

## REVIEW ARTICLE

# Effectiveness of non-pharmacological treatments in lowering blood pressure in pregnant women with hypertension: A systematic review

DOI: 10.29063/ajrh2026/v30i1.14

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## Abstract

Hypertension in pregnant women is a leading cause of maternal morbidity and mortality globally, particularly in developing countries. This systematic review evaluates the effectiveness of non-pharmacological treatments in reducing blood pressure in pregnant women with hypertension. The articles analyzed were sourced from multiple databases between 2013 and 2023, focusing on hypertensive disorders in pregnancy and non-pharmacological treatments. After screening and eligibility assessment, six relevant studies were included. The results revealed that non-pharmacological interventions, such as yoga therapy, Qur'anic recitation (Murottal therapy), lavender aromatherapy combined with classical music, the Go-Yoga application, and foot massage with warm water immersion infused with lemon, effectively lowered blood pressure in pregnant women. These interventions primarily work by promoting relaxation, reducing stress, and improving cardiovascular function and hormonal balance. In conclusion, non-pharmacological treatments offer safe and effective alternatives for managing hypertension during pregnancy. However, further research with larger sample sizes is needed to confirm their long-term safety and efficacy. (*Afr J Reprod Health* 2026; 30 [1]: 124-138).

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**Keywords:** Pregnancy hypertension, non-pharmacological treatment, yoga, murottal, aromatherapy, foot massage

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## Résumé

L'hypertension chez les femmes enceintes est l'une des principales causes de morbidité et de mortalité maternelles dans le monde, en particulier dans les pays en développement. Cette revue systématique évalue l'efficacité des traitements non pharmacologiques pour réduire la tension artérielle chez les femmes enceintes hypertendues. Les articles analysés proviennent de plusieurs bases de données entre 2013 et 2023, se concentrant sur les troubles hypertensifs pendant la grossesse et les traitements non pharmacologiques. Après sélection et évaluation de l'éligibilité, six études pertinentes ont été incluses. Les résultats ont révélé que les interventions non pharmacologiques, telles que la yogothérapie, la récitation coranique (thérapie Murottal), l'aromathérapie à la lavande associée à la musique classique, l'application Go-Yoga et le massage des pieds par immersion dans de l'eau chaude infusée au citron, ont efficacement réduit la tension artérielle chez les femmes enceintes. Ces interventions agissent principalement en favorisant la relaxation, en réduisant le stress et en améliorant la fonction cardiovasculaire et l'équilibre hormonal. En conclusion, les traitements non pharmacologiques offrent des alternatives sûres et efficaces pour la prise en charge de l'hypertension pendant la grossesse. Cependant, des recherches supplémentaires sur des échantillons plus importants sont nécessaires pour confirmer leur innocuité et leur efficacité à long terme (*Afr J Reprod Health* 2026; 30 [1]: 124-138).

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**Mots-clés:** Hypertension de grossesse, traitement non pharmacologique, yoga, murottal, aromathérapie, massage des pieds

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## Introduction

Hypertension in pregnancy is one of the leading causes of maternal morbidity and mortality worldwide, especially in developing countries, where access to maternal healthcare still faces many significant challenges<sup>1</sup>.

Based on data from the World Health Organization (WHO), approximately 10% of pregnant women experience hypertension, which includes preeclampsia and gestational hypertension (GH)<sup>2</sup>. Pregnant women with hypertension are at risk of experiencing various complications, affecting both the mother and the fetus, such as impaired fetal

growth, premature birth, and an increased risk of eclampsia<sup>3</sup>.

The incidence of hypertension in pregnant women in Indonesia and India is a major public health concern. In India, the prevalence of hypertension in pregnancy ranges from 10-15%<sup>4</sup>. Meanwhile, in Indonesia, the incidence of preeclampsia and hypertension in pregnant women is estimated to be 8-10%<sup>5</sup>. The high incidence of hypertension during pregnancy in these countries is influenced by several factors, including socio-economic conditions, limited access to health services, and unhealthy lifestyles. In India, high social inequality, particularly in rural areas, restricts pregnant women's access to adequate prenatal care. Additionally, low public awareness of the importance of routine pregnancy checkups, high-salt diets, frequent consumption of processed foods, and low levels of physical activity contribute to an increased risk of hypertension. Similar factors are observed in Indonesia, where geographical barriers and limited health facilities in remote areas pose significant challenges to providing maternal healthcare. Low socioeconomic conditions and education levels also increase the vulnerability of pregnant women to complications such as preeclampsia due to hypertension<sup>6</sup>.

Hypertension in pregnant women is caused by physiological changes and dysfunction of the vascular endothelium, leading to increased systemic vascular resistance and elevated blood pressure. Several risk factors contribute to hypertension, including maternal age (either too young or too old), obesity, a previous history of hypertension, and first-time pregnancy<sup>1</sup>. Elevated placental hormone levels can affect blood pressure regulation. If left uncontrolled, hypertension can progress to preeclampsia, which is characterized by proteinuria and organ dysfunction. Untreated preeclampsia may lead to eclampsia, a life-threatening condition for both the mother and fetus<sup>7</sup>. Therefore, early blood pressure monitoring during pregnancy is very important for preventing complications<sup>8</sup>.

Cultural beliefs, dietary habits, and public perceptions in India and Indonesia also contribute to the prevalence of hypertension in pregnant women. In India, traditional diets rich in salt, fat, and spices may influence blood pressure levels

during pregnancy. Moreover, the widespread perception that pregnancy does not require routine medical check-ups hinders early detection of hypertension<sup>9</sup>. Similarly, in Indonesia, the tradition of consuming salty and fried foods, combined with limited physical activity due to the belief that pregnant women should rest more, increases the risk of hypertension<sup>10</sup>. Both countries face challenges related to low public awareness of the importance of maintaining a healthy diet during pregnancy<sup>11</sup>.

Educating pregnant women about hypertension management is essential to reducing the risk of complications such as preeclampsia and premature birth. Pregnant women who understand the importance of routine antenatal check-ups, healthy diets, and stress management techniques are better equipped to prevent and manage hypertension. Studies show that community-based education, such as counselling by midwives and health workers in rural areas, effectively increases pregnant women's knowledge about hypertension risks and the importance of early detection<sup>12</sup>. Additionally, digital platforms, such as health applications and educational videos, have been shown to enhance awareness among urban pregnant women about maintaining normal blood pressure<sup>13</sup>. Therefore, innovative and culturally relevant education strategies are essential to ensure that pregnant women from diverse backgrounds receive accurate information to safeguard maternal and fetal health. Studies indicate that the incidence of hypertension in pregnant women is higher among individuals with limited knowledge about a healthy lifestyle and the importance of antenatal check-ups<sup>14</sup>.

Hypertension in pregnant women has significant health implications for both the mother and baby and increases the risk of pregnancy complications. Hypertension can lead to severe conditions such as preeclampsia, eclampsia, premature birth, and even maternal and fetal mortality. Additionally, this condition affects fetal growth, often resulting in low birth weight and neonatal developmental disorders<sup>15</sup>. For mothers, hypertension during pregnancy is associated with a higher risk of cardiovascular disease, including chronic hypertension and stroke. On a broader scale, hypertension in pregnancy also imposes a

financial burden on the healthcare system and reduces the quality of life for mothers and their families. Therefore, early detection, proper management, and ongoing education are very important for preventing and minimizing the adverse effects of hypertension during pregnancy<sup>16</sup>.

Management of hypertension in pregnant women in India aligns with government policies aimed at improving access to and quality of maternal healthcare. The Pradhan Mantri Surakshit Matritva Abhiyan (PMSMA) program provides free pregnancy check-ups, including blood pressure monitoring, at community health centers every month. Additionally, the Indian government has strengthened health worker training programs to improve early detection and management of hypertension and preeclampsia. Furthermore, the Janani Suraksha Yojana (JSY) program offers financial incentives to pregnant women from low-income families, encouraging facility-based deliveries to reduce hypertension-related risks<sup>17</sup>.

Similarly, in Indonesia, government policies prioritize the management of hypertension in pregnant women through various maternal and child health programs. One such initiative is the Healthy Indonesia Program with a Family Approach (PIS-PK), which aims to monitor pregnant women, including those with hypertension, through home visits by health cadres and village midwives. The government also integrates antenatal care (ANC) services, providing routine blood pressure checks, education on healthy dietary practices, and nutritional supplements, such as calcium and iron, to prevent hypertension-related complications<sup>18</sup>.

Various non-pharmacological treatment strategies, such as relaxation therapy, yoga, acupressure, and lifestyle modifications, have demonstrated effectiveness in lowering blood pressure in the general population<sup>19</sup>. Hypertension in pregnant women can be managed through non-pharmacological treatments, such as lifestyle changes and nutritional interventions. Studies indicate that adopting a healthy diet, such as the Dietary Approaches to Stop Hypertension (DASH) Diet, which is rich in fruits, vegetables, and whole grains, and low in sodium, can help lower blood pressure during pregnancy<sup>20</sup>. Regular physical activity, such as prenatal yoga and walking,

enhances blood circulation and reduce stress, a key risk factor for hypertension<sup>21</sup>. Additionally, relaxation techniques such as meditation play an important role in naturally lowering blood pressure during pregnancy. By adopting non-pharmacological treatment, pregnant women can not only mitigate hypertension-related complications but also improve their overall quality of life.

Management of hypertension in pregnant women in Indonesia and India with non-pharmacological therapy is widely utilized due to its effectiveness in reducing hypertension with minimal risk and no side effects. Prenatal yoga and pregnancy exercises are commonly practiced to improve blood circulation and reduce stress, both of which are risk factors for hypertension<sup>22</sup>. Community-based programs also promote locally sourced healthy diets, such as consuming potassium-rich and low-sodium fruits to control blood pressure<sup>23</sup>. In India, traditional practices such as meditation and yoga remain integral to hypertension management, consistent with Ayurvedic principles that emphasize mind-body balance. Furthermore, educational initiatives encourage pregnant women to adopt low-salt and high-fiber diets, including lentils and green vegetables, which significantly contribute to lowering blood pressure during pregnancy<sup>24</sup>.

This study aims to evaluate the effectiveness of various non-pharmacological treatments in lowering blood pressure among pregnant women with hypertension. By analyzing existing evidence, this study provides insights into the potential of relaxation-based interventions as safe and accessible alternatives for hypertension management during pregnancy, ultimately contributing to improved maternal health outcomes.

## Methods

### *Study design*

This systematic review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) approach to evaluate the effectiveness of non-pharmacological treatments in lowering blood pressure among pregnant women with hypertension in India and Indonesia.

### ***Inclusion and exclusion criteria***

The inclusion criteria for this study were: (1) studies that investigated non-pharmacological interventions aimed at reducing blood pressure in pregnant women with hypertension, (2) studies conducted in India or Indonesia, and (3) studies published in scientific journals and available in English or Indonesian. Studies were excluded if they (1) focused primarily on pharmacological treatments, (2) were not available in full text, (3) exhibited low methodological quality based on a risk of bias assessment, or (4) were not original research articles, such as editorials, opinions, or case reports.

### ***Search strategy and study identification***

A comprehensive literature search was conducted across four databases: PubMed, Scopus, ScienceDirect, and Google Scholar. The search strategy involved a combination of Boolean operators to refine the results, using keywords such as (“pregnancy” OR “pregnant women”) AND (“hypertension” OR “high blood pressure”) AND (“non-pharmacological treatment” OR “lifestyle intervention” OR “complementary therapy”). Search queries were adjusted based on the specific indexing and functionalities of each database.

### ***Study selection***

The study selection process was conducted in three stages. First, during the identification stage, all retrieved articles were compiled from the selected databases. Next, in the screening stage, duplicate records were removed, and the abstracts and titles were checked against the inclusion and exclusion criteria. Finally, in the eligibility stage, full-text articles were reviewed to confirm their relevance and methodological quality.

### ***Data extraction***

Data extraction focused on key information from each eligible study, including the author’s name and year of publication, study location (India or Indonesia), study design, type of non-pharmacological intervention, sample size, primary

outcomes related to blood pressure reduction, and key study findings.

### ***Data analysis***

The extracted data were analyzed narratively, categorizing findings based on the type of non-pharmacological intervention used. The review systematically examined the effectiveness of these interventions in lowering blood pressure among pregnant women with hypertension. Additionally, heterogeneity among studies was considered when interpreting the results. The following information was extracted from each included study: author, year of publication, country, title, research design, study subjects, study results, and primary focus.

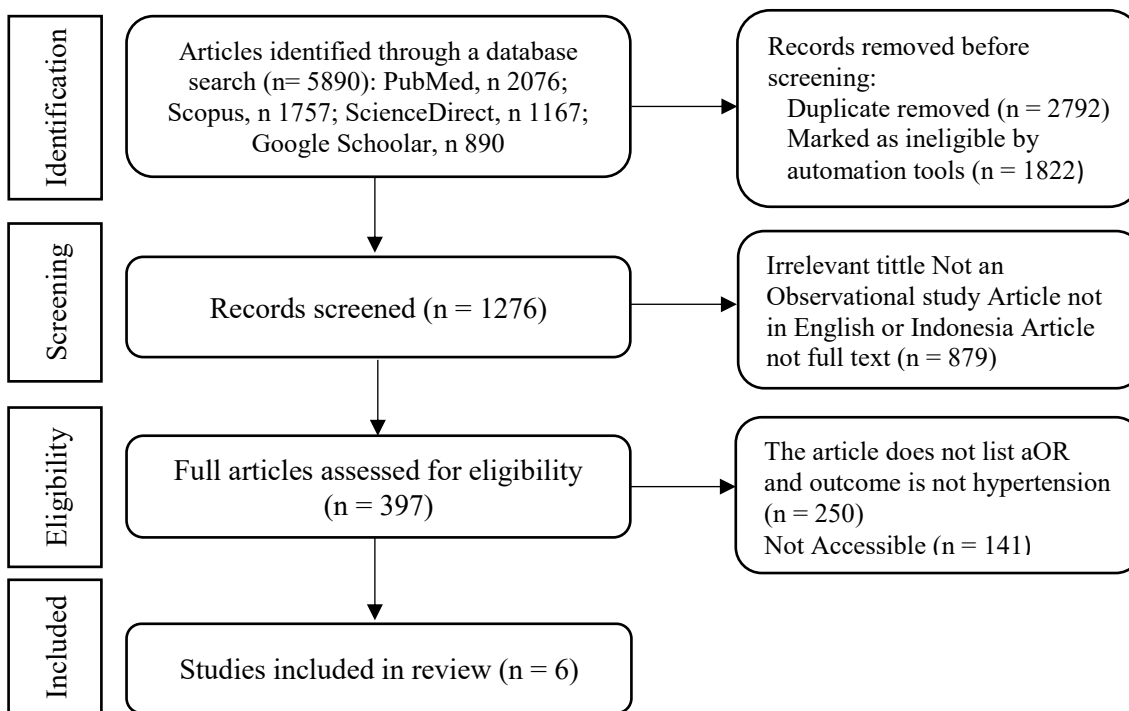
### ***Included studies***

Following the PRISMA process, six studies met the eligibility criteria and were included in this systematic review (Figure 1).

## **Results**

After the literature search process, a total of 5,890 articles were identified across multiple electronic databases. After removing 4,614 duplicates and articles marked as ineligible by automation tools articles, they were then screened based on inclusion and exclusion criteria, leading to the removal of 879 articles due to incomplete information (i.e., lack of an abstract or full-text). Following an eligibility review of 397 full-text articles, 391 articles were excluded for not meeting the research criteria. Ultimately, six articles were deemed relevant and included in this systematic review.

The findings from these six studies are summarized in Table 1. These studies explored various non-pharmacological treatment methods, including Murottal therapy, yoga, lavender aromatherapy combined with classical music, the Go-Yoga application, and a combination of foot massage with warm water immersion infused with lemon. Each method demonstrated effectiveness in reducing blood pressure, either through mechanisms related to relaxation, stress reduction, improved cardiovascular function, or hormonal balance.



**Figure 1:** PRISMA flow chart of the study selection process

The research designs varied, ranging from randomized controlled trials (RCTs) to quasi-experimental studies, incorporating different sample sizes and methodologies to comprehensively evaluate the efficacy of these therapies. The results of this study indicate that yoga, whether practiced directly or indirectly through digital applications, significantly lowers blood pressure and enhances maternal well-being, including comfort during labor. Similarly, Murottal therapy and aromatherapy combined with classical music have been effective in inducing relaxation and stabilizing blood pressure. Meanwhile, the combination of foot massage and warm water immersion infused with lemon provides additional benefits in lowering blood pressure through a calming effect and improved circulation. Overall, these findings confirm that non-pharmacological approaches offer a safe and effective alternative for managing hypertension in pregnancy.

As summarized in Table 2, all interventions demonstrated some degree of blood pressure reduction, achieved through diverse mechanisms such as relaxation response activation, stress reduction, cardiovascular function enhancement,

and hormonal modulation. Yoga interventions—whether instructor-led, home-based, or app-assisted—consistently produced significant decreases in both systolic and diastolic blood pressure, with additional benefits including shorter labour duration, greater maternal comfort, and improved fetomaternal outcomes. Murottal therapy delivered via daily Qur’anic recitation was associated with clinically meaningful declines in blood pressure, attributed to its calming and meditative effects. Lavender aromatherapy and classical music therapy each lowered blood pressure, with the combination showing the greatest effect.

The combined foot massage and warm lemon-water soak also reduced blood pressure alongside lowering anxiety and pulse rate. Other interventions, while evaluated in fewer studies, consistently trended toward clinically relevant reductions. These findings collectively suggest that non-pharmacological strategies, particularly yoga-based approaches and Murottal therapy, are effective and practical options for supporting blood pressure control in pregnant women with hypertension.

**Table 1:** Characteristics of included studies in this review

No.	Author, year	Country	Title	Study design	Study subject	Research objectives	Research focus
1	Wahyuni <i>et al.</i> , 2021	Indonesia	Effect of Murottal therapy on Blood Pressure of Pregnant Women with Hypertension	Quasi experimental research design.	27 Pregnancy Women	To assess the effect of Murottal therapy on blood pressure in hypertensive pregnant women	Murottal therapy
2	Makhija <i>et al.</i> , 2021	India	A randomized control trial to study the effect of integrated yoga on pregnancy outcome in hypertensive disorder of pregnancy	Randomized Controlled Trial	60 pregnant women (30 in the control group, 30 in the intervention group)	To assess the effects of integrated yoga on blood pressure and pregnancy outcomes in hypertensive pregnant women	Yoga
3	Karthiga <i>et al.</i> , 2022	India	Effects of yoga on cardiometabolic risks and fetomaternal outcomes are associated with serum nitric oxide in gestational hypertension: a randomized control trial	Randomized Control Trial	234 pregnant women (control group, n = 113), study group, n = 121)	To evaluate the impact of a 20-week yoga program on gestational hypertension risk, cardiometabolic health, and maternal-neonatal outcomes, along with their association with nitric oxide levels.	Yoga
4	Maisi <i>et al.</i> , 2017	Indonesia	Effectiveness Of Lavender Aromatherapy and Classical Music Therapy in Lowering Blood Pressure in Pregnant Women with Hypertension	Quasi-experimental study with pretest-posttest control group design	52 pregnant women	To evaluate the effects of lavender aromatherapy and classical music therapy on reducing blood pressure in hypertensive pregnant women.	Aromatherapy

5	Zakaria & Astuti, 2022	Indonesia	Utilizing Go-Yoga Smartphone Application to Prevent Preeclampsia in Pregnant Women	Quasi-experimental study	60 pregnant women in the third trimester	To compare the effects of the Go-Yoga app and family support on blood pressure and albumin levels in third-trimester pregnant women	Prenatal Yoga
6	Andansari <i>et al.</i> , 2022	Indonesia	The effect of foot massage in lowering blood pressure in cases of hypertension in pregnancy	Quasi-experimental study	30 participants	To assess the impact of foot massage on lowering blood pressure in hypertensive pregnant women	Combination therapy of foot massage and soaking in warm water mixed with lemon

**Table 2:** A summary of research findings

No.	Author, year	Type of treatment	Treatment details	Important findings	Conclusion
1	Wahyuni <i>et al.</i> , 2021	Murottal (Qur'anic recitation) therapy	Daily home-based audio therapy for 30 days using three versions of QS Maryam recitation: (R1) audio only, (R2) audio with translation, (R3) audio + translation combined. Sessions (~19–45 mins) were done after sunset prayer using a mini speaker. Blood pressure measured weekly.	Murottal therapy can be performed by listening only to the chanting of the verse (Version A), only to the translation (Version B), or the verse accompanied by the translation (C).", "Complementary therapy can help control blood pressure (BP), Murottal therapy is conceptually believed to provide a relaxing effect that can aid in BP regulation.	Combined lavender aromatherapy and classical music therapy was more effective in reducing blood pressure in hypertensive pregnant women than either intervention alone.
2	Makhija <i>et al.</i> , 2021	Integrated yoga therapy	40-min integrated yoga sessions (3×/week until delivery, minimum 4 weeks), initially supervised and later home-based. Included micro-exercises, asanas, pranayama, and Om meditation. Compliance	The mean systolic BP declined by $7.43 \pm 5.86$ mmHg in the study group compared to $2.50 \pm 5.21$ mmHg in the control group ( $p = 0.002$ ). The mean diastolic BP before delivery was $88.00 \pm$	Integrated yoga (40 min, 3×/week) was safe, well-accepted, and effective in lowering blood pressure and enhancing maternal comfort and labor

			monitored via diary and calls. BP measured biweekly; comfort assessed using VAS.	3.71 mmHg in the study group and $92.20 \pm 5.02$ mmHg in the control group ( $p = 0.001$ ). Maternal comfort during labour was significantly higher, and the duration of labour significantly reduced in the study group. Conclusion: Integrated yoga effectively reduced systolic and diastolic blood pressure and increased maternal comfort during labour in pregnant women with hypertensive disorder.	outcomes in women with hypertensive disorders of pregnancy.
3	Karthiga et al., 2022	Prenatal yoga intervention	Structured yoga program (twice daily) from 16th to 36th week of gestation, in addition to standard antenatal care. Initial 5 sessions were instructor-led; thereafter home-based with periodic supervision. Yoga aimed to support delivery and reduce risk of hypertensive disorders. Control group received standard antenatal care only.	In study group, 6.61% women developed hypertension compared to 38.1% in the control group after a 20-week intervention. There was a significant decrease in the risk of developing GH (RR, 2.65; CI 1.42–4.95). The study group also experienced less painful deliveries, shorter labour duration, increased neonatal birthweight, and higher Apgar scores. Increased total power of HRV ( $\beta = 0.187$ , $p = 0.024$ ), BRS ( $\beta = 0.305$ , $p < 0.001$ ), and decreased interleukin-6 ( $\beta = -0.194$ , $p = 0.022$ ) were significantly associated with increased nitric oxide (NO). Conclusion: Twenty weeks of yoga practice during pregnancy	Twenty weeks of prenatal yoga reduced hypertension risk, improved fetomaternal outcomes, and lowered cardiometabolic risk in women at risk of gestational hypertension, likely via enhanced endothelial function.

				reduce the incidence of hypertension, improved fetomaternal outcomes, and reduces cardiometabolic risks in pregnant women at risk of GH. Decreased BP, increased HRV, BRS, and birth weight, as well as reduced inflammation, were associated with improved endothelial function.	
4	Maisi et al., 2017	Lavender aromatherapy, classical music therapy, and combination therapy	Pregnant women with hypertension ( $\geq 20$ weeks gestation) were assigned to: (i) lavender aromatherapy (5 drops in diffuser, 20 min), (ii) classical music (Mozart, 20 min), (iii) combination of both, or (iv) control (standard care). Interventions were home-based; BP measured pre- and post-intervention.	Fifty-two pregnant women were selected using simple random sampling and divided into four groups: the lavender aromatherapy group, the classical music group, the combination of aromatherapy and music group, and the control group. Conclusion: Lavender aromatherapy and classical music therapy significantly reduced blood pressure in pregnant women with hypertension.	Lavender aromatherapy and classical music therapy both reduced blood pressure in hypertensive pregnant women, with the combined intervention being the most effective.
5	Zakaria & Astuti, 2022	Yoga intervention	Yoga practiced 3x/week for 1 month among third-trimester pregnant women, in three groups: (I) yoga via books, (II) yoga via Go-Yoga app without family, (III) yoga via Go-Yoga app with family support. App included guided sessions in multiple languages. Outcomes: blood pressure and albumin levels.	In Group I, 20 pregnant women practiced yoga using books; in Group II, 20 pregnant women exercised yoga using the Go-Yoga app without their families; and in Group III, 20 pregnant women practiced yoga with their families. Objective: To determine the differences in the implementation of the Go-Yoga smartphone application and the	Using the Go-Yoga app with family support three times weekly for one month was more effective in reducing blood pressure and improving albumin levels, suggesting its potential to prevent hypertension in pregnancy.

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6	Andansari et al., 2022	Foot massage and warm lemon water foot soak	Combination therapy of 15-min foot massage with baby oil followed by 15-min foot soak in warm water (38–40°C) mixed with 200g fresh lemon slices, administered to pregnant women with hypertension (>20 weeks gestation). Intervention applied once, compared to control group receiving no treatment. Outcomes: BP, pulse, and anxiety levels.	role of the family involvement in pregnant women in their III trimester on blood pressure and albumin levels. Non-pharmacological therapy in this study consisted of a combination of foot massage and soaking in warm water mixed with lemon. Purpose: To determine the effect of foot massage on blood pressure reduction in hypertensive pregnant women. Method: A quasi-experiment design with group pretest-posttest control group design. Background: Pregnant women who experience severe anxiety may develop persistent hypertension.	Combined foot massage and warm lemon water soak was effective in reducing anxiety, blood pressure, and pulse rate in pregnant women with hypertension.
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## Discussion

The purpose of this study was to determine the effectiveness of non-pharmacological treatments in lowering blood pressure in pregnant women with hypertension. This study identified five non-pharmacological treatments, namely Murottal therapy, yoga, lavender aromatherapy with classical music, the Go-Yoga application, and a combination of foot massage with warm water immersion infused with lemon. Non-pharmacological treatment methods have shown effectiveness in lowering blood pressure through relaxation mechanisms, stress reduction, improved cardiovascular function, and hormonal balance.

### Yoga

The results of studies using the yoga method showed that yoga practice significantly lowers blood pressure in pregnant women and provides additional benefits for maternal and fetal well-being. Research conducted by Amrita Makhija showed that regular yoga can significantly lower systolic and diastolic blood pressure and increase maternal comfort during labor<sup>25</sup>. Meanwhile, research by Kuzhanthaivelu Karthiga *et al.* found that practicing yoga for 20 weeks reduced the incidence of gestational hypertension, increased heart rate variability (HRV), enhanced baroreceptor reflex (BRS), and lowered levels of interleukin-6, which are associated with inflammation<sup>26</sup>. Research by Zakaria & Astuti discussed the use of the Go-Yoga application, which was shown to be effective in lowering blood pressure and albumin levels in pregnant women in the third trimester, especially when practiced with family support. Overall, yoga has been shown to be an effective non-pharmacological intervention for managing blood pressure during pregnancy, reducing the risk of complications, and improving maternal and fetal health<sup>27,28</sup>.

The mechanism of yoga in reducing hypertension in pregnant women is based on its effects in reducing stress, balancing the autonomic nervous system, and improving cardiovascular function. Yoga stimulates the parasympathetic nervous system, which plays a role in lowering heart rate and blood pressure by increasing HRV

and BRS<sup>26</sup>. Additionally, deep breathing exercises and meditation in yoga help reduce stress hormone levels, such as cortisol, which, if excessive, can cause vasoconstriction and increased blood pressure<sup>25</sup>. The relaxation produced by yoga is also known to increase the release of nitric oxide (NO), a natural vasodilator that widens blood vessels and reduces peripheral vascular resistance, thereby decreasing blood pressure<sup>26</sup>.

Beyond its physiological effects, yoga also promotes psychological well-being in pregnant women, which indirectly affects blood pressure. Regular yoga practice can reduce anxiety and improve sleep quality, both of which are closely related to blood pressure regulation during pregnancy<sup>27</sup>. Prenatal yoga exercises with stretching and gentle body movements help improve blood circulation and prevent edema, a common condition in pregnant women with hypertension<sup>29</sup>. Studies have also found that pregnant women who practice yoga regularly experience more comfortable labour and shorter contractions, indicating the role of yoga in improving hormonal and physiological balance during pregnancy<sup>25</sup>.

Yoga movements beneficial for pregnant women with hypertension emphasize deep breathing techniques (pranayama), calming postures, and relaxation. Movements such as Cat-Cow Pose and Child's Pose help relieve body tension, improve blood circulation, and reduce anxiety, which often increases blood pressure. Deep breathing techniques, such as pranayama, slow the heart rate, stabilize blood pressure, and increase oxygenation. Studies have shown that regular yoga practice can reduce cortisol levels and improve hormonal balance, which is crucial for controlling hypertension during pregnancy<sup>30</sup>. Through a combination of gentle movements and regulated breathing, yoga is an effective non-invasive alternative for managing hypertension in pregnant women.

### Murottal Therapy

A study conducted by Santi Wahyuni evaluated the effectiveness of Murottal therapy in lowering blood pressure in pregnant women with hypertension.

Using a quasi-experimental research design and involving 27 pregnant women, this study tested various methods of listening to Murottal, recitation of holy verses, translated verses, or a combination of both. The results demonstrated that Murottal therapy provided a significant relaxation effect, helped control blood pressure, and could be used as a complementary therapy in the management of hypertension during pregnancy. This study highlighted that spiritual-based therapy can be an effective non-pharmacological approach to improving the health of pregnant women with hypertension<sup>31</sup>.

Murottal therapy reduces hypertension in pregnant women by influencing the autonomic nervous system and hormonal balance through sound and music frequencies. Listening to Qur'anic recitations is believed to stimulate a relaxation response through the brain's limbic system, which regulates emotions and stress. This practice reduces anxiety and the secretion of stress hormones such as cortisol, which, if excessive, can elevate blood pressure. Lowering stress levels can help regulate blood pressure, as chronic stress is known to contribute to hypertension during pregnancy<sup>32</sup>.

Murottal therapy also affects physical responses such as slowing the heart rate and increasing blood flow. Music with certain frequencies can enhance parasympathetic activity, which plays a role in reducing blood pressure. Given its psychological and physiological benefits, Murottal therapy is a safe, non-pharmacological intervention for pregnant women and can be used as an alternative or complementary method for managing hypertension<sup>33,34</sup>.

### **Aromatherapy**

Research on aromatherapy has shown that it is effective in lowering blood pressure in pregnant women with hypertension. A study by S. Maisi tested the effectiveness of lavender aromatherapy and classical music therapy in lowering blood pressure in pregnant women. Using a quasi-experimental pre-test and post-test design with a control group, this study involved 52 pregnant women divided into different therapy groups: lavender aromatherapy, classical music therapy group, a combination of both, and the control group. The results indicated that lavender aromatherapy

significantly helped lower blood pressure, primarily through relaxation mechanisms that reduce stress and anxiety, both of which contribute to increased blood pressure<sup>29</sup>.

Lavender aromatherapy reduces hypertension in pregnant women due to its relaxing and anxiety-reducing properties. Lavender contains linalool and linalyl acetate, compounds known for their calming effects on the central nervous system. When inhaled, these compounds stimulate the limbic system, which regulates emotions and stress responses<sup>35</sup>. Reduced stress levels lower the production of cortisol, thereby preventing hypertension. Additionally, lavender aromatherapy can enhance parasympathetic nervous system activity, leading to a reduction in heart rate and improved blood flow<sup>36</sup>.

Beyond its psychological benefits, lavender aromatherapy also contributes to physiological balance by slowing the heart rate and increasing muscle relaxation, which alleviates the cardiovascular system's burden. This makes lavender a safe and effective non-invasive therapy option that is easy to apply for managing hypertension in pregnant women<sup>37</sup>.

### **Combination of foot massage with warm water immersion mixed with lemon**

A study investigated the combined effects of foot massage therapy and warm water immersion with lemon in lowering blood pressure in pregnant women with hypertension. Using a quasi-experimental pre-test and post-test design with a control group, this study involved 30 participants. The results showed that this combination therapy significantly reduced blood pressure, especially in pregnant women experiencing excessive anxiety, which can exacerbate hypertension. The relaxing effect of massage, along with increased blood circulation from warm water immersion with lemon, contributes to a natural reduction in blood pressure. These findings suggest that this non-pharmacological therapy is an effective and safe alternative for managing hypertension in pregnant women<sup>38</sup>.

The mechanism behind this therapy involves two main elements: physical relaxation and the physiological effects of lemon. Foot massage improves blood circulation, reduces

muscle tension, and stimulate the parasympathetic nervous system, which helps lower blood pressure. Gentle pressure on foot reflex points promotes relaxation and slows the heart rate. Warm water immersion also has a vasodilating effect, which widens blood vessels, reducing vascular tension and blood pressure. The combination of these two techniques can increase comfort and reduce stress in pregnant women, which are triggers for hypertension<sup>39</sup>.

Adding lemon to warm water provides additional benefits due to its vitamin C and antioxidant content. Lemon's mild diuretic properties aid in the excretion of excess sodium, reducing blood volume and blood pressure. Furthermore, the fresh scent of lemon has a calming effect, relieving anxiety that can contribute to hypertension. Overall, the combination of foot massage and warm water immersion with lemon provides a comprehensive, safe, and natural approach to hypertension management in pregnant women<sup>40</sup>. This systematic review has some limitations. Only six studies were included, which may limit the generalizability of the findings. Additionally, the studies focused on articles exclusively from Indonesia and India, making it uncertain whether the results apply to other populations with different healthcare systems and cultural practices. Further research with larger sample sizes and long-term follow-up is needed to strengthen the evidence base for these interventions.

### Study strengths and limitations

This systematic review is strengthened by its focus on a diverse range of non-pharmacological interventions, including both traditional and modern approaches, applied in real-world maternal health settings in Indonesia and India. The inclusion of interventions delivered in various formats (face-to-face, digital application, and home-based practice) provides a comprehensive overview of feasible options for blood pressure control during pregnancy, particularly in low- and middle-income countries. The study synthesizes narrative findings, which enhances the applicability of the results for clinical and community health practice. However, several limitations should be noted. Only six studies met the inclusion criteria, limiting the similar

quantitative data, statistical power and generalizability of the findings. The heterogeneity of intervention types, delivery formats, outcome measures, and follow-up periods prevented a formal meta-analysis. Additionally, all included studies were conducted in Indonesia and India, which may limit applicability to other populations with different healthcare systems, cultural practices, and resources. These limitations underscore the need for further high-quality, multicenter randomized controlled trials with larger sample sizes and standardized outcome measures. From a policy and practice perspective, the results suggest that integrating safe, culturally appropriate, and low-cost non-pharmacological interventions, such as yoga, Murottal therapy, and relaxation-based approaches, into antenatal care programs could offer an effective strategy for reducing hypertension-related maternal risks, especially in resource-limited settings.

### Conclusion

Non-pharmacological treatments, including lifestyle modifications such as a healthy diet, physical activity, relaxation techniques, and stress management, have been shown to be significantly effective in lowering blood pressure in pregnant women with hypertension. Although there is variation in the research results, the majority of studies reviewed suggest that non-pharmacological approaches can serve as a valuable alternative or adjunct to the management of hypertension during pregnancy. However, these interventions should be integrated into a comprehensive treatment plan that includes close medical supervision and, when necessary, the use of antihypertensive medications. Further research with larger sample sizes is needed to confirm the long-term efficacy and safety of non-pharmacological treatments for hypertension in pregnant women.

### Author contributions

Aryunani: conceptualized and designed the study, wrote the manuscript  
 Mochammad Bagus Qomaruddin: conceptualized and edited the paper  
 Budi Prasetyo: conceptualized and edited the paper

Firdausi Nuzula: conceptualized and edited the paper

Nova Elok Mardiyana: wrote the discussion and edited the paper.

## Conflict of interest statement

The authors declare no conflicts of interest.

## Acknowledgments

We sincerely thank the Faculty of Public Health, Universitas Airlangga for their facilities and academic support, as well as the Faculty of Medicine for its valuable scientific contributions. We also appreciate the Midwifery Professional Education Program and the Undergraduate Midwifery Study Program at Universitas Muhammadiyah Surabaya for their guidance and logistical support..

## Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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