Review Article

Access this article online

Quick Response Code:



Website: https://www.ovid.com/jnls/jras

DOI: 10.4103/jras.jras_177_26

Maternal–fetal outcomes and safety of Ayurvedic interventions in hypertensive disorders of pregnancy: A systematic review

Wiku Andonotopo[1,2], I Nyoman Hariyasa Sanjaya[3], Anak Agung Gede Putra Wiradnyana[3], Anak Agung Ngurah Jaya Kusuma[3], Aloysius Suryawan[4], Theresia Monica Rahardjo[4], Julia Windi Gunadi[4], Waskita Ekamaheswara Kasumba Andanaputra[5]

[1]Fetomaternal Division, Women Health Center, Department of Obstetrics and Gynecology, Ekahospital BSD City, Serpong, Tangerang, Banten, [2]Fetomaternal Division, Department of Obstetrics and Gynecology, Faculty of Medicine, Maranatha Christian University, Maranatha Hospital, Bandung, West Java, [3]Maternal-Fetal Medicine Division, Department of Obstetrics and Gynecology, Faculty of Medicine, Udayana University, Prof. Dr. I.G.N.G Ngoerah General Hospital, Bali, [4]Fetomaternal Division, Department of Obstetrics and Gynecology, Faculty of Medicine, Maranatha Christian University, Maranatha Hospital, [5]Undergraduate Program in Medical Science, Faculty of Medicine, Padjadjaran University, Bandung, West Java, Indonesia

Address for correspondence:
Dr. Wiku Andonotopo, Fetomaternal Division, Women Health Center, Department of Obstetrics and Gynecology, Ekahospital BSD City, Serpong, Tangerang, Banten 15321, Indonesia.
E-mail: wiku.andonotopo@gmail.com

Submitted : 03-Jun-2026
Revised : 17-Aug-2026
Accepted : 02-Oct-2026
Published : 26-Oct-2026

Abstract

BACKGROUND: Hypertensive disorders of pregnancy (HDP), particularly gestational hypertension and preeclampsia, remain important causes of maternal and perinatal morbidity. Ayurveda and related integrative approaches are used in maternal care, yet their relevance to HDP is uncertain because direct clinical evidence is sparse and much of the literature is mechanistic or contextual.

OBJECTIVE: To systematically examine maternal–fetal outcomes, safety, and biological plausibility of Ayurveda-related interventions relevant to HDP, while distinguishing direct clinical evidence from indirect and contextual evidence.

MATERIALS AND METHODS: This preferred reporting items for systematic reviews and meta-analyses 2020-guided systematic review searched PubMed, Scopus, Embase, Web of Science, Cochrane Library, AYUSH Research Portal, DHARA, and IndMED from inception to May 2025. Eligibility was structured using Population, Intervention, Comparator, Outcomes, and Study Design (PICOS). Thirty sources formed the qualitative evidence corpus. Primary clinical evidence was considered separately from mechanistic studies and secondary contextual sources; reviews and guidelines were not treated as independent patient-level outcome data. Heterogeneity precluded meta-analysis.

RESULTS: Direct clinical evidence was notably limited. The principal randomized evidence evaluated yoga added to standard antenatal care among women at increased risk of gestational hypertension, while other literature mainly informed biological plausibility, pregnancy safety, or clinical context. Proposed mechanisms involved oxidative stress, endothelial dysfunction, inflammation, vascular regulation, and placental function. Evidence supporting herbal or other Ayurveda-specific treatment of established HDP was insufficient, and pregnancy-specific safety reporting remained inconsistent.

CONCLUSION: Current evidence does not establish Ayurveda as an effective treatment for HDP or justify replacing standard obstetric management. Rather, this preliminary synthesis organizes the available evidence and identifies data needed for subsequent investigation. The contributors' work therefore represents an initial evidence-mapping effort to support future prospective studies, standardized interventions, and maternal–fetal pharmacovigilance.

Keywords:

Ayurveda, gestational hypertension, hypertensive disorders of pregnancy, maternal–fetal outcomes, preeclampsia

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 License (CC BY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Andonotopo W, Sanjaya INH, Wiradnyana AAGP, Kusuma AANJ, Suryawan A, Rahardjo TM, *et al*. Maternal–fetal outcomes and safety of Ayurvedic interventions in hypertensive disorders of pregnancy: A systematic review. J Res Ayurvedic Sci 2026;10:231-48.

Introduction

Hypertensive disorders of pregnancy (HDP), particularly gestational hypertension and preeclampsia, remain major causes of maternal and perinatal morbidity. Interest in complementary approaches has grown partly because management is directed mainly toward surveillance, prevention of complications, and timely delivery rather than reversal of the underlying disease process. Within Ayurveda, medicinal plants and traditional therapeutic concepts have been discussed in relation to preeclampsia, especially through antioxidant, anti-inflammatory, endothelial, and antihypertensive pathways.[1] Obstetric reviews have described possible roles for Ayurveda in maternal care, although clinical evidence remains uneven and indirect.[2] Mechanistic work on plant-derived angiotensin-converting enzyme inhibition has added biological plausibility to this field,[3] while experimental endothelial studies using plasma from women with severe preeclampsia have suggested antioxidant effects of *Punica granatum* extracts.[4] These observations are hypothesis-generating rather than proof of efficacy.

This distinction is important because HDP is a high-risk clinical condition with established standards of diagnosis and management. Contemporary guidance emphasizes blood-pressure control, surveillance for maternal organ dysfunction, fetal assessment, and prevention of severe complications.[5] Postpartum care is important because hypertensive pregnancy disorders may confer later cardiovascular risk.[6] The population burden is substantial and varies across regions, particularly where access to specialist obstetric services is limited.[7] Long-term consequences extend beyond pregnancy: women with prior HDP have increased stroke risk,[8] and exposed offspring may face adverse neurodevelopmental outcomes.[9] Qualitative evidence further shows that women experience uncertainty, fear, and disruption in care pathways.[10] Digital monitoring strategies may support continuity of care,[11] while international guideline comparisons show both areas of consensus and persistent variation in management.[12]

Against this clinical background, Ayurveda-related pregnancy care has been explored in broader antenatal contexts. Holistic models integrating yoga, Ayurveda, and Vedic guidance have been proposed to support maternal well-being.[13] Clinical studies of Dhatrilauha in pregnancy anemia,[14] Punarnava Mandura and Dhatri Lauha for *Garbhini Pandu*,[15] Dhatakyadi Varti for vulvovaginitis,[16] and case-based Ayurvedic management of threatened abortion[17] demonstrate that pregnancy-specific interventions have been studied, but these conditions are not HDP. The most directly relevant randomized evidence is a yoga-based intervention among women at increased risk of gestational hypertension, where cardiometabolic and fetomaternal outcomes were linked with serum nitric oxide.[18] By contrast, Ayurvedic treatment for essential hypertension in nonpregnant patients provides only indirect support for antihypertensive plausibility.[19] General Ayurveda literature likewise emphasizes prevention and health promotion rather than disease-specific obstetric efficacy.[20]

Methodological uncertainty therefore remains central. Reviews of pregnancy research in India indicate persistent gaps in trial design and reporting.[21] Safety evidence for herbal medicines in pregnancy is heterogeneous,[22] and systematic evaluation of herbal use for labor induction has likewise highlighted uncertainty around effectiveness and adverse outcomes.[23] At the same time, current clinical references define preeclampsia as a multisystem pregnancy disorder requiring careful diagnosis and risk-based management,[24] while hypertension in pregnancy is recognized as a broader spectrum requiring structured maternal and fetal surveillance.[25] International recommendations reinforce standardized classification and management.[26] Modern pathophysiology identifies abnormal placentation, angiogenic imbalance, endothelial dysfunction, oxidative stress, renal involvement, and inflammation as central mechanisms.[27] These pathways also underpin current perspectives on disease progression and therapeutic development.[28] Contemporary clinical reviews emphasize that preeclampsia is a complex maternal–placental syndrome rather than isolated hypertension,[29] and formal obstetric guidance continues to prioritize evidence-based management for gestational hypertension and preeclampsia.[30]

Accordingly, this review evaluates Ayurveda-related evidence within a deliberately hierarchical framework. Direct clinical studies are distinguished from mechanistic, pregnancy-contextual, nonpregnant, and secondary evidence so that biological plausibility is not mistaken for therapeutic effectiveness. This review also examines maternal–fetal outcomes and safety while avoiding duplication of patient-level data from systematic reviews or guidelines. This preliminary synthesis is intended to organize the existing evidence base, clarify where evidence is truly direct, and identify the clinical and methodological gaps that must be addressed before Ayurveda-related interventions can be considered for broader integration into HDP care.

Materials and Methods

Protocol and reporting guidelines

This systematic review evaluated evidence concerning maternal–fetal outcomes and safety of Ayurveda-related

interventions in HDP. This review was designed and reported in accordance with preferred reporting items for systematic reviews and meta-analyses 2020. Before screening and data extraction, the authors prepared a protocol specifying the review question, eligibility criteria, information sources, search strategy, selection, extraction, appraisal, and synthesis. The protocol was not registered in International Prospective Register of Systematic Reviews (PROSPERO) because the review had progressed beyond the appropriate stage for prospective registration when registration was considered. This is acknowledged as a methodological limitation because a public protocol was unavailable for external comparison of planned and reported methods. To reduce risks of *post hoc* decision-making and selective outcome reporting, eligibility rules and outcome domains were fixed before extraction, and standardized forms and documented exclusion reasons were used.

Eligibility criteria

Eligibility was structured using Population, Intervention, Comparator, Outcomes, and Study Design (PICOS). The target population comprised pregnant women with gestational hypertension, pregnancy-induced hypertension, preeclampsia, or related HDP. Eligible interventions were Ayurveda or Ayurveda-related approaches, including defined herbal formulations, Rasayana-based approaches, *Garbhini Paricharya*, and integrative lifestyle or yoga interventions when explicitly linked to the review question. Eligible comparators included standard obstetric care, active treatment, or add-on care. Placebo or no-intervention groups were acceptable only when participants continued clinically indicated standard obstetric management; studies withholding proven antihypertensive, anticonvulsant, or complication-preventing treatment were not considered ethically acceptable evidence.

Primary studies eligible for outcome synthesis included randomized trials and observational studies reporting maternal, fetal, neonatal, or safety outcomes. Human mechanistic studies were eligible when conducted in pregnant women with HDP or directly examining pregnancy-relevant pathways. *In vitro* or other experimental investigations were retained only as mechanistic evidence and were not interpreted as clinical efficacy evidence. Systematic reviews, narrative reviews, reference chapters, and clinical guidelines were used solely for background, mechanistic interpretation, safety context, and contemporary obstetric comparison; they were not treated as primary patient-level data, and their component studies were not counted again in outcome synthesis. Non-HDP pregnancy studies and nonpregnant hypertension studies were similarly classified as indirect contextual evidence rather than direct evidence of efficacy. Editorials, unsupported opinion pieces, conference abstracts lacking adequate data, and reports without meaningful relevance were excluded.

Information sources and search strategy

Searches covered database inception through May 31, 2025, rather than imposing an arbitrary lower publication-year limit. PubMed/MEDLINE, PubMed Central, Embase, Scopus, Web of Science, Cochrane Library, AYUSH Research Portal, DHARA, and IndMED were searched. No language restriction was applied at the search stage. Records that could not be reliably evaluated because a usable translation was unavailable were documented during eligibility assessment rather than removed through a language filter.

The core PubMed strategy was as follows: ("Hypertension, Pregnancy-Induced"[MeSH] OR "Pre-Eclampsia"[MeSH] OR "hypertensive disorders of pregnancy" OR preeclampsia OR pre-eclampsia OR "gestational hypertension" OR "pregnancy-induced hypertension") AND ("Medicine, Ayurvedic"[MeSH] OR Ayurveda OR Ayurvedic OR "Ayurvedic medicine" OR Rasayana OR "*Garbhini Paricharya*" OR herbal OR phytotherapy OR yoga OR "integrative medicine"). Outcome terms such as maternal outcome, fetal outcome, birth weight, blood pressure, and safety were deliberately omitted from the principal search because requiring outcome terminology can reduce sensitivity. Syntax, controlled vocabulary, truncation, and field mapping were adapted to each database while preserving the same two conceptual blocks: HDP and Ayurveda-related interventions. Searches were rerun before final screening, references of relevant articles and secondary sources were checked, and records were exported with database, date, and query information retained to permit reproducibility.

Study selection

Two reviewers independently screened records using predefined criteria. After deduplication and removal of records identified as clearly ineligible before screening, titles and abstracts were assessed, followed by independent full-text review. Disagreements were resolved by discussion; unresolved decisions were adjudicated by a third reviewer. Agreement between the two reviewers was checked after each screening phase using percentage agreement and Cohen's kappa, with discrepancies reviewed before the database was locked.

As shown in Figure 1, 894 records were identified, comprising 842 database records and 52 register records. Before screening, 426 records were removed: 236 duplicates, 122 records identified as ineligible through automation-assisted organizational screening, and 68 for other prespecified reasons, such as nonhuman or nonpregnancy focus. Of 468 records screened, 336

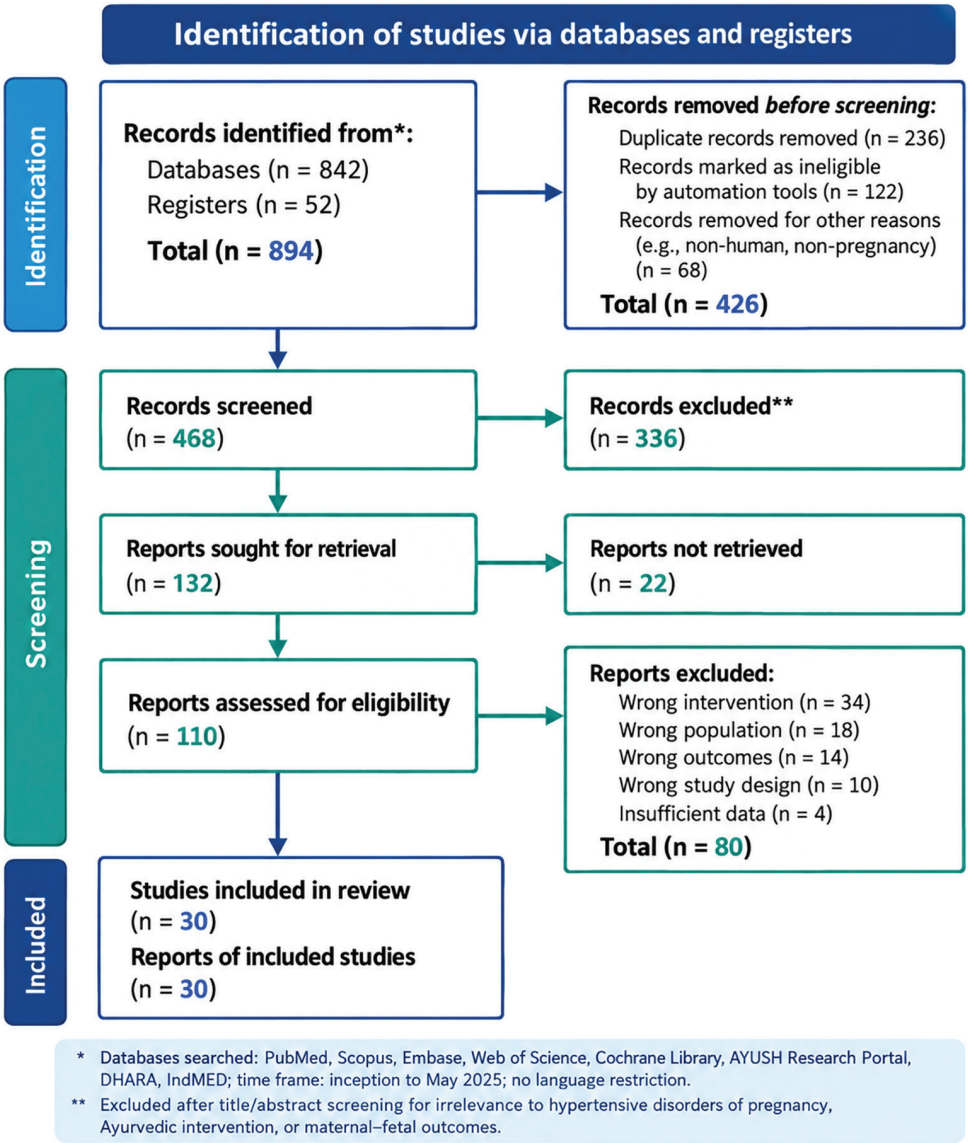


Figure 1: Preferred reporting items for systematic reviews and meta-analyses 2020 flow diagram of study identification, screening, eligibility assessment, and inclusion for the systematic review of maternal–fetal outcomes and safety of Ayurvedic interventions in hypertensive disorders of pregnancy

were excluded. Among 132 reports sought, 22 could not be retrieved; 110 full texts were assessed, and 80 were excluded for wrong intervention (34), population (18), outcomes (14), study design (10), or insufficient data (4). Thirty records remained in the final evidence corpus. Their evidentiary role was classified explicitly so secondary and indirect sources did not inflate the primary clinical evidence base.

Data extraction

Two reviewers independently extracted author, year, design, population, sample size, intervention, comparator, outcome definitions, follow-up, maternal and fetal findings, adverse events, and limitations using a standardized form. Extraction discrepancies were reconciled against the source article. Table 1 maps evidence type and clinical directness; Table 2 summarizes maternal–fetal outcome domains; Table 3 organizes mechanistic and translational pathways; and Table 4 presents safety, implementation limitations, and research gaps. This separation was maintained throughout synthesis to prevent mechanistic plausibility or guideline recommendations from being presented as intervention effectiveness.

Risk-of-bias assessment and data synthesis

Appraisal was design-specific. Randomized trials were assessed using Cochrane Risk of Bias (RoB 2), nonrandomized intervention studies using risk of bias in non-randomized studies of interventions (ROBINS-I), observational cohort or case–control studies using the Newcastle–Ottawa Scale where appropriate, and systematic reviews were used for contextual interpretation using risk of bias in systematic reviews

Table 1: Hierarchical evidence map of primary and contextual literature on Ayurveda-related interventions and hypertensive disorders of pregnancy

Evidence category	Study	Study design/ setting	Population/ experimental model	Sample size	Intervention/ exposure and comparator	Principal outcomes/ contribution	Relevance to review question	Methodological appraisal
Direct primary clinical evidence	Karthiga *et al.*[18]	Parallel, single-blind randomized controlled trial; JIPMER, Puducherry, India	Pregnant women at increased risk of gestational hypertension; normotensive before 16 weeks at recruitment	256 randomized; 234 completed follow-up (121 intervention and 113 control)	Standard antenatal care + 20-week yoga intervention versus standard antenatal care alone	Lower occurrence of new-onset hypertension; favorable cardiometabolic, fetomaternal, and neonatal outcomes were reported in the yoga group	High directness for prevention/ risk reduction, but not a treatment trial in women with established HDP and not an Ayurvedic herbal intervention	RoB 2 applicable. Randomization and allocation concealment were described; interpretation should account for attrition and the practical limitations of blinding a behavioral intervention
HDP-specific mechanistic evidence—not clinical efficacy evidence	Nasifah *et al.*[4]	*In vitro* experimental short communication	Endothelial-cell model exposed to plasma obtained from women with severe preeclampsia	Experimental cellular study; no treated pregnant clinical cohort	*Punica granatum* extract evaluated in an endothelial oxidative-stress model	Demonstrated anti-lipid-peroxidation/ antioxidant activity, providing a possible mechanistic link to endothelial dysfunction in preeclampsia	Indirect mechanistic evidence only; cannot establish maternal, fetal, neonatal, or clinical treatment benefit	Not eligible for RoB 2/ ROBINS-I because this was not a human intervention study; interpreted as mechanistic evidence
HDP-specific mechanistic/ background evidence—secondary source	Wazib *et al.*[1]	Narrative/ mechanistic review	Indian medicinal plants considered in the context of preeclampsia	N/A	Literature synthesis of medicinal plants and proposed therapeutic mechanisms	Identifies antioxidant, anti-inflammatory, endothelial, and antihypertensive pathways potentially relevant to preeclampsia	Contextual only; not treated as primary outcome data	Excluded from primary-study RoB synthesis because it is a secondary source
HDP-specific mechanistic/ background evidence—secondary source	Reddy *et al.*[3]	Phytomedicine/ mechanistic review	Medicinal plants with ACE-inhibitory activity relevant to preeclampsia	N/A	Literature-based evaluation of plant-derived ACE inhibition	Supports biological plausibility for vascular and antihypertensive mechanisms	Contextual only; no pregnancy intervention outcome data	Excluded from primary-study RoB synthesis because it is a secondary source
Ayurveda/ integrative pregnancy context—not HDP-specific	Rakhshani *et al.*[13]	Integrative antenatal-care model	Pregnant women/ antenatal-care context	N/A for HDP-specific efficacy	Yoga, Ayurveda and Vedic antenatal-care framework	Provides conceptual support for integrative antenatal approaches	Indirect; does not establish effectiveness for HDP	Not included as primary HDP efficacy evidence
Pregnancy-specific Ayurvedic clinical evidence—different indication	Roy and Dwivedi[14]	Clinical/ therapeutic study	Pregnant women with iron-deficiency anemia	Not used for HDP synthesis	Dhatrilauha	Provides pregnancy-specific experience with an Ayurvedic intervention	Indirect; different disease indication	Excluded from HDP primary-evidence appraisal
Pregnancy-specific Ayurvedic clinical evidence—different indication	Khandelwal *et al.*[15]	Clinical study	Pregnant women with Garbhini Pandu (anemia in pregnancy)	Not used for HDP synthesis	Punarnava Mandura and Dhatri Lauha	Provides pregnancy-specific clinical experience with Ayurvedic therapy	Indirect; not an HDP population	Excluded from HDP primary-evidence appraisal

Table 1. Continued

Evidence category	Study	Study design/ setting	Population/ experimental model	Sample size	Intervention/ exposure and comparator	Principal outcomes/ contribution	Relevance to review question	Methodological appraisal
Pregnancy-specific Ayurvedic clinical evidence—different indication	Shaikh *et al.*[16]	Controlled randomized clinical trial	Pregnant women with vulvovaginitis	Not used for HDP synthesis	Dhatakyadi Varti	Demonstrates feasibility of studying an Ayurvedic intervention during pregnancy	Indirect; different disease indication and outcome domain	Excluded from HDP primary-evidence appraisal
Pregnancy-specific Ayurvedic evidence—different indication	Roy *et al.*[17]	Case report	Pregnant woman with threatened abortion	1	Ayurvedic case management	Provides isolated pregnancy-specific clinical experience	Very indirect; different indication and uncontrolled evidence	Excluded from HDP primary-evidence appraisal
Ayurvedic antihypertensive evidence—nonpregnant population	Hivale *et al.*[19]	Clinical study	Nonpregnant patients with essential hypertension	Not used for pregnancy/ HDP synthesis	Triphaladi Kala Basti + Arjuna Punarnavadi Ghanavati	Provides indirect evidence for antihypertensive effects of an Ayurvedic regimen	Indirect; nonpregnant population and not HDP	Excluded from pregnancy/ HDP primary-evidence appraisal
Pregnancy herbal-safety context—secondary evidence	Ahmed *et al.*[22]	Systematic review	Pregnant women using herbal medicines in Asian countries	Multiple primary studies	Herbal medicine exposure	Highlights heterogeneity and uncertainty in pregnancy-specific herbal safety	Contextual safety evidence only; not Ayurveda/ HDP-specific primary data	Secondary source; not pooled or counted as primary patient data
Pregnancy herbal-safety context—secondary evidence	Zamawe *et al.*[23]	Systematic review and meta-analysis	Pregnant women using herbal medicines for induction of labor	Multiple primary studies	Herbal medicines for labor induction	Highlights safety and effectiveness uncertainties associated with herbal exposure during pregnancy	Contextual safety evidence; different indication	Secondary source; not pooled or counted as primary patient data
Contemporary HDP clinical context—secondary/ guideline evidence	Magee *et al.*[5]; Cairns *et al.*[6]; Noubiap *et al.*[7]; Brohan *et al.*[8]; Atkinson *et al.*[9]; Wetzler *et al.*[10]; Hu *et al.*[11]; Danielli *et al.*[12]; Karrar *et al.*[24]; Luger and Kight[25]; Brown *et al.*[26]; Phipps *et al.*[27]; Rana *et al.*[28]; Chappell *et al.*[29]; ACOG[30]	Guidelines, systematic reviews/meta-analyses, clinical/ reference reviews, and consensus documents	HDP/ preeclampsia populations or relevant clinical literature	N/A/multiple underlying studies	No Ayurvedic intervention evaluated as primary patient-level exposure	Establishes contemporary HDP definitions, pathophysiology, outcomes, safety priorities, and standard obstetric management	Background/ context only; explicitly excluded from primary Ayurvedic intervention synthesis	Not treated as primary studies and therefore not combined with intervention-study RoB findings

Table 1. Continued

Evidence category	Study	Study design/ setting	Population/ experimental model	Sample size	Intervention/ exposure and comparator	Principal outcomes/ contribution	Relevance to review question	Methodological appraisal
General Ayurveda/ research context—secondary evidence	Pisani-Conway[2]; Sharma *et al.*[20]; Karekar *et al.*[21]	Clinical/ narrative review, conceptual review, and clinical-trial-registry review	General obstetric Ayurveda, primary health care, or pregnancy-research context	N/A	No HDP-specific primary Ayurvedic intervention	Provides contextual information on Ayurveda in obstetric care and feasibility/gaps in pregnancy research	Background only	Not treated as primary clinical evidence

HDP = hypertensive disorders of pregnancy, RoB = risk of bias, ROBINS-I = risk of bias in non-randomized studies of interventions, ACOG = American College of Obstetricians and Gynecologists, ACE = angiotensin-converting enzyme.
Evidence was hierarchically classified according to directness to the review question; only original human intervention studies relevant to prevention or management of HDP were considered primary clinical evidence, whereas systematic reviews, clinical guidelines, narrative reviews, reference chapters, non-HDP pregnancy studies, nonpregnant studies, and mechanistic investigations were retained solely for contextual, safety, or biological interpretation and were not counted as independent patient-level outcome data. Risk of bias for eligible randomized clinical evidence should be assessed using the Cochrane Risk-of-Bias 2 framework, while ROBINS-I should be applied if eligible nonrandomized intervention studies are identified; secondary and experimental sources were not assigned an artificial clinical risk-of-bias category. This separation avoids double counting of primary studies contained within reviews or guidelines and emphasizes that the available direct clinical evidence is sparse, with the principal randomized controlled trial[18] evaluating yoga plus standard antenatal care in women at risk of, rather than already diagnosed with, gestational hypertension

Table 2: Framework of maternal, fetal, and clinical outcomes relevant to Ayurvedic interventions in hypertensive disorders of pregnancy

Primary outcome domain	Clinical variable	Definition	Clinical relevance	Expected direction of benefit	Measurement method	Timing of assessment	Evidence strength	References
Maternal hemodynamics	Systolic blood pressure	Peak arterial systolic pressure	Core HDP outcome	Decrease	mm Hg	Antenatal follow-up	High	[5,18,26,29,30]
Maternal hemodynamics	Diastolic blood pressure	Resting arterial diastolic pressure	HDP severity indicator	Decrease	mm Hg	Antenatal follow-up	High	[5,18,26,29]
Disease progression	Progression to severe preeclampsia	Development of severe disease features	Major maternal outcome	Reduction	Diagnostic criteria	Pregnancy course	High	[5,24,26,30]
Renal function	Proteinuria	Urinary protein excretion	Diagnostic marker of preeclampsia	Reduction	Urine protein assessment	Antenatal follow-up	High	[5,24,27,29]
Maternal morbidity	Maternal complications	Eclampsia, HELLP, organ dysfunction	Critical safety outcome	Reduction	Clinical diagnosis	Pregnancy and postpartum	High	[5,6,26,30]
Fetal growth	Birth weight	Neonatal weight at delivery	Indicator of placental function	Increase	Kilograms/ grams	Delivery	High	[9,18,27,29]
Neonatal outcome	Preterm birth	Delivery before 37 weeks	Major perinatal endpoint	Reduction	Gestational age	Delivery	High	[5,8,29,30]
Neonatal outcome	NICU admission	Requirement for intensive neonatal care	Indicator of neonatal morbidity	Reduction	Hospital record	Postpartum	Moderate–high	[9,18,29]
Perinatal survival	Perinatal mortality	Fetal and neonatal death	Ultimate fetal outcome	Reduction	Clinical record	Delivery/ postpartum	High	[7,8,29,30]

HDP = hypertensive disorders of pregnancy, NICU = neonatal intensive care unit, HELLP = hemolysis, elevated liver enzymes, and low platelet count.
Outcome domains were selected according to contemporary maternal–fetal medicine recommendations and are expected to represent the most clinically meaningful endpoints for evaluating Ayurvedic interventions. Evidence strength reflects the consistency of reporting across obstetric guidelines, systematic reviews, and pregnancy-related intervention studies

(ROBIS) to assess RoB. Guidelines and narrative reviews were not assigned patient-level intervention RoB judgments. Assessments were performed independently by two reviewers, and disagreements were resolved by consensus or third-reviewer adjudication. Clinical, mechanistic, and contextual evidence was synthesized narratively because interventions, populations, study designs, and outcomes were too heterogeneous for

Table 3: Translational mechanisms potentially linking Ayurvedic interventions with maternal–fetal outcomes in hypertensive disorders of pregnancy

Mechanistic domain	Pathophysiological target	Ayurvedic conceptual correlate	Potential intervention class	Proposed biological effect	Maternal relevance	Fetal relevance	Translational significance	References
Oxidative stress	Reactive oxygen species excess	Shotha and Dosha imbalance	Rasayana and antioxidant herbs	Reduced oxidative injury	Improved endothelial function	Improved placental function	High	[1,4,27,28]
Endothelial dysfunction	Vascular injury	Srotas dysfunction	Polyherbal formulations	Improved vascular responsiveness	Better blood pressure control	Better uteroplacental perfusion	High	[1,3,4,27,29]
Inflammation	Pro-inflammatory cytokines	Doshic aggravation	Anti-inflammatory botanicals	Reduced systemic inflammation	Lower disease severity	Improved fetal environment	High	[1,27-29]
Neurohormonal activation	Renin–angiotensin dysregulation	Vata predominance	Herbal antihypertensive agents	Reduced vasoconstriction	Improved hemodynamic stability	Reduced placental stress	Moderate–high	[3,19,27]
Cardiometabolic dysfunction	Metabolic and vascular burden	Garbhini Paricharya principles	Yoga-integrative care	Improved cardiometabolic profile	Reduced maternal risk	Improved fetal growth	Moderate–high	[13,18,29]
Placental dysfunction	Impaired placental adaptation	Garbha-poshana impairment	Integrative antenatal care	Enhanced maternal support	Reduced HDP progression	Improved fetal growth	High	[13,27-29]
Hemodynamic instability	Elevated vascular resistance	Vata-related disturbance	Basti and systemic therapies	Improved circulatory regulation	Lower blood pressure	Improved placental circulation	Moderate	[18,19,26]
Long-term cardiovascular risk	Persistent vascular injury	Rasayana and preventive care	Lifestyle and Ayurvedic prevention	Improved cardiovascular resilience	Reduced future maternal risk	Indirect benefit	Moderate	[8,20,26]

HDP = hypertensive disorders of pregnancy.
This table summarizes biological pathways potentially relevant to Ayurvedic interventions rather than demonstrating direct causality. Mechanistic domains were synthesized from contemporary preeclampsia pathophysiology and Ayurveda-based conceptual frameworks. These pathways may assist interpretation of maternal–fetal outcomes reported across heterogeneous clinical studies

Table 4: Safety, implementation considerations, and evidence gaps for Ayurvedic interventions in hypertensive disorders of pregnancy

Assessment domain	Variable	Current evidence status	Potential benefit	Potential concern	Research priority	Clinical applicability	Future recommendation	References
Maternal safety	Adverse maternal events	Limited direct evidence	Supports clinical acceptability	Under-reporting possible	Very high	Moderate	Standardized safety reporting	[5,22,23]
Fetal safety	Fetal adverse outcomes	Limited evidence	Potential reassurance	Insufficient pregnancy-specific data	Very high	Moderate	Prospective fetal monitoring	[22,23,29]
Herbal exposure	Pregnancy use of medicinal plants	Emerging evidence	May expand treatment options	Variability in formulations	High	Moderate	Product standardization	[1,22,23]
Pharmacovigilance	Adverse-event surveillance	Sparse reporting	Improved risk assessment	Missing safety databases	Very high	Low–moderate	Dedicated registries	[21-23]
Integrative care	Ayurveda plus standard care	Growing interest	Potential complementary benefit	Interaction uncertainty	High	High	Controlled comparative studies	[2,13,18]
Guideline integration	Alignment with obstetric care	Limited evidence base	Broader clinical adoption	Evidence threshold not reached	High	Moderate	Multicenter trials	[5,12,30]
Generalizability	Applicability across populations	Restricted geographic evidence	Cultural relevance	Limited external validity	Moderate–high	Moderate	International collaboration	[7,21,22]
Research quality	Methodological rigor	Variable	Expanding literature base	Small studies and heterogeneity	Very high	Moderate	PRISMA-compliant trials and reviews	[6,12,21]
Evidence gap	HDP-specific Ayurvedic interventions	Major knowledge gap	High innovation potential	Insufficient high-quality trials	Very high	High	Large prospective studies	[1,18,19,30]

HDP = hypertensive disorders of pregnancy, PRISMA = preferred reporting items for systematic reviews and meta-analyses.
Safety remains the most important consideration when evaluating Ayurvedic interventions during pregnancy. Existing evidence suggests promising integrative potential but remains constrained by limited HDP-specific clinical trials, heterogeneous interventions, and incomplete pharmacovigilance reporting. Future research should prioritize rigorous maternal–fetal safety assessment, standardized intervention protocols, and high-quality comparative effectiveness studies

defensible statistical pooling. Direct clinical evidence on HDP was given interpretive priority. Mechanistic relationships are summarized in Table 3 and Figures 2–4, while Table 4 and Figure 5 integrate safety considerations, evidence gaps, and research priorities without implying proven clinical benefit.

Use of artificial intelligence and digital software tools

Artificial intelligence (AI)-assisted and digital tools supported only manuscript preparation and graphical presentation. Grammarly assisted grammar, readability, and language refinement. Figures were author-conceived and prepared with Canva, Adobe Illustrator, Adobe Creative Cloud, and Adobe Firefly; AI-assisted graphical functions, when used, were limited to visual enhancement. These tools did not conduct searches, select studies, extract data, assess bias, analyze evidence, interpret findings, or formulate conclusions. All scientific content and judgments were generated, checked, and approved by the authors, who retain full responsibility for accuracy, integrity, and originality.

Results

Study selection

The search and screening process is summarized in Figure 1. Across the prespecified information sources, 894 records were identified, comprising 842 records from databases and 52 records from registers or supplementary sources. Before title and abstract screening, 426 records were removed: 236 duplicates, 122 records identified as ineligible during preliminary screening, and 68 records excluded for other prespecified reasons, including nonhuman or nonpregnancy relevance. The remaining 468 records underwent title and abstract screening, after which 336 were excluded. Of 132 reports sought for retrieval, 22 could not be obtained, leaving 110 full-text reports for eligibility assessment. Eighty full-text reports were excluded because of an ineligible intervention, population, outcome domain, study design, or insufficient data. Thirty sources remained in the final qualitative evidence corpus. Because this corpus contained markedly different study designs, populations, intervention types, and purposes, it was not treated as a single pool of equivalent clinical evidence, and quantitative meta-analysis was not undertaken.

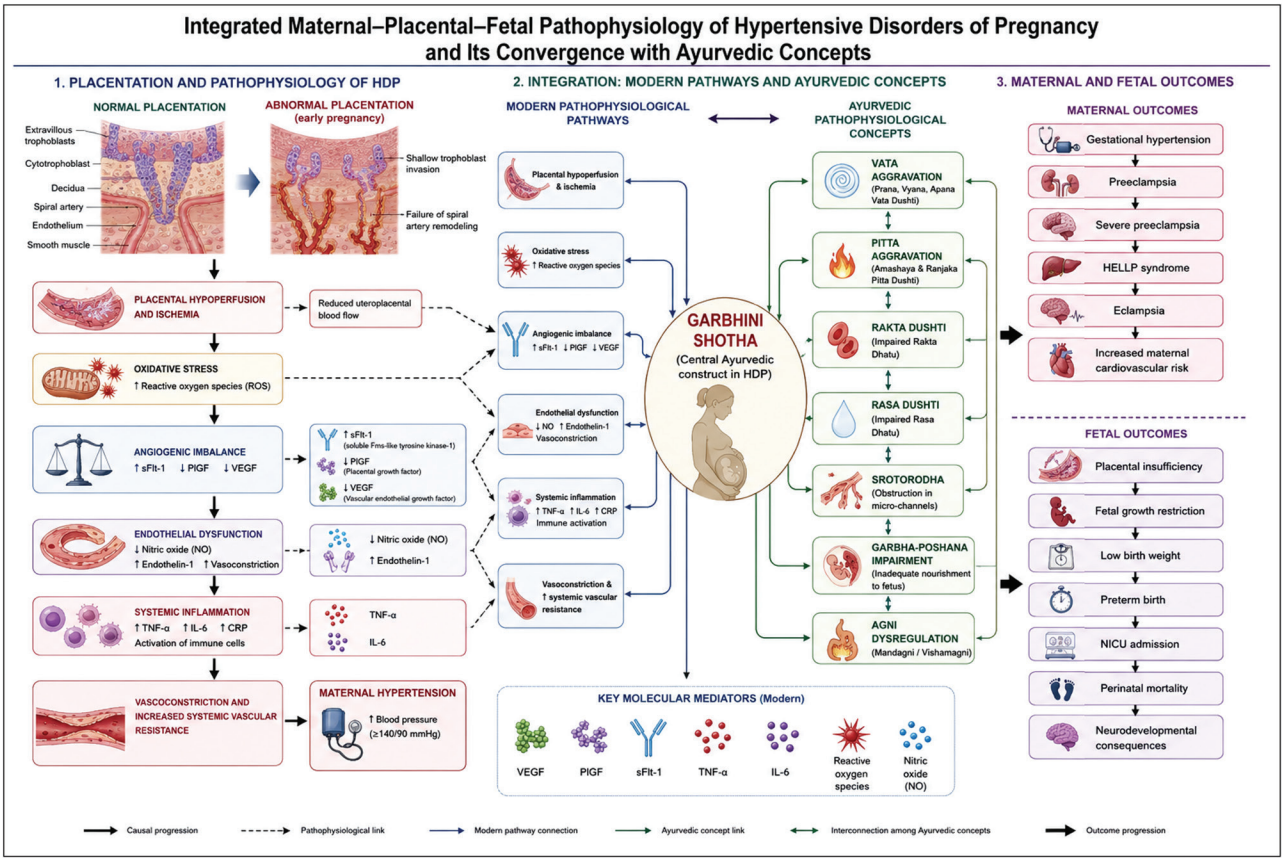


Figure 2: Integrated maternal–placental–fetal pathophysiology of hypertensive disorders of pregnancy and its convergence with Ayurvedic concepts

Study characteristics

The hierarchical structure of the evidence is presented in Table 1. The most important finding at this stage was the uneven directness of the literature. Only a small portion of the corpus provided primary clinical evidence relevant to prevention or management of HDP, whereas much of the remaining literature served mechanistic, pregnancy-safety, guideline, or contextual purposes. Karthiga *et al.*[18] provided the principal randomized clinical evidence, evaluating yoga added to standard antenatal care among women at increased risk of gestational hypertension. By contrast, Nasifah *et al.*[4] contributed experimental evidence using endothelial cells exposed to plasma from women with severe preeclampsia, while Wazib *et al.*[1] and Reddy *et al.*[3] primarily informed biological plausibility. Studies of anemia, vulvovaginitis, threatened abortion, and nonpregnant essential hypertension were retained only as indirect contextual evidence and were not interpreted as demonstrations of efficacy for HDP. Contemporary guidelines and reviews[5,26,29,30] were similarly used to define clinical standards and disease context rather than as independent patient-level outcome data.

An additional finding concerned how evidence had to be interpreted across source types. Secondary reviews and guidelines summarized large bodies of obstetric research, but they did not provide independent participants for this review. Their inclusion was therefore restricted to clinical framing, definitions, safety context, and comparison with accepted standards of care. This approach avoided double counting primary trials represented elsewhere and prevented consensus recommendations from being mistaken for intervention effects. It also exposed the central weakness of the literature clearly: the apparent breadth of publications contrasted with the narrow amount of directly applicable clinical evidence. Reporting was uneven. Several sources described biological or clinical benefits without complete information on prespecified outcomes, intervention standardization, or adverse-event ascertainment, reducing confidence in cross-study comparison.

Risk-of-bias assessment

Appraisal was design-specific. Randomized comparative clinical studies were assessed using Cochrane RoB 2, and systematic reviews used for contextual interpretation were assessed using ROBIS. ROBINS-I and the Newcastle–Ottawa Scale were prespecified for eligible nonrandomized intervention studies and observational cohort or case–control studies, respectively; however, no studies meeting these design criteria were identified, and no artificial domain-level judgments were assigned.

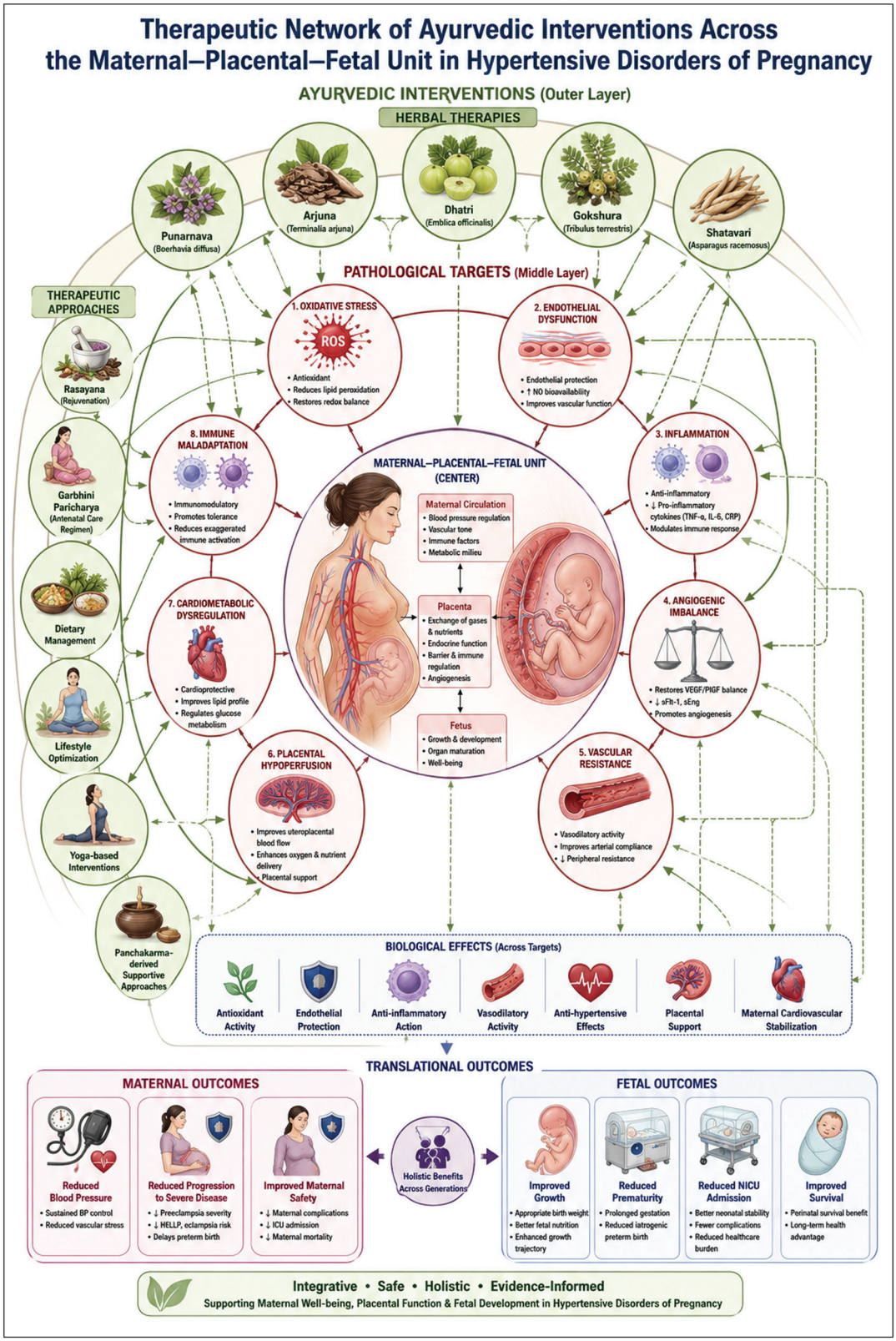


Figure 3: Therapeutic network of Ayurvedic interventions across the maternal–placental–fetal unit in hypertensive disorders of pregnancy

Guidelines, narrative reviews, mechanistic studies, and other sources not amenable to patient-level RoB assessment were retained for contextual interpretation only. Assessments were performed independently by two reviewers, with disagreements resolved by consensus or third-reviewer adjudication. Domain-level judgments and

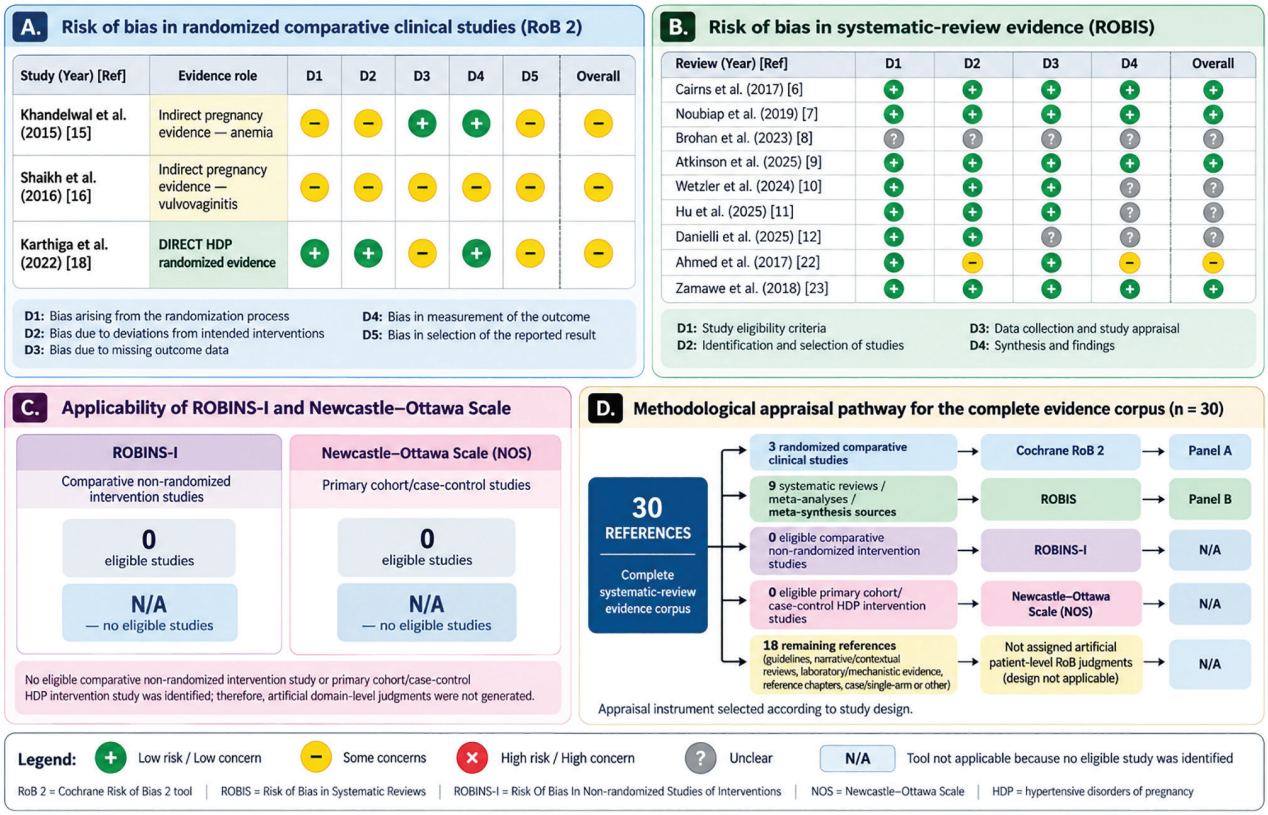


Figure 4: Multi-panel risk-of-bias and methodological appraisal of the evidence corpus

the design-specific methodological appraisal pathway are presented in supplementary Figure 4. Clinical, mechanistic, and contextual evidence was synthesized narratively because interventions, populations, designs, and outcomes were too heterogeneous for defensible statistical pooling.

Maternal outcomes

Clinically relevant maternal outcome domains are summarized in Table 2. Blood pressure, progression to severe disease, proteinuria, and major maternal complications remained the central outcomes against which any future Ayurveda-related intervention would need to be judged. These outcomes reflect established HDP management priorities described in contemporary guidance.[5,26,30] Within the primary integrative evidence, Karthiga *et al.*[18] reported favorable cardiometabolic findings and a lower occurrence of new-onset hypertension with yoga added to standard antenatal care in women at increased risk. This finding is clinically interesting but should not be read as evidence that yoga, herbal medicine, or another Ayurvedic intervention treats established preeclampsia. The distinction matters because the population was preventive rather than therapeutic. Evidence from nonpregnant hypertension[19] and general integrative antenatal care[13] was therefore interpreted only as supportive context.

Fetal and neonatal outcomes

Table 2 also maps fetal and neonatal outcomes considered clinically meaningful, including birth weight, preterm birth, neonatal intensive care admission, and perinatal mortality. These outcomes were consistently recognized in the broader HDP literature as consequences of worsening maternal disease and placental dysfunction.[8,9,29] Direct evidence that Ayurveda-specific treatment improves these outcomes in women with established HDP was not identified. The randomized yoga study[18] reported favorable fetomaternal and neonatal observations, but its preventive design and integrative intervention limit extrapolation. Accordingly, the fetal evidence was judged suggestive rather than confirmatory, and no causal claims were made for Ayurveda-specific improvement in growth, prematurity, neonatal morbidity, or survival.

Mechanistic and translational evidence

Mechanistic findings are summarized in Table 3 and integrated conceptually in Figure 2. Across experimental and review-based evidence, recurrent pathways included oxidative stress, endothelial dysfunction, angiogenic imbalance, inflammation, placental hypoperfusion, and increased vascular resistance.[1,3,4,27,28] Nasifah *et al.*[4] provided the clearest experimental link by demonstrating antioxidant activity of *P. granatum* extract in an endothelial model exposed to severe preeclamptic plasma. These findings support biological plausibility, not clinical effectiveness.

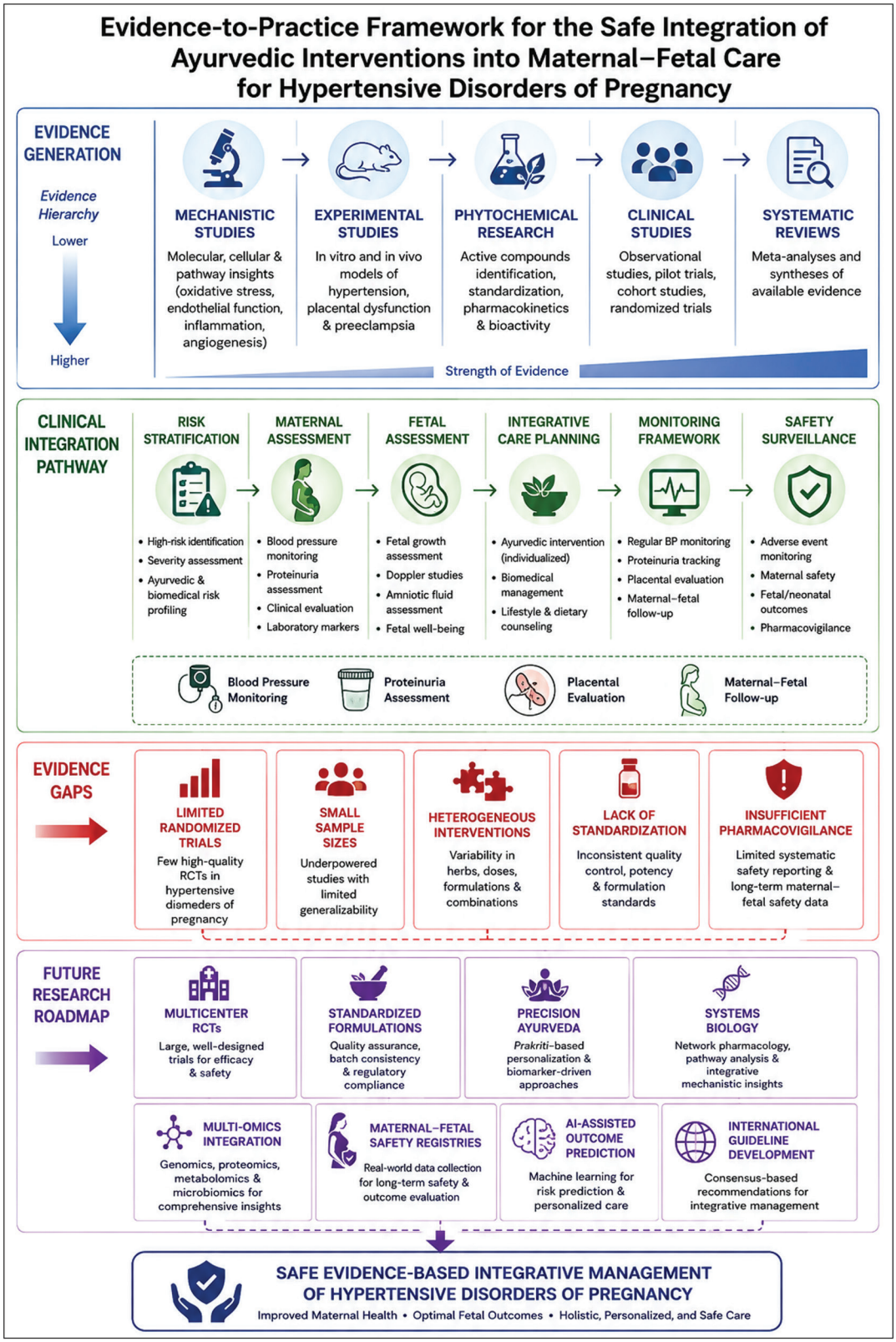


Figure 5: Evidence-to-practice framework for the safe integration of Ayurvedic interventions into maternal–fetal care for hypertensive disorders of pregnancy

Figure 3 extends this interpretation by depicting how Ayurvedic concepts and interventions might intersect with maternal–placental–fetal pathways. The network is therefore translational and hypothesis-generating; it should not be read as evidence that the depicted interventions have already been shown to prevent maternal or fetal complications.

Safety findings

Safety findings are summarized in Table 4. The literature revealed substantial uncertainty rather than reassurance. Reviews of herbal medicine use in pregnancy[22,23] described heterogeneous products, incomplete adverse-event reporting, and variable safety classification. Pregnancy-specific Ayurvedic reports provided some experience with intervention use, but most were small, indication-specific, or methodologically unsuitable for detecting uncommon maternal or neonatal harms. Absence of reported adverse events was therefore not treated as evidence of safety. The need for pharmacovigilance, standardized formulations, prospective fetal assessment, and clearer documentation of herb–drug interactions emerged repeatedly.

Evidence gaps and overall synthesis

The overall evidence pattern is brought together in Figure 5. The main gap was not a lack of theoretical mechanisms but a lack of adequately powered, disease-specific clinical trials in women with established HDP. Small samples, heterogeneous interventions, inconsistent formulation standards, and sparse long-term safety data further limited interpretation. The corpus therefore supports a cautious hierarchy of conclusions: mechanistic plausibility is stronger than clinical proof, contextual pregnancy experience is broader than HDP-specific evidence, and standard obstetric management remains the reference framework. Taken together, the findings identify a preliminary translational evidence base rather than an established therapeutic one. Future work should prioritize multicenter trials, standardized Ayurveda-related interventions, prespecified maternal–fetal outcomes, rigorous adverse-event surveillance, and transparent registration before clinical integration can be considered.

Discussion

Principal findings

The finding of this review is the striking imbalance between the breadth of literature surrounding HDP and the limited direct clinical evidence evaluating Ayurveda-related interventions in this setting. The screening pathway shown in Figure 1 yielded a final evidence corpus of 30 sources, but their evidentiary roles were not equivalent. As organized in Table 1, only a small fraction contributed primary clinical information relevant to prevention or management of HDP, whereas many others provided mechanistic, contextual, safety, or guideline-based support. This distinction is essential because a large literature base can create an impression of therapeutic maturity when, in fact, much of the evidence remains indirect.

The clinical framing therefore rests first on established obstetric evidence. Brown *et al.*[26] emphasized that HDP is a multisystem disorder involving placental dysfunction, vascular maladaptation, and maternal systemic responses rather than isolated elevation of blood pressure. Chappell *et al.*[29] similarly described preeclampsia as a syndrome arising from abnormal placentation and downstream maternal endothelial injury. These concepts are reflected in Table 2, where blood pressure, proteinuria, progression to severe disease, maternal complications, fetal growth, prematurity, neonatal intensive care admission, and perinatal survival appear as linked rather than separate.

Maternal and fetal implications

Direct intervention evidence was sparse. Karthiga *et al.*[18] provided the most relevant randomized evidence by examining yoga added to standard antenatal care among women at increased risk of gestational hypertension. Favorable cardiometabolic and fetomaternal findings were reported, but the study did not test treatment of established preeclampsia, nor did it evaluate an Ayurvedic herbal formulation. Its contribution is therefore best interpreted as preventive and integrative rather than disease-specific therapeutic evidence. Rakhshani *et al.*[13] offered broader support for holistic antenatal care, including lifestyle regulation and maternal well-being, yet their model was not HDP-specific.

The adverse fetal consequences of HDP are driven largely by placental dysfunction and disease severity, not merely maternal blood pressure. Atkinson *et al.*[9] showed that exposure to maternal HDP may carry longer-term neurodevelopmental implications, while Brohan *et al.*[8] highlighted the lasting vascular consequences for mothers after affected pregnancies. In this context, claims that an integrative intervention improves fetal growth, reduces prematurity, or lowers neonatal morbidity require direct pregnancy-specific evidence. Such evidence was not identified with sufficient consistency here. The outcome domains summarized in Table 2 should therefore be read primarily as clinically relevant targets for future trials rather than outcomes already proven to improve with Ayurveda-related care.

Biological plausibility and mechanistic integration

The mechanistic evidence is broader than the clinical evidence and helps explain why the topic remains scientifically interesting. Table 3 and Figure 2 place oxidative stress, endothelial dysfunction, angiogenic imbalance, inflammation, placental hypoperfusion, and increased vascular resistance within the same maternal–placental–fetal pathway. Phipps *et al.*[27] and Rana *et al.*[28] have described these mechanisms as central to preeclampsia pathogenesis. Their work provides a biological framework for considering traditional therapeutic hypotheses.

Within the Ayurveda-related literature, Wazib *et al.*[1] discussed medicinal plants with potential antioxidant, anti-inflammatory, endothelial-protective, and antihypertensive actions. Reddy *et al.*[3] focused more specifically on angiotensin-converting enzyme inhibition as a plausible vascular mechanism. Nasifah *et al.*[4] provided experimental evidence by demonstrating anti-lipid-peroxidation effects of *P. granatum* extract in endothelial cells exposed to plasma from women with severe preeclampsia. These findings are relevant, but they remain mechanistic. They cannot establish maternal benefit, fetal benefit, dose adequacy, or pregnancy safety.

Figure 3 illustrates this translational distinction well. It presents a network in which herbal therapies, Rasayana concepts, dietary measures, yoga, and broader supportive practices may intersect with oxidative, vascular, inflammatory, and placental pathways. The figure is hypothesis-generating, not a map of proven clinical effects. In clinical practice, HDP rarely behaves as a single-pathway disorder; vascular, metabolic, placental, and psychosocial problems often overlap, which is one reason multidimensional models are appealing. That clinical complexity, however, makes rigorous testing more necessary rather than less.

Clinical integration of Ayurveda

Any discussion of integration must remain anchored to standard obstetric care. Magee *et al.*[5] and the American College of Obstetricians and Gynecologists practice bulletin[30] provide clear frameworks for diagnosis, surveillance, blood-pressure management, prevention of severe complications, and timing of delivery. Nothing in the reviewed evidence supports replacing these measures with Ayurveda. This is particularly important in severe hypertension or preeclampsia, where treatment delay can have serious consequences.

At present, Ayurveda-related care is more defensibly considered a research question involving complementary strategies added to standard care. Yoga, nutritional support, stress reduction, and selected traditional approaches may justify further evaluation, but only within protocols that preserve indicated obstetric therapy and prospectively define maternal and fetal safety outcomes. The nonpregnant hypertension study by Hivale *et al.*[19] offers indirect support for antihypertensive plausibility, yet its population prevents direct application to pregnant women. Similarly, pregnancy studies involving anemia, vulvovaginitis, or threatened abortion provide experience with Ayurvedic interventions during pregnancy but cannot be used as evidence of efficacy in HDP.

Comparison with existing literature

The present synthesis differs from broader reviews of Ayurveda in obstetric care because it separates directness of evidence rather than treating all sources as clinically equivalent. Pisani-Conway[2] discussed Ayurveda within modern obstetrics, whereas Ahmed *et al.*[22] and Zamawe *et al.*[23] examined herbal medicine safety in pregnancy more broadly. These sources are useful for context, but they do not answer whether an Ayurveda-specific intervention improves HDP outcomes.

That distinction is central to interpreting Table 4. The major issues identified are not simply a shortage of publications but limited disease-specific trials, heterogeneous interventions, inconsistent formulation standards, and incomplete pharmacovigilance. These problems matter because pregnancy alters drug disposition, placental transfer, and fetal vulnerability. A treatment described as "natural" cannot be presumed safe, and the absence of reported adverse events is not equivalent to demonstrated safety.

Ethical and policy considerations

Ethical safeguards are especially important in pregnancy research. Any future trial must ensure that standard antihypertensive, anticonvulsant, or other indicated therapy is not withheld for the sake of a placebo or untreated comparator. Complementary interventions should be evaluated as additions to accepted care unless genuine clinical equipoise exists. Safety monitoring should include maternal adverse events, fetal growth, neonatal outcomes, and potential herb–drug interactions.

Figure 5 places these concerns within an evidence-to-practice pathway. The framework appropriately positions mechanistic research and early clinical observations below the threshold required for routine implementation, while highlighting standardization, multicenter trials, safety registries, and pharmacovigilance as prerequisites for progress. In that sense, the current evidence base is best viewed as translationally promising but clinically immature. The field has enough biological rationale to justify better studies, but not enough direct evidence to support routine therapeutic claims.

Strengths, limitations, and future directions

A principal strength of this review is its structured separation of direct clinical evidence from mechanistic, translational, and contextual literature. This distinction was particularly important because systematic reviews, clinical guidelines, non-HDP pregnancy studies, and experimental investigations could otherwise create an exaggerated impression of the clinical evidence supporting Ayurveda in HDP. Secondary sources were therefore used for clinical context and interpretation rather than treated as independent patient-level evidence, reducing the possibility of double counting. This review also incorporated design-specific RoB assessment and

considered maternal, fetal, neonatal, mechanistic, and safety outcomes within a common evidence framework.

Important limitations remain. Direct HDP-specific clinical evidence was sparse, with much of the available literature consisting of indirect, experimental, or contextual evidence. Considerable heterogeneity in populations, interventions, formulations, treatment duration, comparators, and outcome definitions precluded meaningful meta-analysis. The protocol was not prospectively registered in PROSPERO, which limits external verification of adherence to prespecified methods. To reduce selective outcome reporting, eligibility criteria and outcome domains were defined before data extraction, standardized extraction procedures were applied, and exclusions were documented systematically. Incomplete adverse-event reporting also means that the absence of reported harm cannot be interpreted as evidence of safety.

Future research should prioritize prospectively registered, adequately powered multicenter trials evaluating standardized Ayurveda-related interventions only as adjuncts to evidence-based obstetric care. Prespecified maternal–fetal outcomes, transparent reporting, appropriate comparators, standardized formulations, herb–drug interaction assessment, and active pharmacovigilance are essential. Long-term maternal and offspring follow-up would further determine whether any observed benefit extends beyond pregnancy.

Conclusion

HDP remain serious maternal–fetal conditions for which established obstetric management and timely surveillance are essential. This systematic review found that evidence supporting Ayurveda-related interventions in HDP is currently limited, heterogeneous, and predominantly indirect. Although experimental and mechanistic findings suggest biologically plausible effects involving oxidative stress, endothelial function, inflammation, vascular regulation, and placental physiology, these observations should not be interpreted as evidence of clinical efficacy. Direct pregnancy-specific evidence was sparse, and available studies do not establish Ayurvedic interventions as effective treatments for preeclampsia or gestational hypertension. Likewise, incomplete adverse-event reporting prevents firm conclusions regarding maternal or fetal safety. Ayurveda-related approaches should therefore not replace evidence-based obstetric treatment and, where investigated, should be evaluated only as carefully monitored complementary interventions. The present review provides a preliminary evidence framework that supports further investigation through prospectively registered, adequately powered clinical trials using standardized interventions, clinically relevant maternal–fetal outcomes, and rigorous pregnancy-specific pharmacovigilance.

Acknowledgments

The authors gratefully acknowledge all investigators whose published studies contributed to this review. No external writing assistance, editorial support, or professional medical writing services were used in the preparation of this manuscript.

Author contributions

Conceptualization and study design: INHS and WA. Literature search, screening, and data extraction: WA and AAGPW. Methodology and evidence synthesis: INHS, WA, and AANJK. Critical appraisal, interpretation of findings, and content review: AANJK and AS. Clinical interpretation and methodological supervision: TMR and WEKA. Manuscript drafting: JWG and WA. Manuscript revision and final approval: All authors. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

Data availability statement

All data analyzed during this study were obtained from previously published articles included in the reference list. No new datasets were generated or analyzed. All information supporting the findings of this review is available within the cited literature.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Declaration of generative artificial intelligence

The authors used digital and AI-assisted tools during the systematic review and manuscript preparation. Rayyan (Rayyan Systems Inc., Cambridge, MA, USA; web-based platform) was used for literature management, duplicate handling, and automation-assisted prioritization during title and abstract screening; however, all eligibility, inclusion/exclusion, full-text assessment, data extraction, and methodological appraisal decisions were independently reviewed and verified by the authors. Grammarly was used solely for grammar, language refinement, readability, and editorial refinement and was not used to generate or analyze scientific data, determine study eligibility, perform methodological appraisal, interpret findings, or formulate scientific conclusions. Figures and graphical materials were prepared using Canva and Adobe Creative Cloud, including Adobe Illustrator and Adobe Firefly, exclusively for graphical design, layout, formatting, and visual enhancement; AI-assisted graphical functions were not used to

generate, alter, analyze, or infer scientific data or results. Human oversight was maintained throughout all stages of the review and manuscript preparation. All AI-assisted outputs were critically reviewed and verified by the authors, who accept full responsibility for the originality, accuracy, integrity, scientific interpretation, and validity of the manuscript.

References

1. Wazib S, Ambardar Y, Quasimi H, Alam S, Afghan S, Alam MI. Potential therapeutic use of Indian medicinal plants for preeclampsia management. J Ayurveda Integr Med 2025;16:101218.
2. Pisani-Conway C. Ayurveda for modern obstetrics. Clin Obstet Gynecol 2021;64:589-601.
3. Reddy R, Baijnath S, Moodley R, Moodley J, Naicker T, Govender N. South African medicinal plants displaying angiotensin-converting enzyme inhibition: Potential use in the management of preeclampsia. J Ayurveda Integr Med 2022;13:100562.
4. Nasifah I, Soeharto S, Nooryanto M. Effects of anti-lipid peroxidation of *Punica granatum* fruit extract in endothelial cells induced by plasma of severe pre-eclamptic patients. J Ayurveda Integr Med 2017;8:215-7.
5. Magee LA, Smith GN, Bloch C, Côté AM, Jain V, Nerenberg K, *et al*. Guideline No. 426: Hypertensive disorders of pregnancy: Diagnosis, prediction, prevention, and management. J Obstet Gynaecol Can 2022;44:547-71.e1.
6. Cairns AE, Pealing L, Duffy JMN, Roberts N, Tucker KL, Leeson P, *et al*. Postpartum management of hypertensive disorders of pregnancy: A systematic review. BMJ Open 2017;7:e018696.
7. Noubiap JJ, Bigna JJ, Nyaga UF, Jingi AM, Kaze AD, Nansseu JR, *et al*. The burden of hypertensive disorders of pregnancy in Africa: A systematic review and meta-analysis. J Clin Hypertens (Greenwich) 2019;21:479-88.
8. Brohan MP, Daly FP, Kelly L, McCarthy FP, Khashan AS, Kublickiene K, *et al*. Hypertensive disorders of pregnancy and long-term risk of maternal stroke: A systematic review and meta-analysis. Am J Obstet Gynecol 2023;229:248-68.
9. Atkinson JA, Gordon HG, Tong S, Walker SP, Mehdipour P, Lindquist AC, *et al*. Hypertensive disorders of pregnancy and childhood neurodevelopment: A systematic review and meta-analysis. PLoS Med 2025;22:e1004558.
10. Wetzler SR, Wishlade T, Cates F, Kuhn I, Aiken CE. Lived experience of hypertensive disorders of pregnancy: A systematic review and meta-synthesis. Am J Obstet Gynecol MFM 2024;6:101494.
11. Hu H, Noori N, Lee V, Chow C, Cheung NW, Ekanayake K, *et al*. eHealth and hypertensive disorders of pregnancy: Systematic review. J Med Internet Res 2025;27:e77064.
12. Danielli M, Moothathamby T, Khanji MY, Wiles K, Gupta A. Current concepts in the management of hypertension in hypertensive disorders of pregnancy—A systematic review of international guidelines. Eur J Prev Cardiol 2025:zwaf373.
13. Rakhshani A, Nagarathna R, Sharma A, Singh A, Nagendra HR. A holistic antenatal model based on yoga, Ayurveda, and Vedic guidelines. Health Care Women Int 2015;36:256-75.
14. Roy A, Dwivedi MD. Right choice for iron deficiency anemia in pregnancy. Ayu 2014;35:283-8.
15. Khandelwal DA, Donga SB, Dei L. Clinical efficacy of Punarnava Mandura and Dhatri Lauha in the management of Garbhini Pandu (anemia in pregnancy). Ayu 2015;36:397-403.
16. Shaikh NMS, Dei L, Donga S. Dhatakyadi Varti—An effective local treatment for Upapluta Yonivyapad (vulvovaginitis during pregnancy): A standard controlled randomized clinical trial. Ayu 2016;37:98-104.
17. Roy A, Sen B, Vm M. Management of threatened abortion through Ayurvedic intervention: A case report. J Ayurveda Integr Med 2023;14:100783.
18. Karthiga K, Pal GK, Dasari P, Nanda N, Velkumary S, Chinnakali P, *et al*. Effects of yoga on cardiometabolic risks and fetomaternal outcomes are associated with serum nitric oxide in gestational hypertension: A randomized control trial. Sci Rep 2022;12:11732.
19. Hivale US, Bhatted SK, Bhojani MK, Bhusal N. A clinical study on the effect of Triphaladi Kala Basti with Arjuna Punarnavadi Ghanavati in the management of essential hypertension. Ayu 2018;39:250-5.
20. Sharma H, Chandola HM, Singh G, Basisht G. Utilization of Ayurveda in health care: An approach for prevention, health promotion, and treatment of disease. Part 2—Ayurveda in primary health care. J Altern Complement Med 2007;13:1135-50.
21. Karekar SR, Pooja SG, Marathe PA. A review of clinical studies involving pregnant women registered in the Clinical Trials Registry of India. Perspect Clin Res 2020;11:8-12.
22. Ahmed M, Hwang JH, Choi S, Han D. Safety classification of herbal medicines used among pregnant women in Asian countries: A systematic review. BMC Complement Altern Med 2017;17:489.
23. Zamawe C, King C, Jennings HM, Mandiwa C, Fottrell E. Effectiveness and safety of herbal medicines for induction of labour: A systematic review and meta-analysis. BMJ Open 2018;8:e022499.
24. Karrar SA, Martingano DJ, Hong PL. Preeclampsia. In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2026. Available from: https://www.ncbi.nlm.nih.gov/books/. [Last accessed on 14 Oct 2026].
25. Luger RK, Kight BP. Hypertension in pregnancy. In: StatPearls. Treasure Island, FL: StatPearls Publishing; 2026. Available from: https://www.ncbi.nlm.nih.gov/books/. [Last accessed on 14 Oct 2026].
26. Brown MA, Magee LA, Kenny LC, Karumanchi SA, McCarthy FP, Saito S, *et al*.; International Society for the Study of Hypertension in Pregnancy (ISSHP). Hypertensive disorders of pregnancy: ISSHP classification, diagnosis, and management recommendations for international practice. Hypertension 2018;72:24-43.
27. Phipps EA, Thadhani R, Benzing T, Karumanchi SA. Pre-eclampsia: Pathogenesis, novel diagnostics and therapies. Nat Rev Nephrol 2019;15:275-89.
28. Rana S, Lemoine E, Granger JP, Karumanchi SA. Preeclampsia: Pathophysiology, challenges, and perspectives. Circ Res 2019;124:1094-112.
29. Chappell LC, Cluver CA, Kingdom J, Tong S. Pre-eclampsia. Lancet 2021;398:341-54.
30. Gestational Hypertension and Preeclampsia: ACOG Practice Bulletin, Number 222. Obstet Gynecol 2020;135:e237-60.

हिंदी सारांश

गर्भावस्था के उच्च रक्तचाप संबंधी विकारों में आयुर्वेदिक चिकित्सा उपक्रमों के मातृ–भ्रूण परिणाम एवं सुरक्षा: एक व्यवस्थित समीक्षा

विकू एंडोनोटोपो, आई न्योमान हरियासा संजय, अनक अगुंग गेदे पुत्र विरादन्याना, अनक अगुंग नगुराह जया कुसुमा, अलॉयसियस सूर्यवान, थेरेसिया मोनिका रहार्डजो, जूलिया विंडी गुनाडी, वास्किता एकमहेश्वर कसुम्बा अंदानापुत्र

पृष्ठभूमि: गर्भावस्था के उच्च रक्तचाप संबंधी विकार, विशेष रूप से गर्भकालीन उच्च रक्तचाप और गर्भावस्था-विषाक्तता, मातृ एवं प्रसवकालीन रुग्णता के महत्वपूर्ण कारण बने हुए हैं। आयुर्वेद तथा उससे संबंधित समन्वित उपचार पद्धतियों का मातृ देखभाल में उपयोग किया जाता है, किंतु गर्भावस्था के उच्च रक्तचाप संबंधी विकारों में उनकी भूमिका अभी स्पष्ट नहीं है, क्योंकि प्रत्यक्ष नैदानिक साक्ष्य सीमित हैं और उपलब्ध साहित्य का बड़ा भाग क्रियाविधि-आधारित अथवा संदर्भात्मक प्रकृति का है।

उद्देश्य: गर्भावस्था के उच्च रक्तचाप संबंधी विकारों से संबंधित आयुर्वेद-आधारित हस्तक्षेपों के मातृ–भ्रूण परिणामों, सुरक्षा तथा जैविक संभाव्यता से जुड़े उपलब्ध साक्ष्यों का व्यवस्थित मूल्यांकन करना तथा प्रत्यक्ष नैदानिक साक्ष्यों को अप्रत्यक्ष एवं संदर्भात्मक साक्ष्यों से स्पष्ट रूप से अलग करना।

अध्ययन विधि: यह व्यवस्थित समीक्षा व्यवस्थित समीक्षाओं एवं समेकित विश्लेषणों के लिए निर्धारित अधिमान्य प्रतिवेदन दिशा-निर्देशों के अनुसार की गई। चिकित्सा एवं स्वास्थ्य-विज्ञान संबंधी अंतरराष्ट्रीय तथा आयुर्वेदिक शोध-संग्रहों में उनकी स्थापना से मई २०२५ तक उपलब्ध साहित्य की खोज की गई। पात्रता मानदंड जनसंख्या, हस्तक्षेप, तुलनात्मक उपचार, परिणाम तथा अध्ययन-रूपरेखा के आधार पर निर्धारित किए गए। गुणात्मक साक्ष्य-संश्लेषण में कुल ३० स्रोत सम्मिलित किए गए। प्राथमिक नैदानिक साक्ष्यों का मूल्यांकन क्रियाविधि-आधारित अध्ययनों और द्वितीयक संदर्भात्मक स्रोतों से अलग किया गया; समीक्षाओं तथा चिकित्सकीय दिशा-निर्देशों को स्वतंत्र रोगी-स्तरीय परिणाम-साक्ष्य के रूप में नहीं माना गया। अध्ययनों में पर्याप्त पद्धतिगत विविधता होने के कारण सांख्यिकीय समेकित विश्लेषण नहीं किया गया।

परिणाम: प्रत्यक्ष नैदानिक साक्ष्य अत्यंत सीमित पाए गए। प्रमुख यादृच्छिक अध्ययन में गर्भकालीन उच्च रक्तचाप के बढ़े हुए जोखिम वाली महिलाओं में मानक प्रसवपूर्व देखभाल के साथ योग के प्रभाव का मूल्यांकन किया गया, जबकि अन्य उपलब्ध साहित्य मुख्यतः जैविक संभाव्यता, गर्भावस्था-संबंधी सुरक्षा अथवा नैदानिक संदर्भ से संबंधित था। प्रस्तावित जैविक क्रियाविधियों में ऑक्सीकरणजन्य तनाव, रक्तवाहिका-अंतःस्तरीय विकार, सूजन, संवहनी विनियमन तथा अपरा-कार्य सम्मिलित थे। स्थापित गर्भावस्था-जनित उच्च रक्तचाप संबंधी विकारों के उपचार में औषधीय वनस्पतियों अथवा अन्य विशिष्ट आयुर्वेदिक हस्तक्षेपों के समर्थन में साक्ष्य अपर्याप्त थे तथा गर्भावस्था-विशिष्ट सुरक्षा संबंधी प्रतिवेदन असंगत पाए गए।

निष्कर्ष: वर्तमान साक्ष्य गर्भावस्था के उच्च रक्तचाप संबंधी विकारों के प्रभावी उपचार के रूप में आयुर्वेद की प्रभावकारिता स्थापित नहीं करते और न ही मानक प्रसूति प्रबंधन के स्थान पर इसके उपयोग का समर्थन करते हैं। इसके विपरीत, यह प्रारंभिक साक्ष्य-संश्लेषण उपलब्ध जानकारी को व्यवस्थित करता है और भावी अनुसंधान के लिए आवश्यक ज्ञान-अंतरालों की पहचान करता है। अतः योगदानकर्ताओं का यह कार्य भावी अग्रदर्शी अध्ययनों, मानकीकृत उपचार-विधियों तथा मातृ–भ्रूण औषधि-सुरक्षा निगरानी को दिशा प्रदान करने वाला एक प्रारंभिक साक्ष्य-मानचित्रण प्रयास है।