

Impact of a Comprehensive Nursing Intervention Program on Obstetric Outcomes in Pregnant Women with Hypertensive Disorders

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Received: 28th Feb, 2026; Revised: 6th March 2026; Accepted: 7th April, 2026; Available Online: 20th April, 2026

ABSTRACT

Hypertensive disorders during pregnancy remain a significant global health concern, impacting a substantial number of pregnant women and posing a major risk for both maternal and fetal health, particularly in low- and middle-income countries. The consequences of a hypertensive crisis during pregnancy can be prevented by providing timely, effective, comprehensive antenatal care to women with such disorders. Though considerable research has been conducted on interventions to enhance the perinatal outcomes and prevent the complications of hypertensive disorders during pregnancy, evidence on complementary preventive strategies adopted for pregnant women in low- and middle-income settings remains limited. This study addresses this gap by evaluating a comprehensive Nursing Intervention program to reduce adverse obstetric outcomes among pregnant women with Hypertension. A cluster-randomized controlled study was conducted at the sub-centres Amtalia, Purba Medinipur, West Bengal. 20 pregnant women with hypertension who were at 24-32 weeks of gestation were recruited through random sampling. The intervention was an 8-week Comprehensive Nursing Intervention Programme that emphasized physical, psychological, and motivational aspects of antenatal health. Maternal knowledge on Hypertension in pregnancy, physiological parameters, stress, and perinatal outcomes was assessed. The program significantly improved maternal knowledge score (2.7 to 16.3, $p < 0.0001$) and reduced Blood Pressure (158.9 to 126.1, $p < 0.0001$), stress scores ($p < 0.00077$), and reduced adverse perinatal outcomes ($p < 0.0001$). This Comprehensive Nursing Intervention Programme was effective and provided a viable framework for improving maternal knowledge level on Hypertensive disorders of Pregnancy, reducing blood pressure, stress, and adverse obstetric outcomes among women with Hypertensive disorders.

Keywords: Hypertensive Disorders, Pregnancy, Comprehensive Nursing Intervention Programme, Obstetric Outcome

How to cite this article: Anitha B, Geetha C, Mani N, Bhavanani AB, Jeyadeepa R. Impact of a Comprehensive Nursing Intervention Program on Obstetric Outcomes in Pregnant Women with Hypertensive Disorders. Int J Drug Deliv Technol. 2026;16(6): 387-395. DOI: 10.25258/ijddt.16.6.46

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

Hypertensive Disorders of Pregnancy (HDP) are a significant global concern, affecting 5-10% of pregnancies and contributing to maternal and newborn morbidity and mortality¹. The prevalence of HDP demonstrated per pregnancy (7.3%) underestimated the number of affected women after their reproductive years (15.3%)². Women with a history of HDP, compared with those with normotensive pregnancies, demonstrated significantly increased risks for kidney and heart disease, including cardiac arrhythmias, CAD, and stroke². Between 1990 and 2021, global HDP incidence rose from 31.33 million to 36.10 million cases (15.24%), while prevalence surged from 6.15 million to 36.10 million cases (487%)³. Approximately 10–22% of pregnant women are affected

by these conditions, with prevalence expected to rise due to increasing maternal age and the growing incidence of risk factors such as obesity and metabolic syndrome³. The cardiovascular consequences of HDP extend beyond childbirth as women with hypertension during their pregnancy are significantly more likely to develop cardiovascular risk factors in the immediate postnatal period and major cardiovascular disease in the long term⁴. HDP is responsible for 16% of maternal deaths in high-income countries and approximately 25% in low- and middle-income countries⁵. West Bengal is an eastern state of India, with the prevalence of hypertensive disorder in pregnancy was 9.01% – 10.4% in West Bengal^{6, 7}, and has a high risk of eclampsia with an incidence rate of >3 % and an 8-19% fatality rate^{8, 9}.

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West Bengal is currently experiencing a 10–30 times higher incidence and case fatality rate of eclampsia than developed nations^{10, 11}. Hypertensive disorders of pregnancy can significantly impact maternal and fetal health, leading to increased risks of complications like preterm birth, low birth weight, stillbirth, and even maternal mortality, with studies showing a considerable proportion of maternal deaths being attributed to complications from hypertensive disorders during pregnancy, particularly in areas with limited access to proper prenatal care¹². To minimize the burden of the problem, much has to be done by health care professionals and stakeholders focusing on the identification and proper management of mothers with hypertensive disorders¹³. The report informs that Mindfulness-based interventions decreased women's fear of childbirth, depression, anxiety, and stress levels and increased their psychological well-being, self-compassion, and mindfulness levels. As well, it was reported that mindfulness interventions increased vaginal delivery rates and healthy life behaviors, women had a better birth experience, and less pain during the birth process¹⁴. Although there is an increasing recognition of the importance of HDP in risk assessment and prevention, there is a significant lack of access to and implementation of non-pharmacological relaxation practices for high-risk antenatal mothers in India, particularly in rural and underserved areas. The gap between evidence and practice hinders effective prevention strategies and the formulation of maternal healthcare policies¹⁵. There is an urgent need for comprehensive research in resource-poor settings. This research addresses that gap by investigating whether adopting the non-pharmacological comprehensive strategies can mitigate these risks. Thus, this article aims to evaluate the efficacy of the Comprehensive Nursing Intervention Programme in improving perinatal outcomes among antenatal mothers with Hypertensive Disorders of pregnancy and to determine the feasibility and

acceptability of the study procedures proposed in a larger study.

MATERIALS & METHODS

Cluster Randomized controlled- study was conducted in the period September 2023- February 2024 among antenatal mothers (24-32 weeks of gestation) with Hypertensive Disorders who registered and visited the Sub-centres under Amtalia Gram panchayats, Basantia Block Primary Health Centre, Contai, Purba Medinipur, West Bengal, utilized a true experimental design to evaluate the impact of a comprehensive nursing intervention program on pregnant women with hypertension (24-32 weeks gestation). This program aimed to enhance participants' perinatal outcomes. The intervention group underwent regular assessment and continuity of care with the program. The post-test is administered to determine Blood pressure, psychological stress at the end of the program, and to find out the occurrence of adverse obstetric outcomes, including preterm birth, Caesarean deliveries, Low birth weight, perinatal death, neonatal death, NICU admission, postpartum haemorrhage, and postpartum depression. The goal was to determine the program's effectiveness in reducing adverse perinatal outcomes. The program emphasized health information on Hypertensive disorders of pregnancy, Regular mindful Walking, Guided Mindful meditation, and yogic-based breathing exercise, pranava pranayama. Core activities included educational material, a pamphlet on HDP, and sessions tailored for women. The Principal Investigator had sessions (3-5 days/week) lasting 20–45 min and included follow-ups through phone and online communication. These interventions focus on continuous monitoring and managing hypertensive disorders during pregnancy. The program's practical design aimed to empower pregnant women to adopt effective relaxing practices, thereby providing a replicable model for public healthcare settings (Table 1).

Table 1. Activities in an 8-week program for promoting knowledge on preterm birth

Week	Time	Activity	Objective
1 week	20 minutes	Recruitment and Initial Contact	Introduce and build relationships with study participants; establish trust, ensuring ethical standards, and fostering a collaborative, respectful connection; gather contact information; conduct knowledge and health assessment;
2-3 weeks	20 minutes	Structured Maternal Education Programme	Educating the mothers on Hypertensive Disorders of Pregnancy, causes, risk factors, alarming signs and symptoms of pre-eclampsia, short-term and long-term complications of hypertensive disorders of pregnancy, and its preventive strategies, including nutrition, lifestyle modification, and alternative complementary therapies such as regular walking, meditation and yogic-based breathing exercises. And increase awareness and utilization of essential antenatal care services and the recognition of complications.
4-8 weeks (3-5 days/week)	30 minutes	Mindful Walking twice a day	Promoting and maintaining regular mindful walking helps manage and lower blood pressure, reduce stress and anxiety, improve overall physical well-being, and strengthen the mind-body

			connection.
	10 minutes	Pranava pranayama	Intervening and practicing pranava pranayama at a comfortable, relaxed sitting posture includes slowly breathing in and out through the nostrils at their comfortable level without straining themselves. Then, they were advised to follow the instructions: • Inhale slowly and deeply (as per individual subject's limitation) and on exhalation slowly with sound (AAAA...), be aware of the vibration and fetal movements. Repeat two more rounds of practice • Inhale, breathe in slowly and deeply (as per individual subject's limitation) and on exhalation slowly with sound (UUU...), be aware of the vibration and fetal movements. Repeat two more rounds of practice • Take a breath in slowly as well as deeply (as per individual subject's limitation) and on exhalation slowly and utter the sound (MMM...), (as per individual subject's limitation). Repeat two more rounds of practice. • Each round of practice is followed by a minute of silence. During the practice, the subjects were asked to be aware of breath and fetal movement [16].
	10 minutes	Guided mindful meditation	Implementing and adopting mindful meditation with a guide (Audio recording) includes Audio scripts- awareness on pregnancy, connections with body, and maternal and fetal bonding to reduce stress, lower blood pressure, improve emotional well-being, and enhance maternal-fetal bonding. This helps to improve overall maternal and fetal health.

Study population and setting

Pregnant women at 24-32 weeks of gestation with Hypertensive registering and following antenatal visits Disorders who were registered and attended health visits at Subcentres of Amtalia gram panchayats, were randomly recruited to the experimental and control group. The sample size was calculated using a formula that involves the Intraclass Correlation Coefficient (ICC or ρ) to account for the similarity of individuals within a cluster and the Design Effect (DE) for clustering. The calculated sample size for the main study was about 164 for the experimental and control groups. For considering 10% of the main study's sample size, 150 antenatal mothers were included in this study¹⁷.

Sampling Procedure

Simple random sampling was used to select the sub-centres as clusters using the lottery method. The study was conducted at Block Primary Health Centres (BPHCs) in Contai Municipality, West Bengal. In this BPHC, 33 subcentres are functioning under 8-gram panchayats. The gram panchayats are randomly selected as clusters. The study participants who are registered and have visited the selected clusters are then randomly assigned to the intervention and control groups.

In this study, 150 Antenatal mothers at 24-32 weeks of gestation with Hypertensive Disorders who registered and visited the Sub-centres of Amtalia Gram Panchayats were enrolled. The antenatal mothers were randomly assigned to the intervention group (n=75) and control group (n=75). Pregnant women medically diagnosed with conditions that prevent them from safely and effectively practicing the interventions (e.g. Spinal deformities, Hearing Disabilities), Medical contraindications for Yogic based breathing technique (Eg. Eye/ear infection, Epilepsy), Post in Vitro Fertilization (IVF) pregnancy, Structural abnormalities in the reproductive system, Maternal Psychiatric illness and pregnant mothers who is practicing Relaxation techniques regularly over the past 3 months were excluded from the study.

Comprehensive Nursing Intervention Programme:

Components of the programme include,

- Structured Maternal Education Programme on Hypertensive Disorders of Pregnancy
- Regular Mindful Walking
- Pranava pranayama
- Guided mindful meditation

Both the intervention and control groups received comprehensive antenatal care under the Government of India, Pradhan Mantri Surakshit Matritva Abhiyan initiative. Additionally, the intervention group underwent a comprehensive nursing intervention programme including a structured maternal education programme, regular mindful walking, pranava pranayama, and guided mindful meditation (20-45 minutes per day) for 8 weeks. To ensure objectivity, the post-test was administered to assess Blood pressure and psychological stress at the end of the program, and Adverse perinatal outcomes were determined after 24 hours of childbirth in both groups.

Outcome of the study

- Dependent variable: Comprehensive Nursing Intervention Programme

- Independent variables:

Primary Variable: Obstetric outcomes-Maternal & Neonatal outcome

Secondary Variable: Blood pressure, Psychological stress

Data collection technique and tools

Data collection began with the development of an 8-week comprehensive nursing intervention program for pregnant women attending antenatal care at the subcentres of Amtalia, Gram Panchayat, Purba Medinipur, West Bengal. The program includes activities such as structured maternal education, Regular mindful walking, Pranava Pranayama, and guided mindful meditation to enhance maternal and neonatal health outcomes. After developing the program, the researcher ensured the strengthening of data collection tools through consultation with the expert. The researcher obtained approval from the institutional review board and coordinated with the Block Medical Officer of Health, Basantia Block, Purba Medinipur, to conduct the study. Research assistants, including registered midwives, were recruited to assist with data collection, including interviewing pregnant women for general information. Preparatory meetings were conducted with the research team to ensure consistency and coordination throughout the study.

Data quality control

Researchers and research assistants (B.Sc Registered Nurses & Midwives) obtained training for two days on study aims & objectives, data collection procedures, and ethical issues. The questionnaire on demographic, obstetrics & clinical variables, and checklist to determine the perinatal outcomes were prepared in English, submitted to the supervisor, and then the study tool was validated for its content, accuracy, completeness, timeliness, and relevance with Research Experts from various disciplines, including Medical, Nursing, Maternity,

alternative medicine, and Yoga therapy. After checking for consistency and completeness, the research investigators translated the tool into the regional language, Bengali. The Bengali edited material was checked and validated by a Bengali Language Expert. Then, the final study tool was applied to demonstrate its reliability and validity.

Cronbach Alpha Method was used to measure the reliability of the tool- Structured Interview Schedule on Knowledge level of antenatal women ($\alpha = 0.79$), Checklist of Physiological parameter (Blood Pressure), and Checklist of Adverse Obstetric Outcome ($\alpha = 0.85$), and Modified Prenatal Maternal Stress due to HDP was assessed by using the Inter Rater Method (Cohen's kappa = 0.82). The internal consistency was high, indicating strong coherence and agreement among the items within the tool¹⁸.

Data processing and analysis

Data were coded and checked for their quality, accuracy, consistency, completeness, and validity. The researchers used descriptive and inferential statistics to analyze the data using SPSS version 26 & R 4.4.3, including Frequency, Percentage distribution, Mean, and Standard Deviation, and the student paired 't' test was calculated and provided in tables.

RESULTS AND DISCUSSION

Socio-demographic variables of the antenatal mothers with hypertensive disorders

In this study, there was a total of 150 antenatal mothers with hypertension, out of which 75 were in the Intervention group and 75 in the Control group. The mean age of the participants was 23 ± 1.24 years, with a range of 18–35 years. Most Antenatal mothers, 30 (40 %), were aged 21–25. Almost 71% of the participants from the control group and 91% participants from the experimental group completed their high school education. The majority of antenatal women (53 (71%) in the Control group and 60(80%) in the Experimental group were homemakers, and the majority, 53 (71%) in the Control and 60(80%) in the Experimental group, were Hindus. Among the study participants, 30 (40%) in the Control and 23 (31%) in the Experimental group were at 24-25 weeks of gestation, and 45 (60%) in the Control and 53 (71%) in the Experimental group were primi gravidarum mothers. Among the participants, 7 (9.33%) in the control group and 22(29.33) in the experimental group had a family history of hypertension, and 15 (20%) had a previous history of HDP in the control group. Most of the antenatal women, 45 (60%), were obese, and 65 (80%) had 140-149mmhg of systolic Blood pressure, and 9 (45%) women had diastolic blood pressure. (Table 2).

Table 2. Frequency, Percentage Distribution of Demographic & clinical variables of Antenatal women with HDP, N=150

S. No.	Variable (Background Data)	Intervention Group	Control Group	χ^2	p-value
		Frequency (%)	Frequency (%)		

1	Age				
	18- 20 years	15(20)	8(10.67)	3.055	0.38 (NS)
	21-25 years	30(40)	30(40)		
	26-30 years	23(30.67)	30(40)		
	31-35 years	7(9.3)	7(9.33)		
2	Education				
	No formal Education	0 (0)	0 (0)	9.61	0.002 (S)
	Primary School	22 (29.33)	7 (9.33)		
	High School	53 (70.67)	68 (90.67)		
	Diploma & Graduate	0 (0)	0 (0)		
3	Occupation of the mother				
	Home Maker	53(70.67)	60(80)	2.56	0.28 (NS)
	Daily Wages	15(20)	8(10.67)		
	Private Employee	7(9.33)	7(9.33)		
	Government Employee	0(0)	0(0)		
4	Family Income (Rs)				
	2500-5000	22(29.33)	7(9.33)	10.82	0.01 (S)
	5000- 10,000	30(40)	45(60)		
	10,000-20,000	15(20)	15(20)		
	20,000 & Above	7(9.33)	8(10.67)		
5	Religion				
	Hindu	53(70.67)	60(80)	1.76	0.18 (NS)
	Christian	0(0)	0(0)		
	Muslim	22(29.33)	15(20)		
6	Gestational Age				
	24-25 week	30(40)	23(30.67)	23.75	0.00 (HS)
	26-27 week	15(20)	15(20)		
	27-28 week	7(9.33)	30(40)		
	29-30 week	23(30.67)	7(9.33)		
	31-32 week	0(0)	0(0)		
6	Gravida				
	Primi	45(60)	53(70.67)	1.88	0.17 (NS)
	Multi	30(40)	22(29.33)		
7	Family History of Hypertension				
	Yes	7(9.33)	22(29.33)	9.62	0.002 (S)
	No	68(90.67)	53(70.67)		
9	History of Disorders in previous pregnancy				
	Yes	15(20)	7(9.33)	3.41	0.006 (NS)
	No	60(80)	68(90.67)		
9	Body mass index (Kg)				
	> 30	45(60)	38(50.67)	1.32	0.25(NS)
	25- 29.9	30(40)	37(49.33)		
	18- 24.9	0(0)	0(0)		
	< 18	0(0)	0(0)		
10	Systolic Blood Pressure				
	120-129 mmHg	0(0)	0(0)	0.0	0.34 (NS)
	130-139 mmHg	0(0)	68(90.67)		
	140-159 mmHg	60(80)	7(9.33)		
	160 mmHg & higher	15(20)	0(0)		
11	Diastolic Blood Pressure				
	80 mmHg	0(0)	0(0)	18.68	0.000 (HS)
	80-89mmHg	22(29.33)	7(9.33)		
	90-99 mmHg	38(50.67)	30(40)		
	100 mmHg & higher	15(20)	38(50.67)		

*S-Significant, HS-Highly Significant, NS- Not Significant

Comparison of Mean Rank for Blood Pressure, Psychological Stress, and Obstetric Outcomes after the intervention in both groups

This study compares the mean scores of blood pressure, psychological stress, and adverse obstetric outcomes, including maternal and neonatal outcomes, of the intervention group with the control group. Intervention group showed significant reduction of blood pressure (126.1 ± 5.821 , 80.9 ± 3.176 , $P < .00001$) and psychological stress level (1.7 ± 5.36 , $P=.000019$) compared to the

control group (Table 3). Pregnant women with HDP in the intervention group who received the Comprehensive nursing intervention programme had less experience of adverse perinatal outcome (maternal outcome= 2.273 ± 0.863 & neonatal outcome = 2.3 ± 0.781) than the control group (maternal outcome= 5.46 ± 0.498 & neonatal outcome= 4.44 ± 0.8), indicating a significant difference in adverse maternal and neonatal outcomes in the post-test between the intervention and control group, $p < .00001$ (Table 4).

Table 3. Comparison of Mean Rank for Blood Pressure, Psychological Stress after the intervention in both groups (N=150)

Variable	Experimental Group (N=10)		Control Group (N=10)		Student Independent 't' test	P Value
	Post test		Post test			
	Mean	SD	Mean	SD		
Systolic Blood Pressure	126.1	5.821	161.7	10.1	9.16	< .00001 (S)
Diastolic Blood Pressure	80.9	3.176	98.3	6.034	7.65	< .00001 (S)
Psychological stress	1.7	2.002	5.36	2.805	5.42	< .000019 (S)

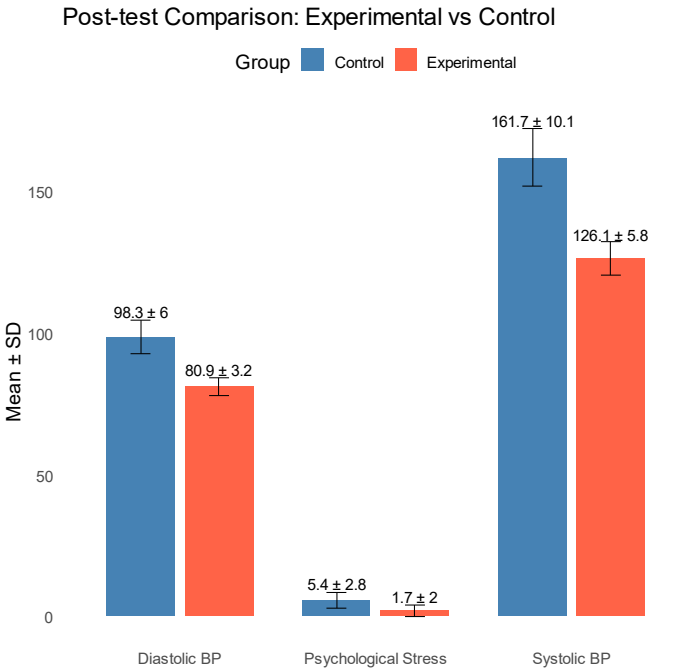


Figure 1. Post-test Comparison of BP and Stress Between Groups (Mean ± SD); The experimental group showed lower mean systolic BP (126.1 ± 5.8 mmHg) and diastolic BP (80.9 ± 3.2 mmHg) compared to the control group (161.7 ± 10.1 mmHg & 98.3 ± 6.0 mmHg), indicating effective BP control in post-intervention. Additionally, psychological stress was lower in the experimental group (1.7 ± 2.0) than in the control group (5.36 ± 2.8), suggesting that the intervention also reduced stress levels. Overall, the experimental group consistently demonstrated improved outcomes across all three measures, with error bars reflecting variability within each group.

Table 4: Comparison of Mean Rank for Obstetric outcomes after the intervention in both groups (N=150)

Variable	Intervention Group		Control Group		Mean Difference	Student Independent t-test	P value
	Mean	SD	Mean	SD			
Maternal Outcome	2.273	0.863	5.46	0.498	3.187	10.115	< .00001 (S)
Neonatal outcome	2.3	0.781	4.44	0.8	2.140	6.053	< .00001 (S)

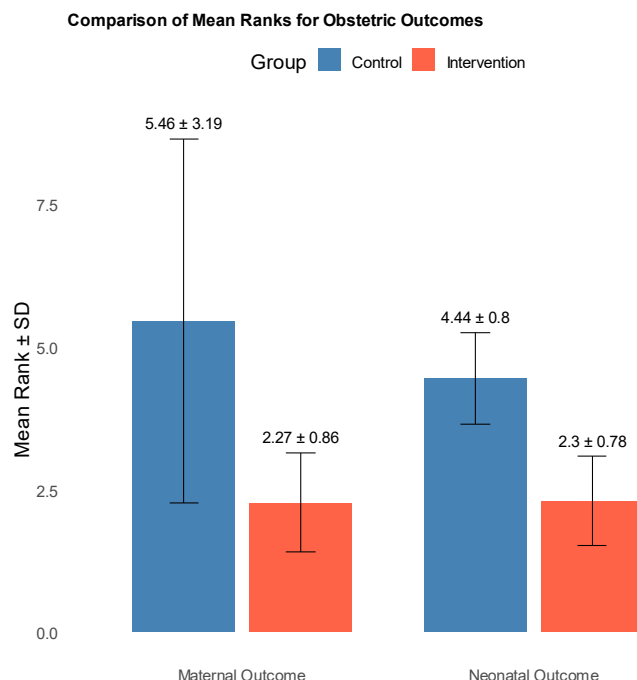


Figure 2. Post-intervention Obstetric outcomes (Mean $\pm$ SD); The intervention group demonstrated lower mean ranks for maternal outcomes (2.27 $\pm$ 0.86) and neonatal outcomes (2.30 $\pm$ 0.78) compared to the control group (maternal: 5.46 $\pm$ 3.19, neonatal: 4.44 $\pm$ 0.80), indicating that the intervention had a positive impact on both maternal and neonatal health parameters. These results suggest that the intervention effectively improved obstetric outcomes in the study population

The study findings indicate significant variability in participants' perinatal outcomes, highlighting the need for alternative non-pharmacological comprehensive strategies that promote cardiovascular parameters, lower blood pressure, and improve positive maternal and neonatal outcomes. These results align with those of the studies¹⁹⁻²⁴. The study intervention was developed with components of a maternal education program, regular mindful walking, Pranava Pranayama, and guided mindful meditation promoting maternal and neonatal well-being. The comprehensive nursing intervention programme includes Pranava Pranayama, which enhances maternal and fetal cardiovascular parameters, as supported by Vasundhara *et al.*¹⁶. Research evaluation indicates that regular walking improves obstetric outcomes and significantly reduces adverse pregnancy complications and incidence of caesarean deliveries among pregnant women with HDP^{25, 26}. Mothers with pre-eclampsia had experienced increased antenatal depressive symptoms, which are strongly associated with a wide range of short- and long-term adverse health outcomes for mother and child²⁷. In this study, the intervention consisted of activities focused on psychological well-being, which emphasized substantial improvements in positive perinatal outcomes. A vital aspect of the intervention in this study was the continuous delivery of knowledge-based content, safe, non-pharmacological mindful practices, and yogic-based breathing exercises to improve mental well-being among rural women dealing with significant psychological distress, aiming to reduce adverse maternal and fetal

outcomes. The findings of the current study have a significant effect in reducing adverse perinatal outcomes among the intervention group compared to the control, $P < 0.00001$. This finding aligns with prior studies that emphasize the critical role of non-clinical nursing intervention in reducing adverse perinatal outcomes^{28, 29}. A study reviewed the efficacy of mindfulness-based interventions in improving perinatal psychological outcomes³⁰. The program successfully raised awareness about hypertensive disorders of pregnancy, promoted maternal and fetal well-being, and reduced adverse perinatal outcomes in resource-poor settings. Given these positive outcomes, health care professionals should implement this program in antenatal care settings and integrate it into comprehensive antenatal care services. Enhancing the role of primary health workers in delivering and sustaining this program in the early stage is crucial to ensure long-term success in preventing adverse perinatal outcomes among hypertensive women. This suggests that further research with a broad population is necessary to understand the impact of the intervention. Therefore, healthcare providers should prioritize enhancing knowledge and psychological well-being, and adopting regular comprehensive antenatal practices within the community, particularly in low- and middle-income countries.

STRENGTHS AND LIMITATIONS OF THE STUDY

The researchers considered an adequate sample size and multiple variables. This study strengthens the main

interventional study by testing its feasibility and reliability, and refining research methods to improve quality. This study aimed to explore causal relationships and expand the sample size to outstanding perinatal outcomes among antenatal women with hypertensive disorders. This research study designed the interventions for high-risk pregnant women, particularly in rural or low-income populations. Further directions include conducting longitudinal studies with a large sample size across various health settings.

CONCLUSION

This study provides evidence of the feasibility and acceptability of such studies in the large-scale experiment, showing a significant reduction in adverse perinatal complications and enhancing the positive perinatal outcome among antenatal mothers with HDP. Comprehensive nursing intervention can be practiced effectively and safely in this population; it may be adopted for outcomes in the antenatal, intranatal, and postnatal periods and prevent short and long-term complications related to HDP.

Ethics statement

Ethical approval was obtained from the Institutional Human Ethics Committee of Vivekananda Nursing Institute, Vivekananda Loksiksha Niketan (VNI/IHEC/001/2023). Study participants were fully informed about the study, including its objectives, risks, and benefits, and provided their voluntary agreement to participate in this study. Participants' personal information and their anonymity were ensured throughout the research process.

Declaration of competing interest

The authors have no competing interests to declare.

Acknowledgments

The authors would like to express their appreciation and gratitude to all study participants and collaborators for their contribution to this study.

Authorship contribution statement

Anitha B: Writing – original draft, Validation, Methodology, Data curation, Formal analysis, Conceptualization. Geetha C: Writing-review, Data curation, Validation, Methodology, Formal analysis, Visualization, Supervision. Ananda Balayogi Bhavanani: Writing-review, Data curation, Validation, Methodology, Formal analysis, Visualization, Supervision. Jeyadeepa R: Writing-review, Data curation, Validation, Methodology, Formal analysis, Visualization, Supervision. Mani N: Writing – review & editing, Writing – original draft, Formal analysis, Supervision, Conceptualization.

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