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Obstetric care provider's knowledge about the use of low dose aspirin for preeclampsia prevention in low and middle income countries: a systematic review and meta-analysis

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Abstract

Introduction : Preeclampsia can elevate the likelihood of unfavorable consequences for a mother, such as severe morbidity and mortality. World Health Organization recommends low dose acetylsalicylic acid (aspirin, 75 mg per day) for the prevention of preeclampsia in women at moderate or high risk of developing the condition. The use of low dose aspirin is dependent on the knowledge of health care providers working in the antenatal care units. We found inconsistent figures regarding the knowledge level of health care providers on low dose aspirin for preeclampsia prevention around different low and middle income countries in the world. Thus, determining the pooled knowledge level of health care providers is very important.

Methods This systematic review and meta-analysis (SRMA) was conducted on the knowledge level of among obstetric care providers towards preeclampsia prevention in low and middle income countries. We identified relevant literature in the English language only. A comprehensive search was conducted on databases such as PubMed, Google Scholar, HINARI, and Scopus. Subsequently, all datasets were exported to Mendeley reference manager and transferred to a Microsoft Excel spreadsheet to eliminate duplicate data during the review process. The extracted Microsoft Excel spreadsheet format data was imported to STATA software version 17 (STATA corporation, Texas, USA) for analysis. Then random effect model was used to estimate the pooled level of knowledge of health care providers on low dose aspirin for preeclampsia prevention in low income countries. Cochran Q-test and I^2 statistics were computed to assess heterogeneity among all the studies included in this SRMA.

Result A total of 1231 articles were identified through our search strategies, including Google Scholar, PubMed, Hinari and Scopus. Ultimately, six articles met the eligibility criteria for inclusion in the final SRMA. The pooled knowledge level of healthcare providers regarding the use of low-dose aspirin for preeclampsia prevention in low-

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income countries was found to be 16.38% (95% CI: 4.36–28.40). The Cochrane heterogeneity index, with a substantial I^2 value of 98.89% and a significant P-value of 0.01, indicated significant heterogeneity among the primary studies included.

Conclusion the knowledge level of obstetric care providers in low and middle income countries is found very low and all the governmental and non-governmental organizations should strive to enhance the knowledge of obstetric care providers on the use of low dose aspirin for preeclampsia prevention in low and middle income countries.

Keywords Aspirin, Preeclampsia prevention, Low and middle income countries

Introduction

Preeclampsia can elevate the likelihood of unfavorable consequences for a mother, such as early abruption of placenta, renal dysfunction, hepatic failure, cerebrovascular accident, HELLP syndrome, and the need for intensive care unit admission. Additionally, it can present risks for the infant, which may include fetal or neonatal mortality and the need for admission to the neonatal intensive care unit. Furthermore, preeclampsia may lead to an increased reliance on additional medical interventions and hospitalization [1]. The onset of preeclampsia is associated with compromised placental development in the early stages of pregnancy, a condition attributed to increased levels of circulating anti-angiogenic factors like soluble fms-like tyrosine kinase [2]. Moreover, there is impaired immunological tolerance between maternal, paternal (placental), and fetal tissues, coupled with maternal maladjustment to the cardiovascular or inflammatory alterations typically observed during a typical pregnancy [3].

The suggested mechanism of action for aspirin in preventing preeclampsia involves: inhibiting platelet aggregation and exerting its antithrombotic effect. This, in turn, results in a reduced level of placental infarction [4]. Additionally, it enhances healthy placental development and growth, while also exhibiting anti-inflammatory effects and promoting endothelial stabilization [2]. A recent meta-analysis involving data from 45 randomized trials revealed noteworthy decreases in severe preeclampsia. The relative risk was found to be 0.47 when low-dose aspirin was initiated prior to the 16th week of pregnancy [5]. Administering low-dose aspirin to women with a high risk of preterm preeclampsia led to a reduced occurrence of this condition compared to a placebo [6].

The United States Preventive Services Task Force (USPSTF) recommends the use of low-dose acetylsalicylic acid (aspirin 81 mg) in a daily basis as preventive medication after 12 weeks of gestation in women who are at high risk for preeclampsia [7]. World Health Organization (WHO) recommends low dose acetylsalicylic acid (aspirin, 75 mg per day) for the prevention of preeclampsia in women at moderate or high risk of developing the condition [1]. American college of Obstetricians and Gynecologists recommends low dose aspirin (81 mg) on a daily basis

and optimally initiated at 16 weeks of gestation in women with more than one moderate risk factors (first pregnancy, maternal age greater than 40, body mass index of greater than 35, family history of preeclampsia and multiple pregnancy) and women with one or more high risk factors (hypertension in the previous pregnancy, chronic kidney disease, type 1 or 2 diabetes and chronic hypertension) [8].

In 2020, the global maternal mortality ratio stood at 223 per 100,000 live births, with a significantly higher ratio of 545 per 100,000 in Sub-Saharan Africa compared to a much lower ratio of 4 per 100,000 in Australia and New Zealand. Preeclampsia ranks as the second most common cause of maternal mortality, accounting for 14% of total maternal deaths. The lifetime risk of maternal death in low income countries as a whole was 1 per 49, women in sub Saharan Africa faces the highest lifetime risk (1 in 41) compared to 1 in 11,000 in Western Europe [9].

Preeclampsia carries numerous potential consequences, impacting almost every organ system, thereby posing a substantial risk for morbidity and mortality in both the mother and the fetus. Adverse effects associated with preeclampsia encompass conditions like acute renal failure, liver failure, or stroke in affected women. When untreated, the condition may advance to eclampsia, marked by the occurrence of tonic-clonic seizures, and at the very least, it can necessitate admission to intensive care [10].

Beyond the risk of maternal mortality, numerous women face life-threatening complications. Notably, the incidence of severe maternal morbidity is more pronounced in low and middle-income countries compared to high-income ones. Hemorrhage and hypertensive disorders stand out as the primary contributors to severe maternal morbidity across all regions, particularly in sub-Saharan Africa [11]. Preeclampsia is associated with higher rate of mortality even in developed countries like United Kingdom with a case fatality rate of 2.26% from preeclampsia and 4.1% from eclampsia [12].

Out of the individuals diagnosed with a hypertensive disorder during pregnancy, 37% experienced preeclampsia, eclampsia, or HELLP syndrome. Among these cases, 36.8% met the criteria for receiving low-dose

aspirin before childbirth, yet only 4.8% actually received the aspirin treatment [13]. A cross-sectional study conducted in SSA revealed that only 1.1% of women in the high-risk group received low-dose aspirin, indicating that 98.9% missed the opportunity for this intervention [14]. Approximately 37% of obstetric care providers exhibited insufficient involvement in discussing aspirin prophylaxis with pregnant women, and their level of knowledge emerged as a notable determining factor in this regard [15]. Of the 269 women with two or more moderate risk factors, aspirin was recommended only for 13 of them [16]. The use of low dose aspirin is dependent on the knowledge of health care providers working in the antenatal care units. We found inconsistent figures regarding the knowledge level of health care providers on low dose aspirin for preeclampsia prevention around different low and middle income countries in the world. Thus, determining the pooled knowledge level of health care providers is very important. The objective of this SRMA was to determine the pooled knowledge level of obstetric care providers on preeclampsia prevention by low dose aspirin in low and middle income countries.

Objective

To determine the pooled knowledge level of obstetric care providers on preeclampsia prevention by low dose aspirin in low and middle income countries.

Methods

Study design and setting

This systematic review and meta-analysis (SRMA) was conducted on the knowledge level of among obstetric care providers towards preeclampsia prevention in LMICs. Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines were followed.

PRISMA is a checklist that guide the conduct and reporting of SRMA (Supplementary file 1), which increase the transparency and accuracy of reviews in medicine and other fields. This SRMA was conducted in the context of low- and middle-income countries (LMICs), encompassing regions across Africa, Asia, Latin America, and parts of Eastern Europe. LMICs exhibit diverse socio-economic, cultural, and geographical characteristics, making them a crucial focus for research across various disciplines, including public health, economics, and social sciences. Understanding the unique contexts of these countries is essential for designing interventions, policies, and strategies that address the specific challenges they face. LMICs span a wide range of geographical landscapes, from arid deserts to lush tropical rainforests, high mountain ranges to coastal plains. This diversity not only influences climate patterns but also has significant implications for health considerations. The study setting acknowledges the heterogeneity

of LMICs, recognizing the need for context-specific approaches.

Search strategy

A SRMA were conducted on knowledge of obstetric care providers about low dose aspirin for preeclampsia prevention in low and middle income countries. Both published and unpublished literatures conducted on knowledge of health care providers about low dose aspirin for preeclampsia prevention in low income countries were searched via two authors (ESL and GY). Eligible literatures in English language only were identified. Any disagreement between reviewers was resolved by the third author (MA). Consensus was declared through critical discussion and evaluation of the articles by all the independent reviewers. A comprehensive search was conducted on databases such as PubMed, Google Scholar, HINARI, and Scopus. Furthermore, relevant articles found from grey literatures available on local shelves and institutional repositories were reviewed systematically. Search terms were formulated using PICO guidelines through online databases. Medical Subject Headings (MeSH) and key terms had been developed using different Boolean operators 'AND' and 'OR'. The following search terms were used: "Level" OR "Magnitude" OR "Proportion" AND "Knowledge" AND "low dose aspirin" OR "preeclampsia prevention" AND "low and middle income countries". Subsequently, all datasets were exported to Mendeley reference manager and transferred to a Microsoft Excel spreadsheet to eliminate duplicate data during the review process. Both published articles and grey literatures in English language from February 2014 to 1st February 2024.

Eligibility criteria

Inclusion

This SRMA included all articles conducted in all low and middle income countries in the world reporting the level of knowledge of health care providers on low dose aspirin use for preeclampsia prevention. All observational study designs (case-control and cross-sectional study designs) were included in this SRMA.

Exclusion

Articles which lack our outcome of interest: knowledge of health care providers on low dose aspirin use for preeclampsia prevention were excluded from this SRMA. On the other hand, literatures with poor quality as per the criteria of reviewing articles were excluded from this SRMA.

Outcome measurement

The outcome of interest of this study is the level of knowledge of obstetric care providers about the use of low dose

aspirin for prevention of preeclampsia. A knowledge score was calculated based on participants' feedback in the questionnaire. Afterwards, the knowledge level was categorized into adequate and inadequate by using the mean population's score as the cutoff.

Data extraction

All the datasets were exported to Mendeley reference manager, and then we transferred to the Microsoft Excel spreadsheet to remove duplicate data in the review. Two authors (ESL and GY) independently extracted all the important data using standardized data extraction format that developed according to 2014 Joanna Briggs Institute (JBI) Reviewers' manual [17]. Any disagreement between reviewers was resolved by the third author (MA). Consensus was declared through critical discussion and evaluation of the articles by all the independent reviewers. The name of the author, sample size, publication year, studied country, studied continent, study design, level of knowledge of health care providers on low dose aspirin use were extracted. Articles which fulfilled the predetermined criteria were used as a source of data for the final analysis.

Quality assessment

After exporting the database results to the Mendeley reference manager and eliminating any duplicate entries, we used the Newcastle–Ottawa quality assessment scale, tailored for cross-sectional studies. This approach was utilized to evaluate the quality of each study incorporated in the SRMA (Supplementary file 2). This quality assessment scale evaluates the literatures in three categories:

- A. Selection (5 points).
- B. Comparability (2 points) and
- C. Outcome (3 points).

Two authors (ESL and GY) assessed the quality of each study (i.e. methodological quality, sample selection, sample size, comparability and the outcome, and statistical analysis of the study). In the case of disagreement between two authors; another third author (MA) was involved and discussed and resolved the disagreement.

Data processing and analysis

The extracted Microsoft Excel spreadsheet format data was imported to STATA software version 17 (STATA corporation, Texas, USA) for analysis. Then random effect model was used to estimate the pooled level of knowledge of health care providers on low dose aspirin for preeclampsia prevention in low and middle income countries. Cochrane Q-test and I^2 statistics were computed to assess heterogeneity among all the studies included in this SRMA. Accordingly, if the result of I^2 is

0–40% it is mild heterogeneity, 40 to 70% would be moderate heterogeneity, and 70 to 100% would be considerable heterogeneity [18]. Funnel plot and Egger's test were done to assess publication bias. The p -value > 0.05 indicated that there was no publication bias. Subgroup analysis was done based on the continent where the study has been carried out. A forest plot format was used to present the pooled level of knowledge of obstetric care providers with 95% CI.

Subgroup and sensitivity analyses

Subgroup analyses were performed according to sample size once the mean is determined. To identify determinant factors, we used the pooled AOR in forest plot format with its respective 95% CI.

Result

Characteristics of the included studies

A total of 1231 articles were identified through our search strategies, including Google Scholar, PubMed, Hinari and Scopus. After removing 859 duplicate articles, 372 remained. Subsequent screening of titles and abstracts led to the exclusion of 280 and 62 articles, respectively. Thirty full-text papers were assessed against predefined inclusion criteria, resulting in the exclusion of 24 articles due to a lack of relevance to the outcome of interest. Ultimately, six articles met the eligibility criteria for inclusion in the final SRMA (Fig. 1). The studies included in this SRMA spanned diverse geographical locations, with one each from Ethiopia, DR Congo, Uganda, Nigeria, Bangladesh, and Saudi Arabia. All six studies utilized a cross-sectional study design. A total of 1253 participants with the smallest 92 to the largest 379 participants included and found the knowledge level ranges from 1.7 [19] to 42.5% [20] about preeclampsia prevention in low and middle income countries. On the other hand, the quality of each study was assessed by using Newcastle Ottawa Quality Assessment scale, the score of all included studies lies between 8 and 9 which indicates good quality (Table 1).

Knowledge level of health care providers on low dose aspirin for preeclampsia prevention

The pooled knowledge level of healthcare providers regarding the use of low-dose aspirin for preeclampsia prevention in low-income countries was found to be 16.38% (95% CI: 4.36–28.40). The Cochrane heterogeneity index, with a substantial I^2 value of 98.89% and a significant P -value of 0.01, indicated significant heterogeneity among the primary studies included. To address this heterogeneity, we chose to employ a random-effect model. Additionally, we are considering the use of subgroup analysis as a potential approach to address the

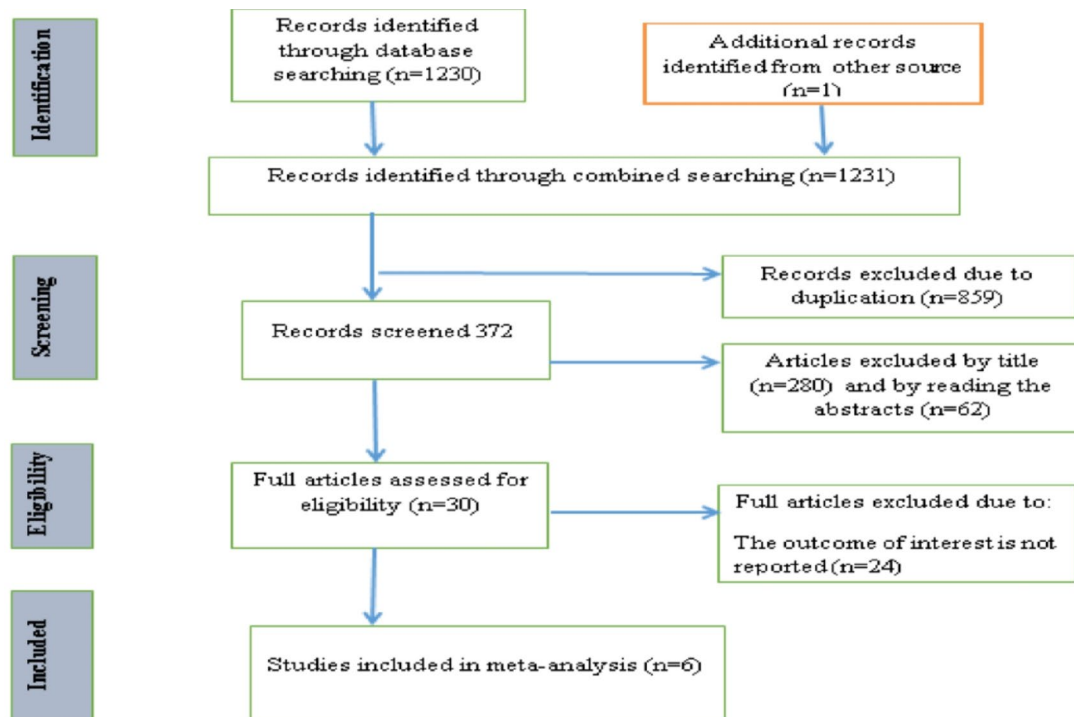


Fig. 1 PRISMA flow chart for the selection of systematic review of knowledge level of obstetric care providers on preeclampsia prevention in LMICs

Table 1 Characteristics of included studies included in the SRMA of knowledge on low dose aspirin for preeclampsia prevention in low and middle income countries: 2024

Seri no	Author	Year of publication	Country	Study design	Sample size	Knowledge level (%)	Quality
1	Delayehu B et al[23]	2024	Ethiopia	Cross sectional	92	23.8	Good
2	Dalau M et al[24]	2020	DR.Congo	Cross sectional	197	14.2	Good
3	Prisca A et al[25]	2023	Uganda	Cross sectional	136	15.4	Good
4	Salisu M et al[26]	2017	Nigeria	Cross sectional	379	2.9	Good
5	Sultana Kanij and Amy Dempsey[19]	2017	Bangladesh	Cross sectional	289	1.7	Good
6	Assem A et al[20]	2024	Saudi Arabia	Cross sectional	160	42.5	Good

observed heterogeneity. The finding was presented using a forest plot (Fig. 2).

Subgroup analysis of knowledge level of obstetric care providers in LMICs

Subgroup analysis was done based on the continent of the study conducted. The finding of this subgroup analysis by study continent showed that the pooled knowledge level of obstetric care providers was lower in Africa (13.34%; 95% CI (4.92–21.77%), $I^2=92.10\%$, $p=0.00$). However, the pooled knowledge level of obstetric care providers in outside Africa was (21.92%; 95% (CI: -18.06-61.90%), $I^2=99.05\%$, $P=0.00$ (Fig. 3).

Publication bias

The presence or absence of publication bias was verified by using statistical analysis (funnel plot and egger's test ($P=0.87$ ($P>0.05$)) result showed no small study effect (Fig. 4). Nevertheless, the egger's test used to show the

publication bias might be affected by the significant heterogeneity between the included studies and the small number of studies.

Sensitivity analysis

The result of a random effect model revealed that, the pooled knowledge level of obstetric care providers on low dose aspirin for preeclampsia prevention was not influenced by a single study (Fig. 5).

Discussion

The pooled knowledge level of obstetric care providers in LMIC is found to be 16.38% with a 95% CI (4.36, 28.4). This is much lower than the knowledge level of obstetric care providers in Rio Grande Valley of Texas [21], which is more than 90%. The potential reason for this variation could be attributed to the fact that, in contrast to the present study, our SRMA focused on low and middle-income countries. Additionally, the data collection

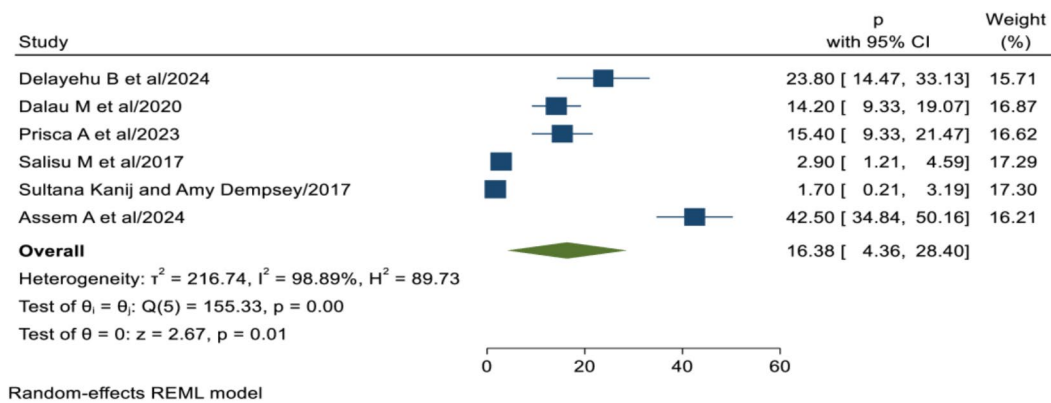


Fig. 2 Forest plot showing the pooled knowledge level of obstetric care providers on preeclampsia prevention in LMICs

specifically targeted obstetrician-gynecologists and specialists in Maternal and Fetal Medicine.

The result of this SRMA is also much lower than a study conducted in United States [22], which revealed 85% of obstetric care providers were familiar with low dose aspirin for preeclampsia prevention. This difference might be due to the study area and groups studied are different. Unlike our SRMA this cross sectional study conducted in United States was among Obstetricians and Maternal Fetal Medicine specialists. On the other hand obstetric care providers in United States are more likely to have good adherence to aspirin prescription guidelines for preeclampsia prevention.

The knowledge level of obstetric care providers in low and middle income countries is found very low

concerning the use of low-dose aspirin for preeclampsia prevention underscores the critical need for multifaceted interventions. In order to address this issue comprehensively: International organizations like WHO must develop tailored educational programs and also design and implement targeted educational programs specifically tailored to the needs and contexts of health-care providers in low and middle income countries. Evidence-based information has to be incorporated on the efficacy, safety, and guidelines for using low-dose aspirin in preventing preeclampsia. Various educational formats; including workshops, seminars, online modules, and informational materials are better to utilize for diverse learning preferences.

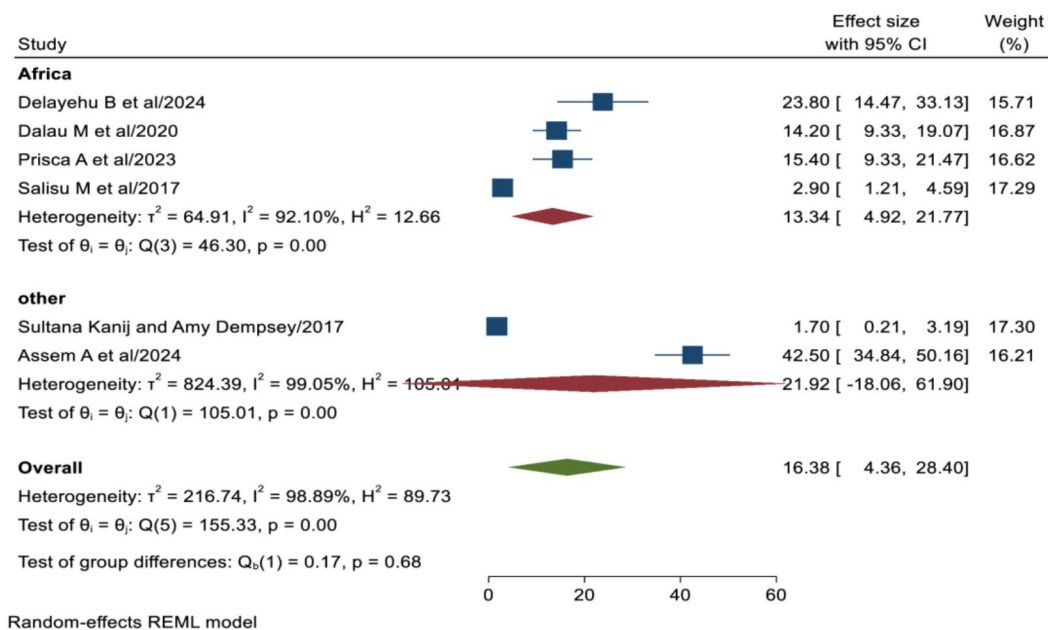


Fig. 3 Forest plot showing sub group analysis of knowledge level of obstetric care providers on preeclampsia prevention in LMICs

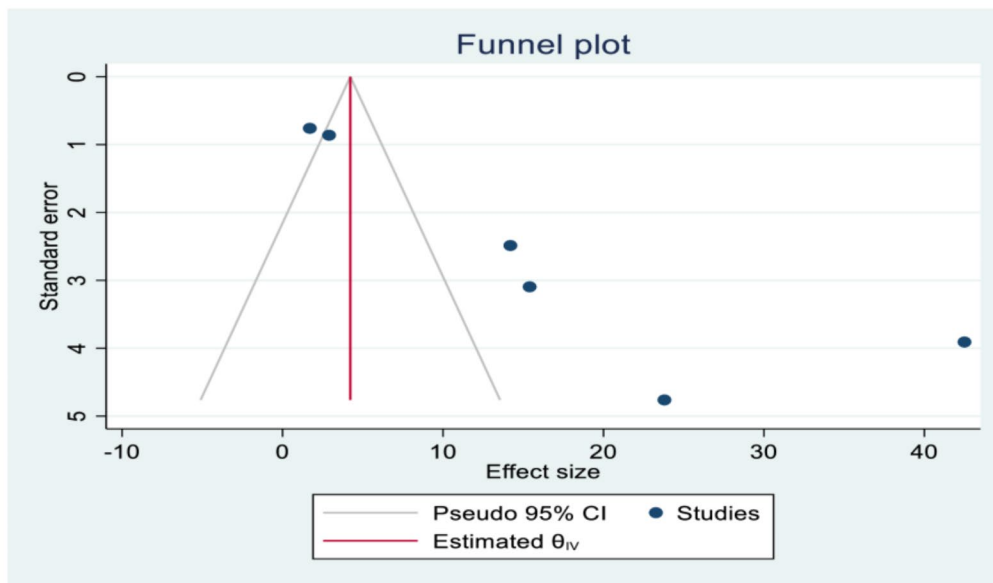


Fig. 4 Funnel plot showing the symmetric distribution of each primary studies of knowledge of obstetric care providers on preeclampsia prevention in LMICs

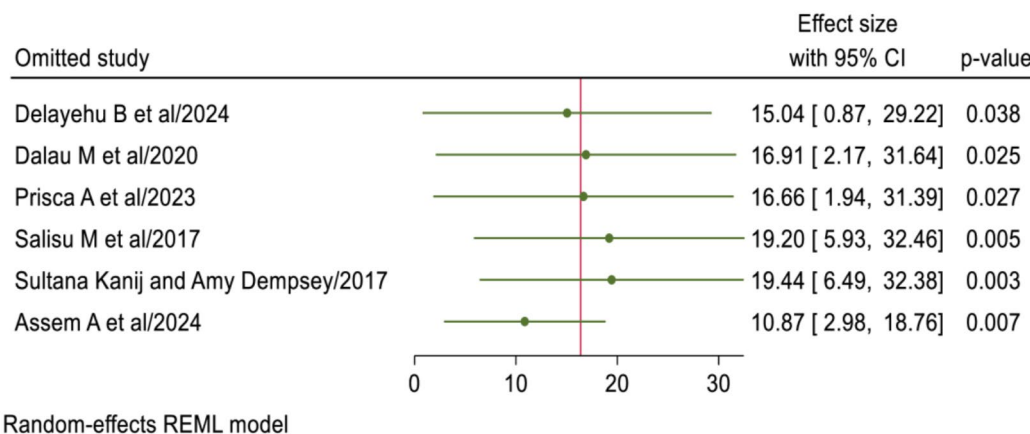


Fig. 5 Sensitivity analysis of knowledge of obstetric care providers on preeclampsia prevention in LMICs

Local and international professional associations involved in maternal and child health must be integrated to leverage existing networks for knowledge dissemination. Encourage these associations to integrate training sessions and informational resources into their conferences and continuous medical education programs. Governmental health agencies and non-governmental organizations should be collaborated and furthermore, policymakers should be involved in endorsing and supporting initiatives aimed at improving obstetric care providers’ knowledge on preeclampsia prevention. Further researcher should be conducted about the factors associated with the knowledge of obstetric care providers on low dose aspirin use for preeclampsia prevention.

By implementing these detailed recommendations, stakeholders can contribute to a sustainable improvement in healthcare providers’ knowledge levels, ultimately leading to better maternal and fetal health outcomes in low-income countries. Further research must be conducted by using qualitative approach and also the possible determining factors must be explored in detail.

Strength and limitation

Since there was no SRMA on the topic previously, our study finding showed the pooled image of health care provider’s knowledge level on low dose aspirin for preeclampsia prevention in low and middle income countries. Strictly following PRISMA guide line and using JBI reviewers’ manual during critical appraisal was additional

strength of this SRMA. The small number of included studies is one of the limitations of this SRMA and presence of high statistical heterogeneity in most of the subgroup analysis was considered as weakness of this review. In addition our search was limited to articles published in English language only.

Abbreviations

ACOG	American College of Obstetricians and Gynecologists
HELLP	Hemolysis, Elevated Liver enzymes, Low Platelet
JBI	Joanna Briggs Institute
LMICs	Lower and Middle Income Countries
PRISMA	Preferred Reporting Items for Systematic Review and Meta-Analysis
SRMA	Systematic Review and Meta-analysis
WHO	World Health Organization

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12884-024-06803-6>.

Supplementary Material 1 : PRISMA checklist of obstetric care provider's level of knowledge on low dose aspirin for preeclampsia prevention.

Supplementary Material 2 : Newcastle-Ottawa Quality Assessment Scale for cross sectional studies used in the SRMA.

Author contributions

ESL conceived the idea and participated in data extraction, analysis, and draft writing. MA, BBE, ASB, BDT, and GY participated in the data extraction, analysis, preparation of the manuscript, and revision. All authors read and approved the final version of the manuscript to be considered for publication.

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Data availability

The result of this SRMA was extracted from the data gathered and analyzed based on the stated methods and materials. All the relevant data are within the paper.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Institutional review board statement

Not applicable. This systematic review and meta-analysis used and analyzed information obtained from pre-existing studies.

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