

Awareness and Associated Factors of Pregnancy-Induced Hypertension among Pregnant Women in Africa: A Systematic Review and Meta-Analysis

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ABSTRACT

Introduction: Pregnancy-Induced hypertension (PIH) remains a major contributor to maternal and fetal illness and death. Enhancing knowledge and implementing preventive measures for PIH among pregnant women is crucial for achieving positive health outcomes. This study explored the level of knowledge and the associated factors among pregnant women in Africa.

Methods: A comprehensive literature search was conducted on Jun, 2025, using international electronic databases including PubMed, Google Scholar, Hinari, Medline and Open Google to assess the pooled awareness of pregnancy-induced hypertension and its associated factors among pregnant women. Two authors independently screened and extracted relevant data from the eligible studies. The collected data were compiled in Excel and subsequently analyzed using STATA version 11. Heterogeneity among the studies was assessed using the I^2 statistic, while potential small study effects were evaluated through graphical methods and Egger's test, with a significance threshold set at 5%. Subgroup and sensitivity analyses were also performed.

Result: A total of eight studies met the inclusion criteria and were incorporated into the systematic review and meta-analysis. The meta-analysis revealed significant associations between PIH knowledge and several factors: educational status (AOR = 4.88, 95% CI: 1.73–13.79), history of previous births (OR = 2.04, 95% CI: 1.30–3.19) and employment status (OR = 2.85, 95% CI: 1.26–6.44). However, due to the limited number of studies addressing each specific variable, the evidence was insufficient to establish conclusive links between PIH knowledge and other factors such as primi gravida status, socioeconomic status, maternal age, sources of information, marital status, maternal nutrition, antenatal care attendance, place of residence and other related variables.

Conclusion: Awareness of PIH is typically lower among women with a personal or family history of the condition, first-time mothers (primiparous women) and those with limited educational attainment, compared to their respective counterparts. To address this gap, increased investment in women's health is essential, with healthcare providers giving particular attention to those at higher risk due to limited PIH knowledge. Moreover, targeted interventions should aim to improve educational opportunities for women and raise awareness about the risk factors associated with PIH.

Keywords: Pregnancy-induced hypertension, Awareness, Pregnant women, Africa

1. Introduction

Pregnancy-induced hypertension is a pregnancy-specific condition characterized by high blood pressure, with or without proteinuria. It typically manifests around the 20th week of gestation or later in pregnancy and resolves after childbirth¹. Maternal mortality and morbidity have been recognized as major global health concerns. Estimates indicate that in 2020, approximately 287,000 women died from maternal causes, equating to around 800 maternal deaths per day². Chronic hypertension, gestational hypertension, preeclampsia/eclampsia and preeclampsia superimposed on chronic hypertension are the main categories of PIH³. Among direct obstetric factors, hypertensive disorders are the most prevalent and the leading contributors to maternal and perinatal morbidity and mortality worldwide⁴. Pregnancy-induced hypertension (PIH) is responsible for about 14% of maternal deaths globally, while 10-15% of maternal fatalities occur in low- to middle-income countries⁵. The global prevalence of pregnancy-induced hypertension revealed that 116.4 per 100,000, with Africa reporting the highest average prevalence at 334.9 per 100,000 women of reproductive age⁵.

According to a systematic analysis by the World Health Organization, it is estimated that these disorders lead to approximately 3,800 maternal deaths annually in Latin America, 22,000 in Asia, 25,000 in Africa and 150 in industrialized nations^{6,7}. Hypertensive disorders during pregnancy contribute to 14% of maternal deaths, making them the second leading cause of maternal mortality in sub-Saharan Africa, following hemorrhage, which accounts for 16%⁴. Similarly, in Ethiopia, the prevalence of pregnancy-induced hypertension varies between 2.2% and 18.3%. Hypertensive disorders during pregnancy are among the top five causes of maternal mortality in the country, accounting for 19% of maternal deaths^{8,9}.

The primary risk factors for (PIH) include primi-parity, alcohol consumption and multiple pregnancies. Other contributing factors include age, a history of PIH, family history, pre-existing medical conditions, obesity, poor nutrition, environmental factors and socioeconomic status⁵. PIH presents with symptoms such as persistent headaches, sudden vision disturbances, loss of consciousness, ongoing discomfort in the right upper quadrant or epigastric area, nausea, vomiting, swelling of the hands and face and convulsions¹⁰.

Women who develop hypertensive disorders during pregnancy are at a higher risk of facing challenges such as limited education, inadequate antenatal care, poor health maintenance, poverty and nutritional deficiencies. These conditions are also linked to an increased likelihood of cesarean delivery, premature placental abruption, preterm birth, low birth weight, stillbirth, acute kidney failure and intravascular coagulation¹⁰. Furthermore, a lack of awareness among pregnant women significantly contributes to delays in seeking medical attention and making informed decisions, hindering the early diagnosis and management of severe complications.

Pregnancy-induced hypertension and related HDP remain among the most important contributors to maternal and perinatal morbidity and mortality globally - a burden that is especially heavy in low and middle-income countries. In sub-Saharan Africa, HDP contribute disproportionately to adverse pregnancy outcomes and in Ethiopia hypertensive disorders of pregnancy

have been estimated to account for up to 19% of maternal deaths¹¹. Nationwide estimates suggest that about 6-7% of all pregnancies in Ethiopia are complicated by hypertensive disorders of pregnancy¹². Regional studies show that the prevalence can range widely (from as low as 1.2% to as high as 18-19%), reflecting variation in geographic, socioeconomic and healthservice factors¹³. Despite this heavy burden, there is limited research on what pregnant women know about PIH - for example, their understanding of risk factors, warning signs, complications and the need for early antenatal care. Such "PIH knowledge" is critical: good awareness may lead to earlier careseeking, better monitoring, timely diagnosis and ultimately reduction of adverse maternal and perinatal outcomes.

Moreover, studies reveal that a significant number of teenage deaths in Africa are associated with pregnancy-induced hypertension¹⁴. Therefore, implementing health education and awareness programs for pregnant women can help lower PIH-related mortality and morbidity. These initiatives contribute to achieving Sustainable Development Goals (SDGs) 3.1 and 3.2. Consequently, early detection of normotensive women developing PIH at or beyond 20 weeks of gestation would become more feasible. Several efforts and primary studies have been conducted to determine the Awareness and associated factors of pregnancy-induced hypertension among pregnant women. This meta-analysis was intended to define the pooled Awareness and related factors of pregnancy-induced hypertension among pregnant women in Africa.

2. Methods

2.1. Protocol registration and reporting

The protocol of this systematic review and meta-analysis has been registered in the International Prospective Register of Systematic Reviews and Meta-analysis (PROSPERO) with a registration number CRD420251018756. The review has followed systematic review and meta-analysis guidelines, which are the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)¹⁵. A completed PRISMA 2020 checklist documenting the systematic review process is provided in (Supplementary file 1).

2.2. Search strategy and information sources

"A comprehensive literature search was conducted to identify relevant articles using validated academic databases only, including PubMed, EMBASE, Scopus and the Cochrane Library. The reference lists of included articles were also reviewed to identify additional studies. Gray literature and non-validated sources such as Google Scholar and manual searching were excluded to improve methodological rigor. The search was performed using the following key terms: "Chronic hypertension" OR "gestational hypertension" OR "preeclampsia" OR "eclampsia" OR "superimposed preeclampsia on chronic hypertension" AND "Pregnant" OR "Gestation" OR "Conception" OR "Perinatal" AND "Women" OR "Mother" AND Africa. Boolean operators (AND or) and truncation were applied as appropriate. The search was conducted up to 20th March 2024." The full electronic search strings for all validated databases are provided.

2.3. Eligibility criteria

We used the Coco Pop (Condition, Context and Population) approach for prevalence studies to declare inclusion and exclusion criteria

2.3.1. Inclusion criteria:

- Only cross-sectional studies
- studies conducted in Africa countries
- published between November 2017 and March 2024
- pregnancy-induced hypertension among pregnant women
- Articles published in peer-reviewed journals or grey literature
- Articles published in English.

2.3.2. Exclusion criteria:

- Studies not fully accessible
- Published before November 2017
- governmental and non-governmental reports, letters to the editor, opinion articles
- Research that did not involve women with PIH
- Poor quality as per the stated criteria
- Studies with no report of prevalence

2.4. Study selection

The article selection process was conducted using the updated 2020 PRISMA flow diagram to present in summarized approach. First, all retrieved articles from the search strategies were imported into EndNote X20 to remove duplicate articles. After eliminating the duplicated articles from the EndNote Library, the titles and abstracts of the remaining articles were assessed independently by two authors (GKN and WCT). When disagreements happened between the two reviewers on article inclusion and exclusion, it was resolved through discussion by other participating authors.

2.5. Data extraction

After screening the eligible studies, two authors (GKN and WCT) extracted the relevant data. Any discrepancies between the authors were addressed through discussion and consultation with other invited reviewers. For each included study, the following information was collected and recorded in a Microsoft Excel spreadsheet: authors' names, publication year, study region, study setting, study design, sample size, definitions of pregnancy-induced hypertension, prevalence of PIH and contributing factors.

2.6. Measurement of outcome variables

Hypertension in pregnancy is systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg or both systolic and diastolic blood pressure rises are important in identifying pregnancy-induced hypertension¹². Pregnancy-induced hypertension (PIH) was defined as new-onset hypertension (systolic BP ≥ 140 mmHg and/or diastolic BP ≥ 90 mmHg) after 20 weeks of gestation in the absence of proteinuria, distinguishing it from other hypertensive disorders of pregnancy (HDP) such as preeclampsia, eclampsia and chronic hypertension. The broad classification of pregnancy-induced hypertension during pregnancy is gestational hypertension, pre-eclampsia and eclampsia¹⁶.

2.7. Data processing and analysis

The Awareness and associated factors of pregnancy-induced hypertension (Chronic hypertension, gestational hypertension, preeclampsia/eclampsia, superimposed hypertension) among

pregnant mothers were analyzed using STATA version 11. A random-effect model was applied to estimate the Awareness of PIH, gestational hypertension, preeclampsia/eclampsia and superimposed hypertension. The results were reported through graphical representation using a forest plot with a 95% confidence interval (CI) and Cochran's Q test and I² were used to identify heterogeneity among the included articles. Furthermore, evidence of publication bias was assessed using funnel plot asymmetry and weighted Egger's regression test with a p-value of less than 0.05 as a cutoff point.

Subgroup analyses were performed based on country and sampling technique to account for potential differences in PIH prevalence and study design. Country stratification was justified by known regional variations in PIH prevalence, health infrastructure and cultural practices influencing maternal knowledge. Sampling technique stratification was included because methodological differences may affect representativeness and prevalence estimates. Stratified random-effects meta-analysis was used to estimate pooled effect sizes within subgroups and meta-regression was conducted to formally test interaction effects across subgroups. Statistical significance of subgroup differences was assessed using p-values for interaction terms and heterogeneity within subgroups was quantified using the I² statistic.

Meta-regression analyses were conducted to explore the influence of continuous study-level covariates on effect size variability. This approach provides a more complete understanding of the sources of heterogeneity and strengthens the robustness and interpretability of the meta-analytic findings.

Potential associated factors of PIH knowledge were prespecified based on prior empirical evidence and theoretical rationale. Maternal educational status was classified as no formal education, primary, secondary or tertiary education; employment status as unemployed, informal or formal employment; parity as nulliparous (0), primiparous (1) or multiparous (≥ 2); and ANC attendance as no visits, 1–3 visits or ≥ 4 visits. These categories were determined prior to analysis. Pooled odds ratios were estimated using random-effects meta-analysis.

3. Result

3.1. Study selection and identification

A total of studies was initiated from different electronic databases through different approaches of searching. Of the total studies retrieved from PubMed (203), Scopus (53) and Science Direct (48) EMBASE (2), Cochrane library (1725) and Google Scholar (10).

3.2. Knowledge of pregnancy-induced hypertension among pregnant women in Africa

The women's knowledge on PIH among the studies included in this study was ranged from 11.40% in Nigeria¹⁷ to 84.00% in Ghana¹⁸. Due to the high heterogeneity (I² = 99.3%, P=00) observed in this analysis, the random effect model was considered to estimate the pooled prevalence. Therefore, the pooled estimated knowledgeable women in Africa on Pregnancy-Induced Hypertension was 45.63% (95 % CI: 27.06 - 64.19, I² = 99.3%) in Africa.

Sub-group analysis was done based on sampling techniques. The pooled prevalence of pregnancy-induced hypertension

among pregnant women in studies conducted using convenient sampling techniques was 56.96% (95% CI: 17.23, 96.69; $I^2=99.6\%$, $P<0.000$ which was higher than studies conducted systematic sampling 28.60% (95% CI: 2.73, 54.47; $I^2=99.1\%$, $P<0.000$).

Subgroup analysis was conducted by country. The pooled prevalence of pregnancy-induced hypertension among pregnant women in studies conducted using country in Nigeria was 76.36% (95% CI: 61.27, 91.45; $I^2=94.7\%$, $P<0.000$ which was higher than studies conducted in country of Ghana 13.36% (95% CI: 9.44, 17.28; $I^2=61.9\%$, $P<0.105$).

3.3. Characteristics of included studies

This included 8 studies from different countries in Africa. The sample size for each study ranges from 100 to 798. The prevalence of Pregnancy-Induced Hypertension among pregnant women in each study varied from 11.4%¹⁹ to 84 %¹⁴. All studies were cross-sectional studies, where two study was from Ethiopia^{10,20} and sex studies were from Africa^{14,21}.

3.4. Publication bias

The presence of Publication Bias was assessed graphically and statistically. Egger's test. There is symmetry of the graph and Egger's test did not indicate statistically significant small-study effects ($P=0.140$), suggesting that publication bias is unlikely to substantially affect the pooled estimate ($P\text{-value} = 0.140$).

3.5. Factors associated with PIH among Pregnant women in Africa

This systematic review and meta-analysis report has been structured to address each factor associated with PIH.

The results showed that participants with tertiary education were about four times more likely to have sufficient knowledge of pregnancy-induced hypertension (PIH) than those with only basic education (AOR = 4.88, 95% CI: 1.73–13.79; $p = 0.003$). On the other hand, women with 1 to 4 previous births were significantly more likely to have adequate knowledge of PIH compared to women who had never given birth (OR = 2.04, 95% CI: 1.30–3.19; $p < 0.012$). Respondents engaged in formal employment were two times more likely to have sufficient knowledge of pregnancy-induced hypertension than those who were unemployed (OR = 2.85, 95% CI: 1.26–6.44; $p = 0.002$).

4. Discussion

The substantial heterogeneity observed in this meta-analysis ($I^2=99.3\%$) is likely due to several factors, including differences in healthcare resources, antenatal care coverage, maternal health education policies and socioeconomic conditions across countries. The large disparity in country-level PIH knowledge, with Nigeria reporting 76.36% and Ghana 13.36%, underscores these contextual differences. Accordingly, the overall pooled estimate of 45.63% should be interpreted cautiously, acknowledging that it represents an aggregate across highly heterogeneous populations. Interventions aiming to improve PIH knowledge should therefore be tailored to specific country contexts, taking into account local healthcare infrastructure, health education initiatives and population characteristics.

This review aimed to assess the combined Knowledge and associated risk factors ofHDP across Africa. The meta-analysis revealed a pooled knowledge of PIH at 45.63% (95% CI: 27.06–

64.19, $I^2=99.3\%$). This rate is somewhat higher than that reported in a previous meta-analysis conducted in Malaysia, which found a prevalence of 32.9%²². However, it aligns with findings from studies in Karbala Hospital of Iraq, where the prevalence was 46.3%²³. On the other hand, the observed prevalence is lower than that reported in studies from Belgaum (74.07%)²⁴ and Bangladesh (92.5%)²⁵ and Iran (72.7%)²⁶. The possible reason for the observed difference may be due to differences in study participants and assessment methods. The study conducted in Belgaum was restricted to pregnant women under 20 weeks of gestation who were attending antenatal outpatient clinics and the study conducted in Iran, the participants were only in health centers, in contrast to the current study, which encompassed all women of reproductive age. Furthermore, the study from Bangladesh employed the Donabedian model, a methodological approach distinct from those used in the articles included in this meta-analysis, which may explain some of the differences in the findings.

However, the proportion of knowledgeable women in this meta-analysis is lower compared to the findings from a study conducted in Brunei Darussalam, where 69% of women were reported to know about pregnancy-induced hypertension¹⁵. The discrepancies observed may be attributed to differences in socio-demographic characteristics, sampling methods and study settings across the studies. For instance, the study from Brunei Darussalam focused on educated women, whereas the current meta-analysis included women regardless of their educational background. It is well-established that education enhances the ability to seek information and increases maternal awareness of available healthcare services. Similarly, studies conducted in Indian and Zimbabwe, non-probability sampling techniques to recruit participants. Additionally, the studies from Utah and the Netherlands were carried out exclusively in maternal and child healthcare clinics, in contrast to the current meta-analysis, which incorporated both facility-based and community-based studies.

This systematic review and meta-analysis found that knowledge of pregnancy-induced hypertension (PIH) among pregnant women in Africa was significantly influenced by factors such as educational status, parity and employment. Education emerged as a particularly important factor. The analysis grouped education levels into categories: no formal education, primary, secondary and tertiary, to explore their association with hypertensive disorders of pregnancy (HDP). It was revealed that women with tertiary education were more likely to be knowledgeable about PIH compared to those without any formal education and this association was statistically significant. This finding was in line with similar studies conducted in the Iraq²⁵ and Zimbabwe²⁷. A possible explanation is that women with higher levels of education may have greater access to information, education and communication through various channels such as the internet, books and television, which could lead to a better understanding of pregnancy-induced hypertension (PIH) compared to women with limited or no formal education. Fadare²⁸ suggests that as a woman's educational level increases, she becomes more likely to gain knowledge about gestational hypertension, develop a positive outlook toward the condition and adopt appropriate behavioral changes.

This systematic review and meta-analysis investigated the influence of parity on knowledge of pregnancy-induced hypertension (PIH). It revealed that Women with previous

births were more likely to be aware of the risk factors for PIH than those who had never given birth, which is consistent with earlier findings in studies conducted in India²⁹ and Iraq³⁰. These differences may be attributed to the fact that women with higher parity are generally more regular in attending prenatal appointments and possess greater awareness and understanding of pregnancy-induced hypertension (PIH), possibly due to their exposure to counselling or educational programs. On the other hand, nulliparous women might be less inclined to visit antenatal clinics due to a lack of prior experience. Increasing awareness among vulnerable groups can be effectively accomplished through focused health education efforts.

Similarly, the findings of this study indicated that pregnant women employed by the government or NGOs were more likely to be aware of pregnancy-induced hypertension (PIH) compared to those who were housewives' pregnant women. This result aligns with a study conducted in selected hospitals in Mangalore, India³¹. The difference may be attributed to greater access to information and education among employed women, as they are more likely to receive pregnancy-related knowledge from colleagues within their workplace.

5. Strengths and Limitations

This study represents the first systematic review and meta-analysis to quantitatively examine factors associated with knowledge of pregnancy-induced hypertension (PIH) in African countries. A thorough search was carried out across various electronic databases, reference lists of relevant articles and through manual searching. Quality assessment was performed and the screening process was independently conducted by two reviewers. However, the study has several limitations. All the included studies were cross-sectional in design, which restricts the ability to infer causality. Additionally, the meta-analysis considered all forms of PIH and only studies published in English were included, potentially excluding relevant research published in other languages. There was significant heterogeneity among the included studies, possibly due to differences in assessment tools or definitions used. Furthermore, there were insufficient studies on some associated factors to draw strong conclusions and not all African countries were represented. As such, more comprehensive and inclusive research is needed across the region.

6. Conclusions and Recommendations

Intervention strategies to improve PIH knowledge should be context-specific, taking into account the substantial heterogeneity observed across countries and study settings. Maternal education, parity, employment status and ANC attendance emerged as key factors associated with PIH knowledge. Accordingly, interventions should focus on enhancing maternal health literacy, promoting regular ANC attendance and tailoring educational programs to specific socio-demographic groups. Multi-level approaches, including health system strengthening and community-based education, are recommended to address the diverse needs of populations and improve maternal outcomes effectively. Overall, most of the associated factors can be identified during antenatal care (ANC) visits, which may help prevent further complications for both the mother and the fetus. As a result, targeted interventions should be developed to address these factors. The findings of this review can support African countries in creating a screening guideline or checklist for use during ANC visits. Updating existing guidelines and

service delivery materials can better equip healthcare providers to assess pregnant women and detect relevant risk factors early, before severe complications arise. In addition, it is crucial to implement effective, multi-sectoral interventions that emphasize primary prevention particularly by screening high-risk women and enhancing women's education levels.

7. Ethics Approval and Consent to Participate

Not applicable.

8. Consent for Publication

Not applicable.

9. Conflict of Interest

The authors declare that there was no commercial or financial conflict.

10. Data Availability

The data used to support the findings of this study are available within the article and will be attached as supplementary information files.

11. Funding

No funding is provided for this study.

12. Authors' Contributions

GK, YA, BW and WC were involved in the conception and design of the study. GK and WC contributed to the development of the methodology. GK, YA and WC participated in the formal analysis, data interpretation and drafting of the manuscript. All authors were involved in the supervision, validation and review of the manuscript.

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