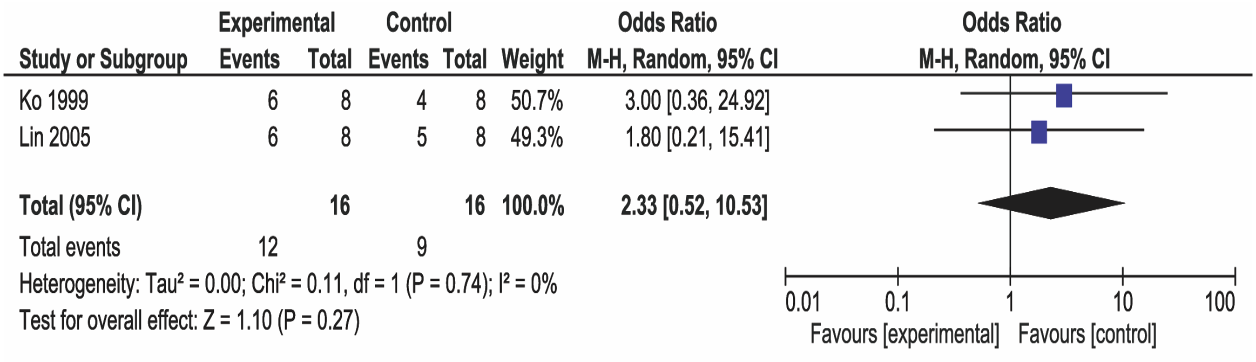

Fig. 8: Forest plot analysis for the subgroup based on the HbA1c level of the gestational diabetes patients with nursing care (experimental) and without nursing care (control)

Risk of bias

Figures 9ABC exhibit the funnel plot outcomes for the analysis of BMI, fasting plasma glucose, and HbA1c levels, respectively. The funnel plots indicated significant heterogeneity and suggested the presence of publication bias. The evaluation of bias risk and funnel plots was performed separately. Furthermore, the asymmetry in the funnel plot may indicate reporting bias due to differences in outcome directions. Heterogeneity across studies may result from differences in research design, population demographics, and intervention methods. Reporting bias could persist despite efforts to reduce publication bias. Assessments using the Cochrane risk of bias tool and funnel plot inspection highlight the rigor of these evaluations. The QUADAS-2 tool emphasizes patient selection, index flow, and time as key aspects of the study methodology (Fig. 10). Notable potential biases in reporting were related to the selection of procedures in the included studies. These conclusions highlight the need for caution in interpreting the findings and addressing potential biases in future research to improve the meta-analysis's confidence.

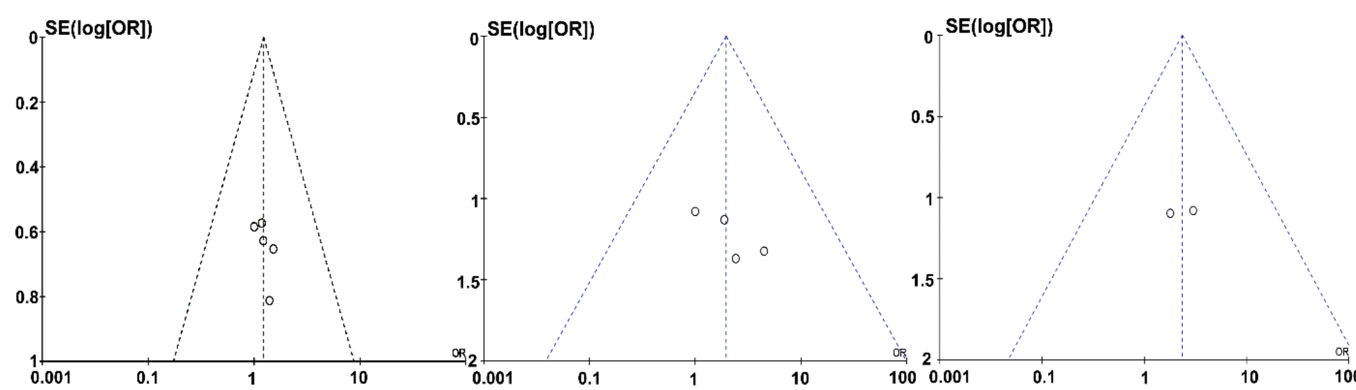

Fig. 9: Funnel plot analysis of the sub-groups (A) BMI (B) fasting plasma glucose and (C) HbA1c

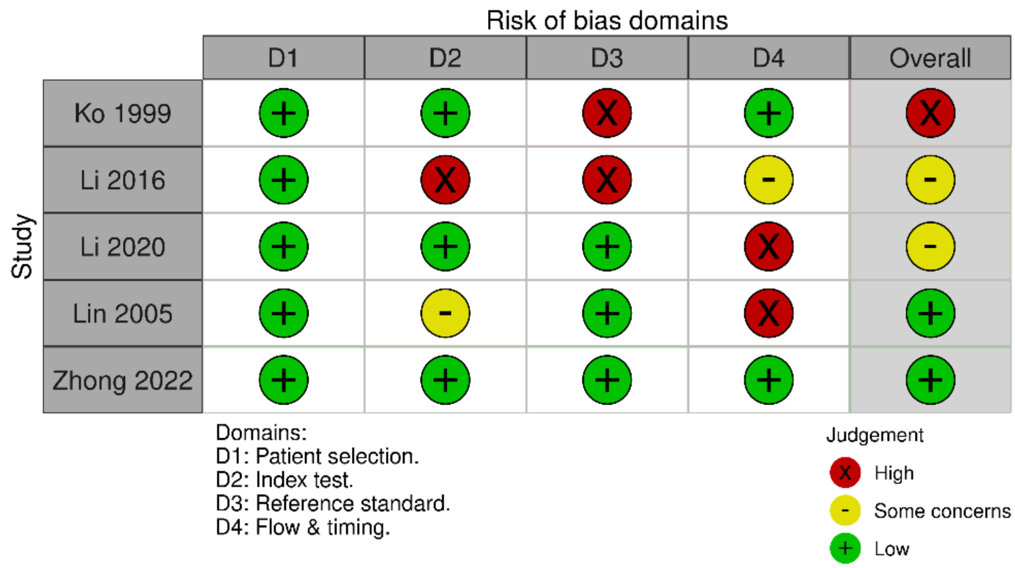

Fig. 10: QUADAS-2 traffic plot of the included studies

Discussion

This meta-analysis is primarily focus on determining the relationship between nursing care in the obstetric, and the breastfeeding practices in Chinese mothers with GDM. GDM is considered to be diabetes first developed during pregnancy without any history of diabetes, as a result, the woman has elevated blood glucose. If untreated, GDM puts the mother and the infant at risk of developing a number of health conditions such as preeclampsia, macrosomia, and neonatal hypoglycemia (1). Mothers with GDM have a greater chance of adverse outcomes in case they suffer from pre-GDM which has been described as having impaired glucose tolerance before pregnancy (14). This study suggests that women with GDM may benefit from individualized nursing care and additional support during and after pregnancy. Although the pooled analysis indicated a trend favoring nursing care interventions (OR=0.27), the result did not achieve statistical significance (*P*=0.14). This outcome is likely due to two factors viz. variability in interventions across studies, including differences in duration, intensity, and delivery of nursing care, and small sample sizes, which reduced statistical power and widened confidence intervals. These factors likely contributed to the lack of significance in the primary analysis, despite favorable trends in some subgroups. The variability among studies likely diluted the overall pooled effect. The extremely high heterogeneity (I^2=99%) limits the validity of the pooled estimate, which can be attributed to several factors.

First, nursing care interventions varied widely across studies, from structured education to general antenatal support without standardized protocols. Second, cultural and healthcare system differences may have influenced outcomes. Third, inconsistent definitions of outcomes, like breastfeeding duration and initiation, limit the generalizability and precision of the pooled effect.

Sensitivity analysis identified influential studies, and further subgroup analysis or meta-regression could explore these differences in future research. This variability may stem from differences in study designs, sample populations, or intervention protocols, as previously reported in meta-analyses exploring similar nursing care interventions (15). Although the pooled analysis showed no statistically significant results, individual studies in this meta-analysis reported positive outcomes from nursing interventions. These findings align with previous research highlighting the benefits of organized nursing care in promoting and extending breastfeeding, especially among vulnerable groups like GDM women (16). More women with GDM would receive the needed for nursed care such as glucose control education, advice on breastfeeding, and psychological support (17). Also, the subgroup analyses showed the potential moderating effect of maternal BMI, FBG and HbA1c on the efficacy of nursing care (18). Obese mothers often face delayed lactation and reduced milk production, which can be addressed with individualized nursing care (19, 20).

Nursing care in GDM mothers systematic reviews and meta-analyses, as this, encounter problems attributable to the heterogeneity of the studies in terms of quality and reporting standards (21, 22). In terms of robustness, sensitivity analysis revealed that the pooled estimate was strongly influenced by two large studies (11, 13). Their removal resulted in noticeable shifts in the effect size, underscoring their weight in the meta-analysis. Meanwhile, studies such as (9, 10, 12) had comparatively minimal influence, suggesting some degree of consistency. Although Egger's test was non-significant, funnel plot asymmetry warrants caution regarding the presence of publication bias. The asymmetry in the funnel plot may suggest reporting bias due to differences in outcome directions. While efforts were made to reduce publication bias, reporting bias may still persist, as selective reporting can distort findings. These factors should be taken into account when interpreting the results, and future research should aim to minimize such biases to improve the reliability of the meta-analysis findings.

The BMI analysis explored nursing care's impact on breastfeeding behaviors, showing that mothers with a normal BMI had better breastfeeding outcomes with standard care. Overweight and obese mothers faced challenges like delayed lactogenesis and reduced milk production, highlighting the need for targeted care based on maternal weight status (23). This analysis shows that mothers with normal BMI had higher breastfeeding success with standard care, while overweight and obese mothers exhibited varied responses (24).

The study findings highlight the need for BMI-based nursing approaches, where normal BMI mothers may require general breastfeeding support, while those with higher BMI need tailored physical, metabolic, and psychological care. Multidisciplinary teams, including lactation consultants, dietitians, and mental health professionals, can enhance intervention effectiveness (25).

The FPG analysis in this study highlights the need for stratified FPG, as nursing care responses in mothers with elevated FPG levels varied (26). Martis et al (27) found individualized nursing care improves glycemic control and maternal outcomes in GDM women, whereas Sweeting et al (28) found no significant effects of generalized nursing measures. The FPG subgroup analysis suggests nursing care may be more effective for mothers with elevated FPG. While some studies showed benefits, others showed limited impact, supporting individualized approaches, as indicated by HbA1c levels and Lemaitre et al.'s findings linking high HbA1c to preeclampsia and fetal growth restriction (29). Existing literature supports HbA1c's clinical relevance in predicting adverse pregnancy outcomes like preeclampsia and fetal growth restriction. Our findings align with this evidence and suggest including HbA1c as a stratification factor in nursing interventions. However, Mañé et al highlight that HbA1c alone may be insufficient without considering other metabolic factors, and controlling these variables could improve understanding of optimal HbA1c levels and associated complications (30).

The subgroup findings in this meta-analysis highlight the clinical importance of tailoring nursing care interventions to maternal metabolic profiles, especially for mothers with high BMI, elevated fasting plasma glucose (FPG), or high HbA1c levels. Women with higher BMI or poor glycemic control are more prone to delayed lactogenesis, reduced milk production, and adverse neonatal outcomes (31, 32). These results emphasize the need for individualized nursing interventions, such as early lactation support, dietary counselling, and glucose management, which may be particularly beneficial for this high-risk group. Multidisciplinary approaches that include lactation consultants, endocrinologists, dietitians, and mental health professionals have shown promise in improving both maternal and neonatal outcomes in women with GDM (33, 34).

Generalized nursing care suits mothers with normal BMI and stable metabolism, while targeted support is needed for obese or hyperglycemic mothers, with personalized protocols based on BMI and glycemic levels (35). When comparing our results with similar meta-analyses in Western or multiethnic populations, consistent patterns emerge. Studies in North American and European cohorts have shown that structured, midwifery-led, or nurse-delivered interventions significantly improve breastfeeding outcomes and maternal satisfaction, particularly in overweight or diabetic mothers (36). Tailored nursing care improved glycemic control and breastfeeding rates among GDM patients in Canada (37). Similarly, a study from the USA demonstrated that culturally sensitive, individualized care led to better outcomes in ethnically diverse populations with GDM (38). Western meta-analyses show lower heterogeneity due to standardized protocols, while our study's high variability calls for multicenter, culturally adapted nursing protocols and individual participant data in future research in China.

Limitations

This study has several limitations: the small sample of five articles reduces statistical power and increases the risk of individual studies over-representing the results. All studies were conducted in China, limiting generalizability due to cultural and healthcare differences. Intervention variability and the lack of standardized nursing protocols further complicate interpretation. Future research should focus on multicenter studies across diverse regions, use standardized nursing protocols, include larger sample sizes, and harmonize outcome measures to improve comparability and robustness.

Conclusion

This study underscores the complexity and potential value of nursing care in improving breastfeeding practices among gestational diabetic women in China. While overall findings are inconsistent, subgroup analyses suggest a positive effect of nursing care, especially for women with normal BMI and well-controlled fasting plasma glucose levels. These results highlight the need for personalized nursing strategies based on metabolic profiles. However, the small number of studies and their focus on Chinese populations limit generalizability. Larger, multicenter studies across diverse regions are needed to strengthen these findings and clarify the roles of HbA1c and fasting glucose as clinical moderators.

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Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests

Availability of data and materials

Data are however available from the authors upon reasonable request and with permission of the corresponding author.

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