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Ethnopharmacological insights and clinical prospects of ten Indonesian medicinal plants for pregnancy, postpartum, and lactation: a systematic review

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ABSTRACT

Background: The perinatal period involves significant physiological and metabolic transitions, particularly concerning hypertensive disorders, preeclampsia, hemorrhage, lactation challenges, and oxidative stress. Although pharmacological therapies are available, their safety and accessibility remain inconsistent, especially in resource-limited settings. Indonesia's extensive biodiversity and deep-rooted ethnomedicinal traditions offer promising yet underutilized botanical alternatives. This study aimed to review the efficacy of Indonesian medicinal plants used in pregnancy, postpartum, and lactation.

Methods: This systematic review investigates ten Indonesian medicinal plants traditionally used during pregnancy, postpartum recovery, and lactation: *Sauropus androgynus, Curcuma longa, Moringa oleifera, Nigella sativa, Centella asiatica, Orthosiphon aristatus, Syzygium polyanthum, Andrographis paniculata, Solanum nigrum, and Zingiber officinale*. Literature from 2000 to 2025 was reviewed using PRISMA guidelines across global and regional databases. Phytochemical composition, mechanisms of action, therapeutic effects (e.g., antihypertensive, antidiabetic, galactagogue, hemostatic, antioxidant), and clinical relevance were critically evaluated.

Results: All ten plants demonstrated pharmacological potential relevant to perinatal health challenges. Notably, *Zingiber officinale* offers antiemetic and anti-inflammatory benefits during early pregnancy, complementing the lactogenic, antihypertensive, and wound-healing properties of other species. However, gaps persist in human trials, dosage standardization, and regulatory oversight.

Conclusion: The review highlights the importance of integrating validated traditional botanicals into perinatal care through interdisciplinary research, targeted clinical trials, and culturally responsive health policies. Bridging ethnopharmacology with maternal health systems offers a scalable, sustainable pathway toward maternal wellness and equity in Indonesia and comparable global settings.

Keywords: perinatal ethnopharmacology, Indonesian medicinal plants, pregnancy and postpartum care, lactation and galactagogues, herbal medicine, maternal health.

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INTRODUCTION

The perinatal period—encompassing pregnancy, postpartum, and lactation—is marked by dynamic physiological changes including hormonal modulation, glucose regulation, uterine recovery, and milk production. These transitions are often complicated by hypertensive disorders, gestational diabetes, postpartum hemorrhage, and lactation insufficiency, which remain leading contributors to maternal and neonatal morbidity globally. Although pharmacological treatments are available, their safety, affordability, and accessibility are often limited, particularly in low-resource settings.[1,2]

Indonesia, one of the most biodiverse nations on Earth, holds approximately 15.5% of global plant species and has a rich tradition of using medicinal plants in maternal health practices.[3] Figure 1 provides visual botanical depictions of the ten medicinal plants featured in this review. These illustrations, rooted in ethnobotanical accuracy, reinforce the cultural and clinical identities of each herb used across perinatal care. Among these, *Sauropus androgynus* (katuk), *Curcuma longa* (kunyit), and *Moringa oleifera* (kelor) are widely used to stimulate lactation, manage postpartum bleeding, regulate blood sugar, and enhance maternal recovery.[4–6]

Scientific investigations have supported many of these traditional uses. For instance, *S. androgynus* has demonstrated lactogenic effects through increased prolactin and oxytocin gene expression in animal and human studies.[4–9] It contains active compounds such as papaverine, flavonoids, and phytosterols that may also contribute to vascular relaxation and uterine recovery.[6,10] Similarly, *C. longa*, rich in curcumin, has been shown to exert potent anti-inflammatory, antioxidant, and antihypertensive effects via NF-κB and AMPK signaling pathways, with implications for managing preeclampsia and glycemic control.[11–15] Although human perinatal trials are limited, curcumin supplementation has shown benefits in animal models of gestational hypertension and uterine involution.[13,16]

Moringa oleifera, known for its high micronutrient and flavonoid content, has proven effective as a galactagogue and antihypertensive agent. Randomized controlled trials in Indonesia and the Philippines reported significantly increased breast milk volume and improved infant weight gain among women who consumed moringa extracts.[17–20] Furthermore, its potential to reduce blood pressure and improve insulin sensitivity offers additional value during pregnancy and lactation.[21–23]

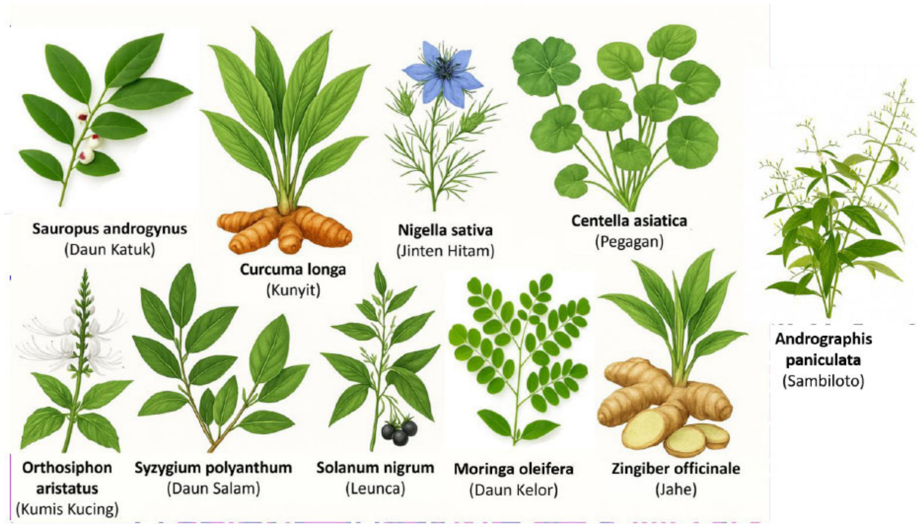

Figure 1. Botanical illustration of ten core Indonesian medicinal plants used in perinatal care.

Other plants such as *Nigella sativa*, *Orthosiphon aristatus*, and *Centella asiatica* have shown promising effects in reducing oxidative stress, controlling blood sugar, promoting wound healing, and modulating inflammatory markers.[24–31] These actions are pharmacologically relevant for preventing or managing conditions like preeclampsia, perineal trauma, and postpartum fatigue.

Zingiber officinale (jahe), widely consumed as a culinary and medicinal spice, has also demonstrated significant relevance to perinatal care. Its bioactive compounds—particularly gingerols and shogaols—exhibit antiemetic, antioxidant, and anti-inflammatory properties that have been shown to alleviate nausea and vomiting in early pregnancy, regulate cytokine expression, and reduce oxidative stress implicated in gestational hypertension and preeclampsia.[32,33]

Despite increasing pharmacological validation, existing reviews remain fragmented, often focusing narrowly on single therapeutic targets like lactation or glucose regulation. There is a notable gap in comprehensive, integrative reviews that explore multiple domains of plant efficacy throughout the perinatal timeline. Furthermore, few studies apply PRISMA-based methodology to evaluate safety, efficacy, and translational readiness in the context of Southeast Asian traditional medicine.

This systematic review aims to consolidate evidence published between 2000 and 2025 regarding ten Indonesian medicinal plants commonly used in perinatal care. It integrates ethnobotanical context, phytochemical mechanisms, and clinical data to provide a holistic foundation for evidence-based, culturally grounded applications in maternal health.

METHODS

This review adopted a narrative synthesis approach informed by the PRISMA 2020 guidelines to ensure transparency, reproducibility, and methodological rigor. Although no meta-analysis was conducted due to the heterogeneity of study designs and outcome measures, the structure adhered to systematic review principles by integrating diverse biomedical, ethnobotanical, and pharmacological sources of evidence.

The review aimed to identify and synthesize literature published between 2000 and 2025 on Indonesian medicinal plants traditionally or currently used in maternal care across the perinatal spectrum—namely, pregnancy, postpartum, and lactation. The focus was directed toward pharmacological

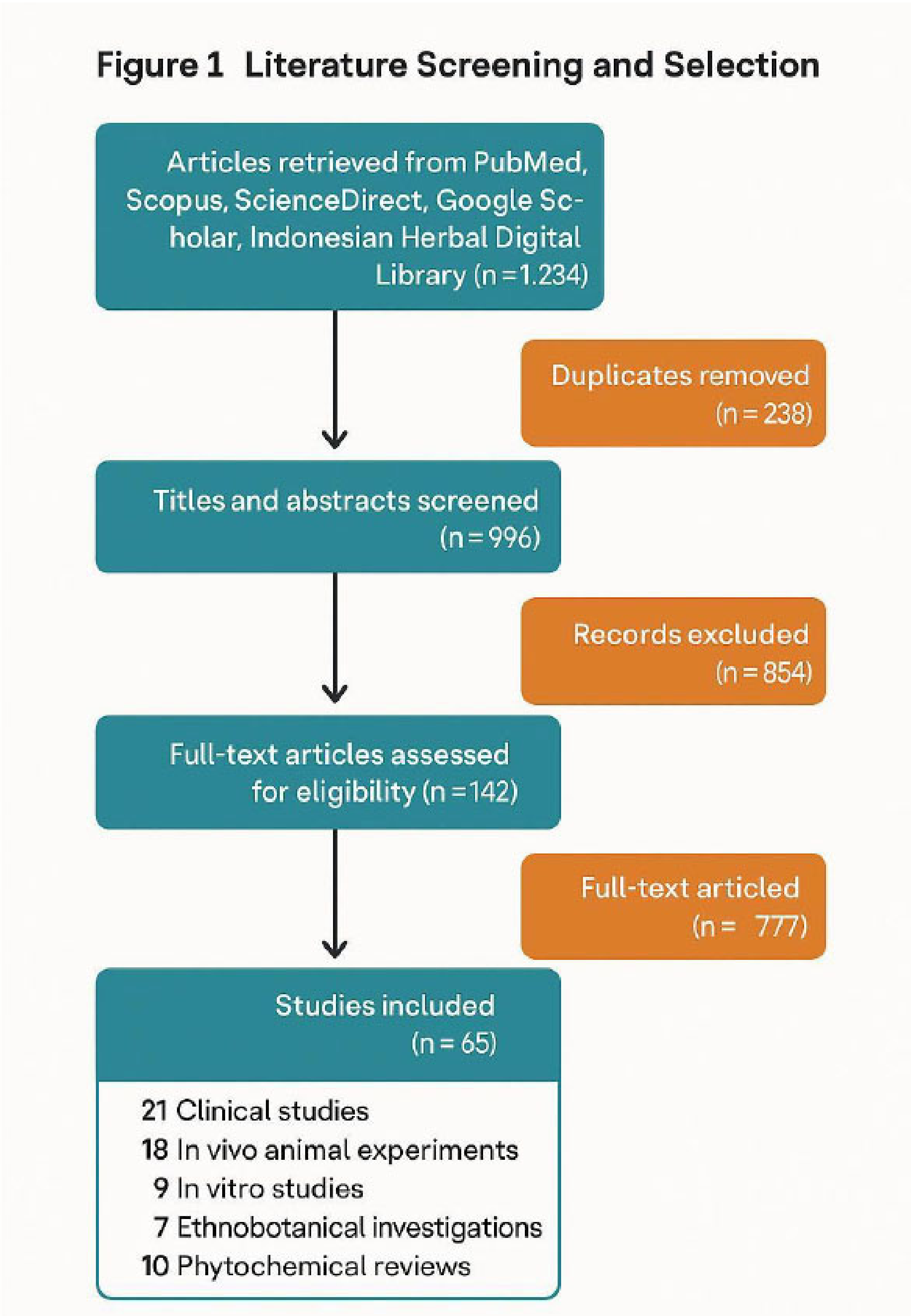

Figure 2. PRISMA 2020 flow diagram of literature screening and selection for Indonesian medicinal plants in perinatal care.

management of key maternal health conditions, including hypertension, preeclampsia, gestational diabetes, postpartum hemorrhage, lactation insufficiency, and oxidative stress, all of which are significant contributors to maternal and neonatal morbidity and mortality.

A comprehensive literature search was conducted across multiple databases, including PubMed/MEDLINE, Scopus, ScienceDirect, Google Scholar, and the Indonesian Herbal Digital Library. Search strategies employed combinations of MeSH terms and Boolean operators such as (“medicinal plants” OR “herbal medicine”) AND (“Indonesia”) AND (“pregnancy” OR “postpartum” OR “lactation”) AND (“hypertension” OR “preeclampsia” OR “diabetes” OR “bleeding” OR “lactation” OR “oxidative stress”). Terms were adapted appropriately for each database. Additional records were identified by manually screening the reference lists of relevant studies.

Studies were eligible for inclusion if they addressed any of the following ten medicinal plants in relation to perinatal health outcomes: *Sauropus androgynus*, *Curcuma longa*, *Moringa oleifera*, *Nigella sativa*, *Orthosiphon aristatus*, *Centella asiatica*, *Andrographis paniculata*, *Syzygium polyanthum*, *Solanum nigrum*, and *Zingiber officinale*. The included literature consisted of randomized controlled trials, observational studies, in vivo and in vitro experiments, ethnobotanical field studies, and review articles discussing phytochemical properties or maternal health relevance.

Studies were excluded if they addressed populations unrelated to perinatal care or assessed herbal mixtures in which plant-specific effects could not be differentiated. From an initial pool of 1,234 titles and abstracts, 65 full-text articles met the inclusion criteria after the removal of duplicates and assessment of relevance. The whole selection process was documented according to the PRISMA 2020 flow diagram (Figure 2).

Findings were analyzed through thematic synthesis across five domains: ethnobotanical usage, phytochemical composition, pharmacological mechanisms, clinical applications, and safety profiles. A detailed synthesis of these pharmacological mechanisms, including molecular targets and associated bioactive compounds, is summarized in Table 1. This table highlights how each plant exerts effects relevant to perinatal conditions such as oxidative stress, hypertension, and lactation insufficiency. Each plant was mapped to one or more phases of the perinatal timeline— pregnancy, postpartum, and lactation—based on its reported effects. A narrative format was employed to accommodate the diversity of the included evidence and to bridge traditional knowledge with biomedical insights. Visual aids, such as mechanistic schematics and summary comparison tables, were developed to support the clarity and translational potential of the findings.

Table 1. Phytochemical constituents and molecular mechanisms of action of 10 Indonesian medicinal plants in perinatal care

Herb	Major Bioactive Compounds	Pharmacological Class	Molecular Targets / Pathways	Mechanism Description	Perinatal Relevance
Curcuma longa[8–16]	Curcumin	Anti-inflammatory, antioxidant	NF-κB, Nrf2, AMPK	Suppresses inflammatory cytokines and enhances antioxidant defense	Reduces oxidative stress in preeclampsia; supports uterine recovery postpartum
Moringa oleifera[17–23]	Flavonoids, vitamin A, and iron	Galactagogue, antihypertensive, antioxidant	Prolactin gene expression, NO, and insulin signaling	Enhances milk production; regulates BP and glucose	Supports lactation and hypertensive control during pregnancy
Nigella sativa[24–27]	Thymoquinone	Anti-inflammatory, antidiabetic	NO, IL-6, insulin receptor	Improves endothelial function and insulin sensitivity	Useful in gestational diabetes and inflammation control postpartum
Centella asiatica[29–33]	Asiaticoside, madecassoside	Wound healing, anxiolytic	GABA, collagen synthesis, VEGF	Promotes tissue regeneration and reduces anxiety	Accelerates episiotomy healing; supports postpartum recovery
Orthosiphon aristatus[34–37]	Rosmarinic acid, sinensetin	Antihypertensive, diuretic	ACE inhibition, NO pathway	Improves vascular tone and fluid regulation	Supports BP management in pregnancy and postpartum edema
Syzygium polyanthum[38–41]	Eugenol, flavonoids	Antihypertensive, antidiabetic	ACE, NO, alpha-glucosidase	Enhances vasodilation and lowers glucose	Applicable in gestational hypertension and diabetes
Andrographis paniculata[42–46]	Andrographolide	Anti-inflammatory, antidiabetic	NF-κB, IL-6, GLUT4	Suppresses cytokines and improves insulin uptake	Promising in preeclampsia and glucose dysregulation
Sauropus androgynus[1–4]	Papaverine, flavonoids	Galactagogue, anti-inflammatory	Prolactin/oxytocin genes, dopaminergic inhibition	Stimulates lactation and reduces inflammation	Used for milk production and postpartum healing
Zingiber officinale[32,33]	Gingerol, shogaol	Antiemetic, antioxidant	Serotonin receptors, TNF-α, IL-6	Reduces nausea and inflammation	Effective for pregnancy nausea and uterine recovery
Solanum nigrum[47–51]	Steroidal saponins, flavonoids	Antioxidant, uterotonic	Estrogen receptor, NO	Mild estrogenic effect and oxidative stress modulation	Supports uterine involution and postpartum recovery

Note: (*) This table synthesizes core bioactive compounds and molecular mechanisms associated with each herb's perinatal application, based on referenced pharmacological studies. Molecular targets are linked to known pathways implicated in perinatal conditions such as hypertension, lactation insufficiency, and oxidative stress.

RESULTS

Literature Screening and Selection (PRISMA Summary)

From an initial pool of 1,234 articles retrieved across PubMed, Scopus, ScienceDirect, Google Scholar, and the Indonesian Herbal Digital Library, 238 duplicates were removed. This left 996 titles and abstracts for preliminary screening, of which 854 were excluded for irrelevance based on topic scope, plant specificity, or population mismatch. A total of 142 full texts were assessed in-depth, yielding 65 articles that met the inclusion criteria. These comprised 21 clinical studies, 18 in vivo animal experiments, 9 in vitro studies, 7 ethnobotanical investigations, and 10 phytochemical reviews. Each study was categorized by medicinal plant, pharmacologic action, and perinatal timing (pregnancy, postpartum, lactation). To facilitate comparison across studies, Table 2 summarizes the core characteristics of the included literature, including study type, perinatal indication, and key outcomes for each herb. A detailed summary is illustrated via the PRISMA 2020 diagram (Figure 1).

Sauropus androgynus

Sauropus androgynus is widely recognized in Indonesian maternal health traditions for enhancing lactation. Leaves are consumed in steamed dishes or decoctions. Mechanistically, this plant influences dopaminergic suppression and enhances oxytocin and prolactin gene expression, thereby increasing milk volume.[1–4] Clinical trials in lactating mothers demonstrate significant breastmilk enhancement.[3,5–7] The phytochemical content—papaverine, flavonoids, and phytosterols—also supports uterine tone and reduces inflammation. Though generally safe postpartum, long-term high-dose use has been associated with bronchiolitis obliterans, as seen in Taiwan.[4] Culinary doses remain culturally accepted, but prepartum safety data are limited.

Curcuma longa

Curcumin, the active compound in turmeric, acts through NF-κB and Nrf2 modulation, exhibiting antioxidant, antihypertensive, anti-inflammatory, and antidiabetic effects.[8–14] Preclinical models show reductions in blood pressure and glucose levels in preeclamptic and diabetic rats.[9,11] Postpartum applications in Indonesia include uterine cleansing and anemia reduction, often via jamu.[13,15] Although perinatal human trials are scarce, recent studies support curcumin's role in postpartum uterine recovery and hemoglobin improvement.[15–16] Early pregnancy use is cautioned due to uterotonic potential.

Moringa oleifera

Moringa leaves, rich in micronutrients like calcium, iron, vitamin A, and bioflavonoids, support postpartum nutrition and lactation.[17–20] RCTs show improved milk production and infant growth in mothers using Moringa supplements.[17,18,23]

Table 2. Literature summary by herb

Author	Herb	Perinatal Application	Study Type	Key Insight	Strength	Limitation
Soka et al. (2010)[1]	*Sauropus androgynus*	Lactation enhancement	In vivo (mice)	Upregulates prolactin and oxytocin gene expression	Molecular mechanism established	Preclinical only
Handayani et al. (2020)[6]	*Sauropus androgynus*	Milk volume increases	RCT (human)	Biscuit form improves breastmilk output	Human trial with measurable outcomes	Small sample size
Filardi et al. (2020)[8]	*Curcuma longa*	Antihypertensive, anti-inflammatory	Review	Curcumin acts via NF-κB, Nrf2 pathways	Broad biochemical mechanisms	Limited perinatal-specific trials
Madbouly et al. (2024)[15]	*Curcuma longa*	Uterine involution	Animal study	Ultrasound showed reduced uterine size postpartum	Objective imaging data	Animal model only
Fungtammasan & Phupong (2022)[17]	*Moringa oleifera*	Galactagogue	RCT (human)	Capsule form increased breastmilk in postpartum women	Strong RCT design	Short-term monitoring
Pareek et al. (2023)[19]	*Moringa oleifera*	Multiphase (nutrition, lactation, BP)	Review	Comprehensive pharmacologic profile	Cross-condition relevance	Narrative data only
Aliza et al. (2025)[26]	*Nigella sativa*	Post-cesarean lactation	Quasi-experimental	Oil increased milk volume	Direct postpartum focus	Limited to one delivery mode
Amartey et al. (2019)[25]	*Nigella sativa*	Anti-inflammatory, vascular	In vitro	Modulated cytokine expression in endothelial cells	Mechanistic insight	No clinical validation
Salsabila et al. (2025)[30]	*Centella asiatica*	Perineal wound healing	RCT (human)	Spray gel reduced healing time	Localized measurable effect	No systemic impact analysis
Brinkhaus et al. (2000)[29]	*Centella asiatica*	Wound, antioxidant	Review	Improves angiogenesis, fibroblast activity	Strong pharmacologic basis	Outdated review
Awale et al. (2003)[28]	*Orthosiphon aristatus*	Hypertensive postpartum	In vitro	Rosmarinic acid inhibits NO	Clear biochemical target	Early-phase evidence
Zhou et al. (2024)[35]	*Orthosiphon aristatus*	Nephroprotective postpartum	Animal study	Ferroptosis modulation in diabetic nephropathy	Targeted application	No human data
Osman et al. (2018)[38]	*Syzygium polyanthum*	Blood pressure regulation	Animal study	Extract reduced BP in hypertensive rats	Acute hypotensive effect	Unclear dose response
Panossian et al. (1999)[42]	*Andrographis paniculata*	Hormone modulation	Animal study	Reduced progesterone in pregnant rats	Endocrine relevance	Safety concerns in pregnancy
Lai et al. (2022)[32]	*Zingiber officinale*	Antiemetic in early pregnancy	Systematic review	Effective against nausea via 5-HT antagonism	Multiple trials included	Lacks dose unification
Sohrabipour et al. (2013)[47]; Chen et al. (2022)[48]	*Solanum nigrum*	Postpartum recovery, uterine involution, oxidative stress	Animal study; Pharmacological review	Steroidal saponins and flavonoids aid uterine tone and antioxidant response; possible galactagogue action.	Evidence of uterotonic and antioxidant effects in rodent models, linked to postpartum restoration	No perinatal human trials; unclear dosage standard; some steroidal effects require further safety evaluation

Note: This table summarizes representative studies for each of the 10 Indonesian medicinal plants with relevance to perinatal health, including study type, key application, and critical insights. Ref# corresponds to the full bibliography listed in the main manuscript.

Pharmacologically, it enhances prolactin and improves insulin sensitivity through antioxidant pathways.[19,21,22] Animal studies confirm reductions in gestational hypertension and oxidative damage.[19,22] It is employed across all perinatal phases, though variability in active compound levels warrants standardization.

Nigella sativa

Black seed is traditionally used as a postpartum for metabolic, lactogenic, and immune support. Thymoquinone acts via nitric oxide modulation and insulin receptor pathways.[24–27] Rodent models confirm antihypertensive and antidiabetic efficacy.[24–25] Human trials in postpartum women demonstrate increases in breastmilk and reduced inflammation.[26] Used from early postpartum, often mixed in honey or oil, it has high safety margins but limited data on prenatal use.

Centella asiatica

Renowned for wound healing, pegagan accelerates perineal recovery via triterpenoids like asiaticoside, which enhance fibroblast activity and angiogenesis.[29–32] RCTs report faster episiotomy healing and pain reduction.[30] Its anxiolytic properties, through GABAergic modulation, may benefit postpartum mood.[31] Though antioxidant and mild antihypertensive activity is also present, its most substantial clinical value lies in wound and neuro-recovery postpartum.[33]

Orthosiphon aristatus

This plant has nephroprotective and antihypertensive actions through rosmarinic acid and sinensetin content.[28,34–37] It promotes diuresis and blood pressure reduction, helpful in preeclampsia management. Animal studies confirm safety and efficacy in hypertensive pregnancy models.[35] Used traditionally postpartum for fluid balance;

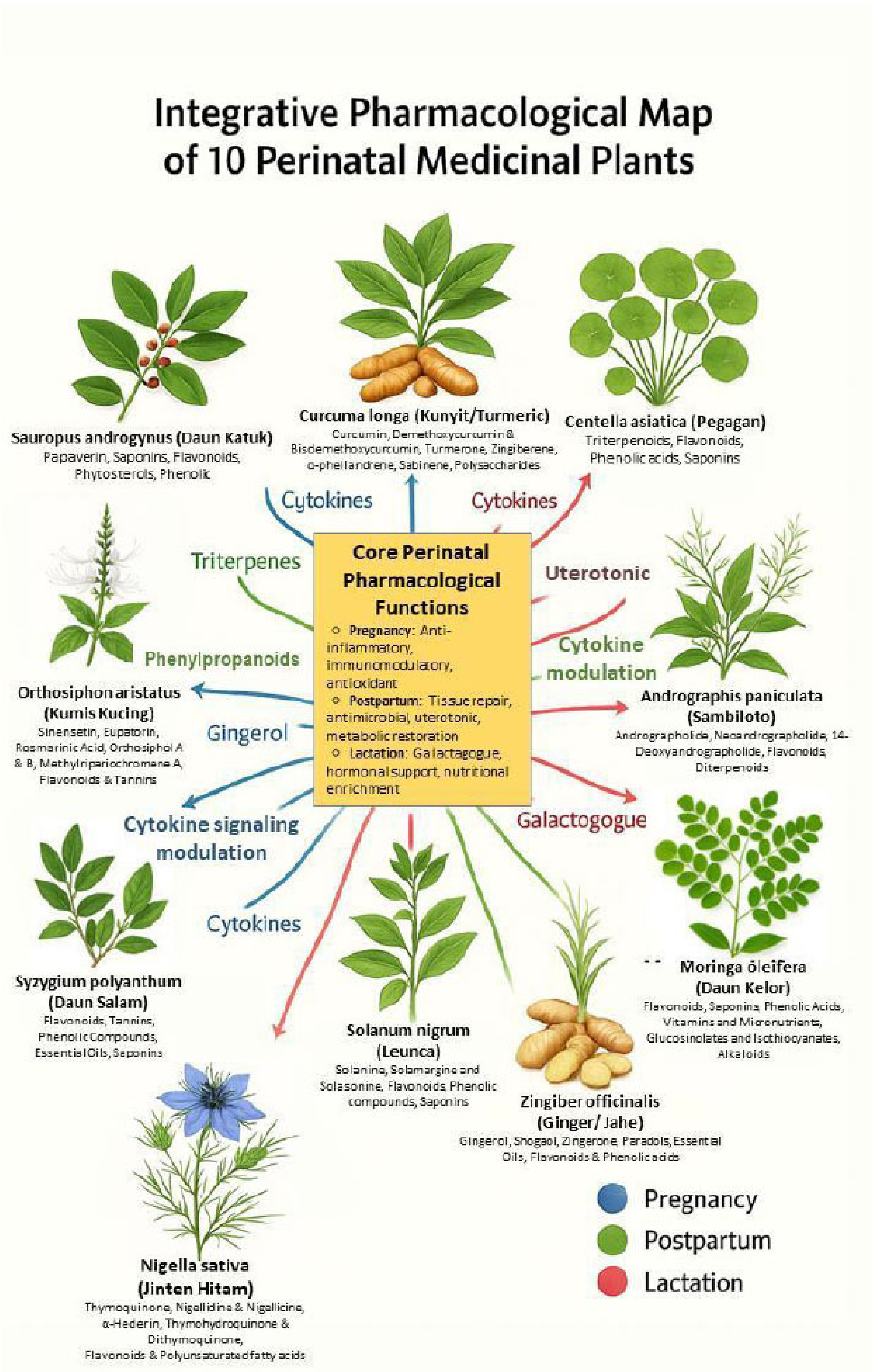

Figure 3. Integrative Pharmacological Map of Ten Indonesian Medicinal Plants in Perinatal Care.

its metabolic and renal benefits warrant deeper exploration.

Syzygium polyanthum

Widely used in both food and jamu, daun salam contains flavonoids and eugenol with antihypertensive, antidiabetic, and anti-inflammatory actions.[38–41] Extracts enhance nitric oxide production and reduce ACE activity, with proven glucose-lowering effects in diabetic models.[39] Though no perinatal human trials exist, its culinary use and postpartum adoption are culturally entrenched.

Andrographis paniculata

Andrographolide, the key compound in sambiloto, suppresses inflammatory mediators like IL-6 and NF-κB.[42–46] Preclinical studies suggest reductions in hypertension-related inflammation in pregnancy.[44] Though not commonly used during gestation due to abortifacient concerns, postpartum applications include fever and inflammation control. Human perinatal studies are lacking, making cautious integration advisable.

Solanum nigrum

Used in specific communities, leunca aids uterine involution and oxidative protection postpartum. Phytochemicals include steroidal saponins and flavonoids that offer antioxidant and mild estrogenic effects.[47–51] Animal studies confirm galactagogue activity and uterotonic effects.[47,48] Traditional preparations focus on ripe berries or decocted leaves. Human data are limited, but culturally informed usage aligns with known phytochemical profiles.

Zingiber officinale

Zingiber officinale, or ginger, is a widely utilized rhizome in Indonesian traditional medicine and cuisine, especially for managing nausea, inflammation, and postpartum fatigue. In the perinatal context, ginger is most recognized for its antiemetic properties, proven effective in reducing pregnancy-induced nausea and vomiting via antagonism of serotonin and cholinergic receptors in the gastrointestinal tract.[32,52–54] Clinical trials and meta-analyses consistently support its safety profile in early pregnancy, with no significant increase in adverse fetal outcomes when used within therapeutic limits.[53–55]

Beyond its gastrointestinal effects, ginger demonstrates antioxidant, anti-inflammatory, and antihypertensive activities, making it relevant to the prevention of pregnancy complications like preeclampsia and oxidative stress disorders.[33,55,56] Key constituents like gingerols and shogaols modulate inflammatory mediators such as TNF-α and IL- 6, and improve endothelial function, possibly impacting placental health and vascular tone.[32,55,56] Although

Table 3. Anti-inflammatory and cytokine modulation profiles of the 10 Medicinal Herbs

Herb Name	Anti-inflammatory Action / Cytokine Targets	Mechanistic Category	Evidence Type	Perinatal Relevance
Sauropus androgynus[1–4]	Inhibits IL-6, increases prolactin-mediated pathways	Endocrine-immunologic	RCTs, animal, in vitro	Supports postpartum lactation via immune-endocrine crosstalk
Curcuma longa[8–16]	Downregulates NF-κB, TNF-α, IL-6; boosts antioxidant enzymes	Antioxidant/Inflammatory	Meta-analyses, animal, molecular	Useful in preeclampsia, uterine involution, postpartum inflammation
Moringa oleifera[17–23]	Suppresses IL-1β, TNF-α; enhances antioxidant response	Metabolic-endocrine	RCTs, human, animal	Addresses gestational hypertension, boosts lactation and immunity
Nigella sativa[24–27]	Inhibits TNF-α, IL-6; enhances nitric oxide signaling	Immune-modulatory	Human trial, in vitro	Reduces inflammation post-CS, may aid lactation and BP
Centella asiatica[29–33]	Reduces proinflammatory cytokines via triterpenoid modulation	Wound/inflammatory	Clinical, in vivo	Accelerates wound healing, mood stabilization postpartum
Orthosiphon aristatus[28,34–37]	Decreases IL-1β, TNF-α via rosmarinic acid pathways	Cardio-renal inflammatory	In vivo, molecular	Controls fluid retention, hypertension in late pregnancy
Syzygium polyanthum[38–41]	Increases nitric oxide bioavailability, reduces ACE-mediated inflammation	Vascular-inflammatory	Animal, in silico	Modulates endothelial dysfunction in preeclamptic states
Andrographis paniculata[42–46]	Strong suppression of NF-κB, IL-1β, TNF-α	Immune-suppressive	Preclinical, in vitro	Inflammation control postpartum, caution in pregnancy
Solanum nigrum[47–51]	Steroidal saponins modulate estrogenic and inflammatory markers	Steroidal/antioxidant	Animal, phytochemical	Supports uterine involution, mild galactagogue effect
Zingiber officinale[32,33,52–55]	Gingerols/shogaols suppress IL-6, TNF-α; inhibit COX-2	GI-neuroendocrine inflammatory	Clinical trials, meta-reviews	Treats nausea in pregnancy, vascular inflammation control

Note: This table summarizes the cytokine, anti-inflammatory, and immunomodulatory effects of the ten perinatal herbs reviewed. Evidence types include randomized controlled trials (RCTs), in vivo animal models, in vitro assays, and molecular or meta-analytic findings. Perinatal relevance refers to stage-specific maternal applications: pregnancy, postpartum recovery, or lactation

Table 4. Safety profile, contraindications, and perinatal precautions of ten Indonesian medicinal plants

Herb	Safety Status	Contraindications	Trimester Relevance	Dosage Notes / Therapeutic Range	Toxicity / Adverse Events	Clinical Recommendation
Sauropus androgynus[1–7]	Generally safe postpartum	Avoid in respiratory disorders (risk of BO)	Postpartum use only	Safe in dietary doses; high doses linked to toxicity	Bronchiolitis obliterans at high dose	Cautious use; avoid during pregnancy
Curcuma longa[8–16]	Mildly uterotonic	Avoid in first trimester due to uterine stimulation	Postpartum; limited 2nd/3rd trimester	500–1000 mg/day curcumin safe short term	Rare GI upset; theoretical risk of miscarriage	Safe postpartum; avoid early pregnancy
Moringa oleifera[17–23]	Widely safe; RCT-backed	None significant; caution in hypotensive patients	All trimesters & lactation	Leaf extracts up to 2g/day well tolerated	Mild GI discomfort	Recommended in postpartum & lactation
Nigella sativa[24–27]	Generally safe postpartum	Avoid in autoimmune conditions	Postpartum & possibly late pregnancy	≤2g/day seed oil appears safe	Hepatotoxicity at very high doses	Caution in pregnancy; safe postpartum
Centella asiatica[29–33]	Safe topically; limited oral safety data	Not recommended orally in early pregnancy	Best for postpartum topical use	Topical: safe; oral: use ≤500 mg/day	High-dose hepatotoxicity in rodents	Favor topical forms postpartum
Orthosiphon aristatus[28,34–37]	Considered safe traditionally	Avoid in hypotensive patients	Late pregnancy/ postpartum	Safe decoction doses; no defined upper limit	Diuresis; electrolyte shifts	More safety studies needed
Syzygium polyanthum[38–41]	Safe in culinary doses	Possible additive hypotension	2nd/3rd trimester & postpartum	Leaf infusion used traditionally; human trials limited	None reported in moderate use	Cultural use supports inclusion
Andrographis paniculata[42–46]	Caution due to abortifacient activity	Contraindicated in pregnancy	Not recommended in pregnancy	≤1g/day andrographolide in trials	Abortifacient at high doses	Postpartum use only; avoid in pregnancy
Solanum nigrum[47–51]	Traditionally used; limited evidence	Avoid unripe berries (solanine content)	Postpartum use only	Decoction of ripe berries/leaves	Neurotoxicity at high doses	Use cautiously postpartum
Zingiber officinale[32,33,52–55]	Safe in therapeutic doses	May increase bleeding risk in late pregnancy	All trimesters (primarily 1st)	≤1g/day ginger root extract widely accepted	GI symptoms; uterine stimulation at high dose	Recommended for nausea; avoid excessive dose near labor

Note: BO = Bronchiolitis Obliterans; GI = Gastrointestinal; RCT = Randomized Controlled Trial. Safety profiles are based on literature and traditional knowledge but require ongoing pharmacovigilance

Table 5. Translational integration and policy readiness matrix for ten Indonesian medicinal plants in perinatal care

Herb Name	Traditional Use	Preclinical Evidence	Clinical Trials	Regulatory Recognition	Integration Potential
Sauropus androgynus[1–7]	Widely used postpartum for lactation	Strong evidence in rodent lactation models	Multiple RCTs in Indonesia	Recognized in local jamu systems	High
Curcuma longa[8–16]	Used for postpartum bleeding, recovery	Strong anti-inflammatory & antioxidant profiles	Few postpartum human trials	Registered in BPOM formulations	High
Moringa oleifera[17–23]	Used for lactation, nutrition	Multiple mechanisms validated	Multiple RCTs in humans	Included in WHO monographs	Very High
Nigella sativa[24–27]	Lactation support, metabolism	Validated in vivo for insulin and milk regulation	Some postpartum trials	Limited formal recognition	Medium
Centella asiatica[29–32]	Wound healing, mental recovery	Strong data on fibroblast stimulation	RCTs in postpartum wound healing	Formulated in topical agents	Medium–High
Orthosiphon aristatus[34–37]	Diuretic postpartum, hypertension	Moderate evidence for NO modulation	No perinatal-specific trials	Traditional use recognized	Low– Medium
Syzygium polyanthum[38–41]	Antihypertensive in food/jamu	Confirmed ACE inhibition in vitro/in vivo	No clinical perinatal trials	Culinary approval only	Medium
Andrographis paniculata[42–46]	Postpartum fever, immune support	Potent cytokine inhibition, GLUT4 effects	Safety review exists; few trials	Pharmacopoeial listings	Medium
Zingiber officinale[32,33,52–55]	Nausea relief, uterine tonic	Strong antiemetic & antioxidant support	Multiple pregnancy-safe RCTs	Globally accepted in guidelines	Very High
Solanum nigrum[47–51]	Uterine recovery, antioxidant	Mild galactagogue & estrogenic effects	Lacks formal human trials	Safety concerns at high dose	Low

Note: This table categorizes each herb's translational maturity across traditional use, preclinical validation, clinical trials, formal recognition, and practical readiness for public health integration in Indonesia. Source references are denoted numerically

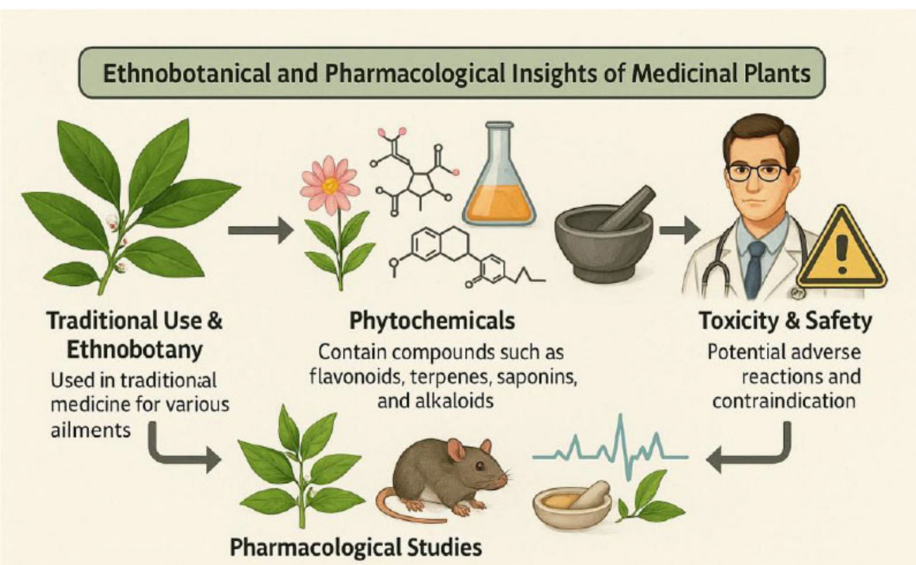

Figure 4. Translational roadmap from ethnobotany to policy for perinatal herbal medicine in Indonesia.

its galactagogue potential remains less documented, postpartum women in Indonesia frequently consume ginger-based jamu to enhance recovery and reduce uterine cramping.

Ginger is typically administered in decoction, extract, or encapsulated form, and is often combined with other herbs in polyherbal formulations. Its multifaceted therapeutic value—spanning from antiemetic to vascular and metabolic modulation—supports its inclusion in integrative perinatal strategies. However, high-dose use should be avoided near labor onset due to mild uterotonic effects reported in select preclinical studies. Given its high global acceptability, ginger stands as a key candidate for broader inclusion in maternal care protocols across both traditional and biomedical systems.[32,33,52–55]

DISCUSSION

Integrative Pharmacological Mechanisms Across the Perinatal Timeline

This review elucidates that Indonesian medicinal plants deliver a range of pharmacological effects tailored to the physiological needs of pregnancy, postpartum, and lactation phases. Sauropus androgynus and Moringa oleifera, for instance, enhance postpartum lactation predominantly via prolactin gene expression and endocrine antioxidant mechanisms.[1–3,5–7,17–18,20] Meanwhile, *Curcuma longa*, *Syzygium polyanthum*, *Nigella sativa*, and *Zingiber officinale* modulate systemic inflammation, vascular resistance, gastrointestinal motility, and glucose metabolism—pathways often dysregulated in hypertensive and preeclamptic pregnancies.[8–11,13–16,24–27,32,33,38–40,52–55] These therapeutic targets mirror known etiologies of perinatal complications, including oxidative stress, insulin resistance, and endothelial dysfunction.[33,53–55]

The pharmacological actions vary by plant:

Syzygium polyanthum enhances nitric oxide bioavailability and inhibits

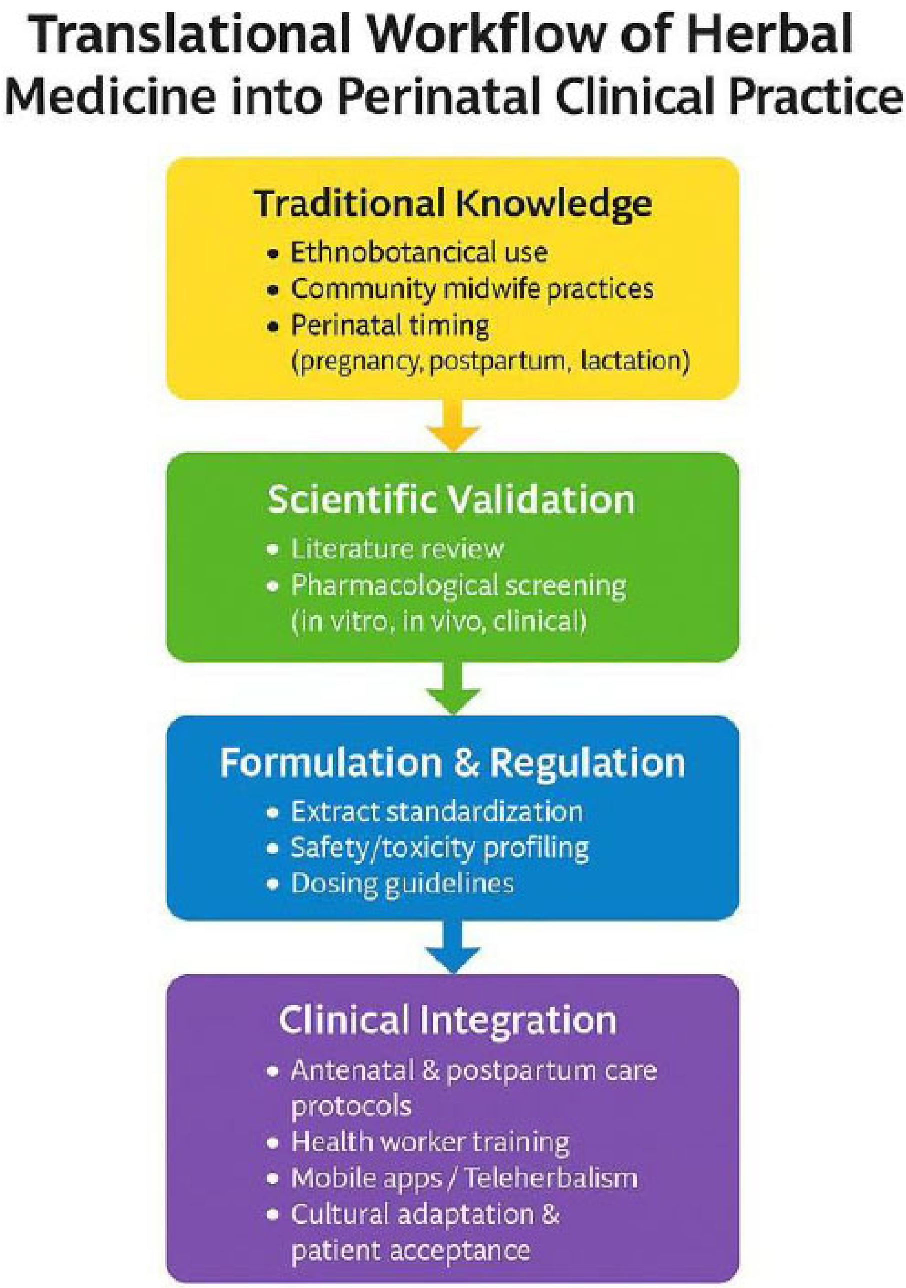

Figure 5. Translational workflow for integrating traditional perinatal herbal medicine into modern clinical practice.

ACE activity, *Sauropus androgynus* antagonizes dopaminergic pathways to increase prolactin, *Andrographis paniculata* suppresses proinflammatory cytokines like TNF-α and IL-6, and *Zingiber officinale* acts as an antiemetic and anti- inflammatory via serotonergic modulation and gingerol-mediated antioxidant pathways.[1–4,32,38,40,42,44–46,52–55] These mechanisms support a precision approach to maternal care, contingent on plant-specific safety thresholds and application timing. Figure 3 offers an integrative pharmacological map showing how each plant, its bioactive constituents, and molecular targets intersect across perinatal phases. This visual tool highlights overlapping and synergistic therapeutic domains. Table 3 further details the anti-inflammatory and cytokine modulation profiles of these herbs, providing mechanistic insight into how they influence maternal immune-endocrine balance. This comparative overview reinforces their role in mitigating perinatal inflammation and vascular dysfunction.

Safety and Clinical Readiness A Critical Gap

Given the variability in safety profiles across perinatal stages, Table 4 summarizes current knowledge on contraindications, dose thresholds, and toxicity data. It underscores the importance of trimester-specific precautions and culturally informed use. Despite encouraging phytopharmacological data, readiness for clinical translation is inconsistent. Moringa oleifera and Sauropus androgynus, supported by community trials, show efficacy in improving lactation and anemia.[3,5–7,17,18,20] In contrast, Andrographis paniculata and Solanum nigrum, despite promising in vitro results,[44,47–51] lack safety data for human pregnancy and lactation. Zingiber officinale, while widely used for pregnancy-related nausea, requires dosage clarity and safety validation in vulnerable perinatal populations.[33,53–55] These inconsistencies highlight the necessity for well-designed human studies, including teratogenicity tests and perinatal dose-finding trials.

Cultural trust in herbs like *Orthosiphon aristatus* and *Centella asiatica* remains strong among traditional birth attendants yet they remain outside formal clinical pathways.[28–31,34–37] Inclusion will require regulatory guidelines, phytochemical standardization, and health worker training. Bridging this gap means aligning biomedical rigor with established traditional practices.

Cultural Relevance and Health Equity

Validated traditional botanicals can fill maternal healthcare gaps in rural, low-resource settings. For communities with minimal access to pharmaceuticals, these herbs already serve frontline roles. Integrating them into formal systems supports maternal health equity while preserving ethnobotanical heritage.[29,56]

By documenting safety and efficacy, these traditions gain legitimacy within public health systems. Such integration fosters South-South health innovation, positioning Indonesia as a model for culturally grounded perinatal care anchored in both ancestral wisdom and scientific validation.

Research Gaps and Policy Translation

Key research gaps persist. Data are scarce regarding herb-drug interactions, pregnancy trimester-specific safety, and long-term outcomes. Studies rarely account for comorbid conditions like gestational diabetes or preeclampsia—despite evidence that oxidative stress and mitochondrial dysfunction underpin these disorders.[53–55]

Policy advancement requires a national perinatal herbal research registry, public trial databases, and stronger collaboration between biomedical and traditional medicine stakeholders. Table 5 presents a policy readiness matrix that aligns traditional use and preclinical evidence with regulatory inclusion potential. This matrix offers a pragmatic tool for prioritizing herbs in future integrative health frameworks. The Indonesian Ministry of Health's jamu roadmap offers a starting point but must expand to include maternal safety guidelines and usage protocols. To visualize this progression, Figure 4 presents a translational roadmap that charts the flow from traditional ethnobotanical knowledge through to clinical policy integration—outlining key checkpoints for regulatory approval and community implementation.

Ethical Considerations and Clinical Implications

Ethically, maternal herbal medicine use mandates robust informed consent, especially in vulnerable populations. Herbal interventions should never be framed as "natural" alternatives without clear efficacy data. Ensuring safety requires enhanced pharmacovigilance, particularly in populations with limited access to conventional obstetric care.

Clinically, the future lies in integrative models that treat botanicals as evidence-based adjuncts—not substitutes—for pharmaceuticals. Medical professionals must be equipped with training on herbal pharmacodynamics, contraindications, and interactions. Such preparedness will safeguard patients while honoring Indonesia's therapeutic heritage. Figure 5 illustrates a stepwise workflow for translating traditional perinatal herbal practices into clinical protocols. It emphasizes safety validation, standardized formulations, and eventual integration into maternal health systems and national policies.

A Call to Action

This review urges a reimagining of maternal herbal medicine—from folklore to formalized evidence-based practice. Researchers must accelerate the translation of laboratory insights into clinical implementation. Policymakers should prioritize regulatory inclusion of validated botanicals in national perinatal strategies. And journals must champion scholarship on ethnopharmacology from regions like Southeast Asia, where plant-based healthcare remains vital.

Ultimately, interdisciplinary collaboration across traditional healers, scientists, clinicians, and policymakers can realize the full potential of Indonesian medicinal plants in safe, equitable, and culturally attuned maternal care.

Strengths, Limitations, And Future Directions

Strengths of This Review This review presents the first PRISMA-guided narrative synthesis dedicated to Indonesian medicinal plants in the context of perinatal health. By spanning literature from 2000 to 2025 and integrating ethnobotanical tradition, phytochemistry, pharmacology, and clinical evidence, it delivers a comprehensive, multidomain evaluation of ten key plants. Importantly, it addresses a broad range of perinatal conditions—hypertension, preeclampsia, hemorrhage, lactation failure, and oxidative stress—while aligning each botanical intervention with the maternal timeline: pregnancy, postpartum, and lactation.

A significant strength lies in its methodological transparency. By adhering to PRISMA guidelines while retaining the narrative flexibility to interpret diverse findings, the review balances academic rigor with contextual depth. Furthermore, the structured synthesis format and visual tools developed here offer a transferable framework for similar ethnopharmacological inquiries in other biodiversity-rich regions. Through this approach, the review establishes a critical bridge between traditional Indonesian medicine and modern maternal health innovation.

Limitations of the Current Evidence Base Despite its integrative scope, the review is constrained by several limitations. First, heterogeneity across study types—ranging from in vitro assays to observational fieldwork— precluded formal meta-analysis. Variability in study design, dosage, outcome measures, and sample populations complicates efforts to generalize results to real-world clinical perinatal contexts.

Second, while a few plants (e.g., Moringa oleifera, Sauropus androgynus) are supported by randomized controlled trials, most of the included studies were preclinical or observational, often lacking dosage specificity, trimester relevance, or long-term outcome assessment. This imbalance restricts the immediate translational potential of the findings.

Additionally, limitations in accessibility and indexing of local Bahasa Indonesia studies may have introduced language bias. Some relevant traditional knowledge—passed orally or captured in non-indexed repositories—was not retrievable, potentially excluding important cultural insights. Moreover, the practice of administering multi-herb jamu formulas made it difficult in some cases to isolate the specific effects of individual plant constituents.

Another challenge is the lack of pharmacokinetic standardization. Differences in plant species, growing conditions, preparation techniques, and extraction solvents generate inconsistencies in bioactive content, limiting reproducibility and dosage formulation for clinical use.

Future Directions for Research, Clinical Trials, and Policy Moving forward, the most promising avenue is the establishment of interdisciplinary research consortia focused on perinatal ethnopharmacology. Initial clinical trials should prioritize plants with existing safety data—such as Moringa oleifera and Sauropus androgynus—with objectives that include dose-ranging, pharmacokinetics, and trimester-specific safety profiling. These studies should incorporate not only biomedical outcomes but also culturally resonant indicators such as breastfeeding satisfaction, postpartum vitality, and community perception.

In parallel, Indonesia must establish pharmacovigilance and toxicovigilance frameworks for herbal use in pregnancy and lactation. These systems should involve national herbal safety registries, integration into midwifery and health provider education, and structured reporting of adverse events. Collaborative research with traditional healers and community midwives will be critical to ensure culturally competent, ethically grounded, and widely accepted practices.

On the policy level, development of standardized perinatal herbal formularies—curated and updated by the Indonesian Ministry of Health—could provide a global model for integrating culturally rooted botanicals into formal maternal care. Such formularies must be informed by rigorous evidence, reviewed regularly, and governed ethically. Global funding agencies and academic journals should also prioritize maternal ethnopharmacology as a strategic research domain that advances both health equity and biodiversity-based innovation.

By combining scientific rigor with cultural respect, Indonesia has the opportunity to lead in shaping a new model of integrative, ethical, and sustainable maternal healthcare—one grounded in ancestral knowledge and validated by modern science.

CONCLUSION

This review underscores the significant yet underleveraged potential of Indonesia's ethnobotanical resources to contribute meaningfully to evidence-based perinatal care. The ten medicinal plants explored—*Sauropus androgynus, Curcuma longa, Moringa oleifera, Nigella sativa, Centella asiatica, Orthosiphon aristatus, Syzygium polyanthum, Andrographis paniculata, Solanum nigrum,* and *Zingiber officinale*—demonstrate diverse pharmacological activities, including antihypertensive, antidiabetic, hemostatic, galactagogue, anti- inflammatory, and antioxidant effects. These bioactivities correspond closely to the physiological demands and complications observed across pregnancy, postpartum recovery, and lactation.

The evidence supports a strong rationale for advancing selected plants—particularly those with favorable safety profiles and preliminary clinical data—into translational research and policy frameworks. In resource- constrained settings, where access to conventional pharmaceuticals is limited and cultural alignment enhances compliance, these botanicals offer practical, acceptable, and potentially transformative maternal health interventions.

While preclinical findings are encouraging, the current lack of robust human trials—especially those addressing dose standardization, trimester-specific safety, and herb-drug interactions—remains a key barrier to clinical integration. Nonetheless, the accumulated data provide a foundation for regulatory innovation and community-driven health strategies.

Going forward, the integration of Indonesian medicinal plants into modern perinatal care must be informed by rigorous clinical research, supported by interdisciplinary collaboration, and governed by ethically sound policies. Such a model honors intergenerational wisdom while delivering scientifically grounded, culturally relevant solutions— advancing maternal health equity both nationally and globally.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

ETHICAL CONSIDERATION

Not applicable.

AUTHORS' CONTRIBUTIONS

INHS, WA, and MAB conceptualized and supervised the review. JD, MBAP, and RSM contributed to literature collection and data extraction. ESP, MIIA, TMR, and AS participated in data analysis and critical content review. BR, CMY, DA, NB, and AAGPW were involved in reviewing ethnobotanical and pharmacological evidence. SS, MS, and AK provided methodological and clinical guidance. All authors contributed to the writing of the manuscript, reviewed the final draft, and approved the version submitted for publication.

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