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Effectiveness of a Multicomponent Nurse-Led Intervention on Maternal and Perinatal Outcomes among Pregnant Women with Hypertensive Disorders of Pregnancy: A Quasi-Experimental Study

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ABSTRACT:

Background: Maternal and perinatal morbidity and mortality are significant due to hypertensive disorders of pregnancy (HDP). The clinical management of an antenatal situation must be accompanied by antenatal education, medication compliance and advice on diet and lifestyle, as well as psychological support. The holistic nurse-led approach can help reinforce maternal self-care practices and help to improve pregnancy outcomes.

Aim: This is a study to assess the effectiveness of a multimodal nurse-led intervention on knowledge, physiological parameters, maternal stress and maternal & perinatal outcomes for women with hypertensive disorders in pregnancy.

Methods: The study was designed as a quantitative quasi-experimental one group pre test–post test design and selected pregnant women with HDP (n=66) of the study were recruited from selected healthcare centres of Deshapran block, Purba Medinipur district, West Bengal. The participants were selected through purpose sampling at the 24-28th week of gestation. The multicomponent 8-weeks nurse-led intervention comprised of structured maternal education, dietary counselling, blood pressure monitoring, medication adherence counselling, lifestyle modification, mindful walking, Pranava Pranayama, guided mindful meditation, and regular follow-up with reinforcement. Before and after the intervention, knowledge, physiological parameters and maternal stress were evaluated, and after childbirth, maternal and perinatal outcomes were assessed.

Results: The mean difference between pretest and posttest scores for knowledge was 11.12, and the paired t value was statistically significant ($p < 0.001$) with mean knowledge score pretest 6.74 ± 2.08 and posttest 17.86 ± 1.42. There was notable improvement in blood pressure (systolic blood pressure, diastolic blood pressure), proteinuria, edema, headache and epigastric pain for all comparisons *($p < 0.001$)*. There was a significant positive correlation between posttest knowledge and maternal outcomes *($r = 0.62$, $p =$*

0.001) and fetal/neonatal outcomes *(r = 0.62, p = 0.001)*. Maternal and fetal/neonatal outcomes were negatively correlated with systolic and diastolic blood pressure *(r = −0.66, p = 0.001)*. Maternal stress also had significant negative correlations with maternal outcomes *(r = −0.58, p = 0.003)* and fetal/neonatal outcomes (r = −0.58, p < 0.001).

Conclusion: There were significant positive associations between the multicomponent nurse-led intervention and maternal knowledge and selected physiological parameters of pregnant women with HDP. The results also reveal strong relationships between maternal knowledge, blood pressure, stress and maternal and fetal/neonatal outcomes. Comprehensive nurse-led education, clinical monitoring, lifestyle support and stress-management techniques could be a helpful supportive measure in the community-based antenatal care for women with HDP. Larger samples and controlled designs in multicentre studies are warranted to confirm these findings.

1. INTRODUCTION

Hypertensive disorders of pregnancy (HDP) are still a significant public health problem and a leading cause of maternal morbidity and perinatal mortality in the world. HDP encompasses chronic hypertension, gestational hypertension, pre-eclampsia and eclampsia; the last two can be particularly significant sources of potentially preventable maternal and fetal complications. Severe hypertension, neurological complications, renal and hepatic dysfunction, stroke, maternal death, fetal growth restriction, preterm delivery, low birth weight, respiratory complications and admission to the neonatal intensive care unit are possible complications of these disorders in women, and fetal and neonatal consequences include fetal growth restriction, preterm delivery, low birth weight, respiratory complications and admission to the neonatal intensive care unit [1–4]. The persistent disease burden of HDP highlights the need to detect, monitor, treat and provide good antenatal care early.

Treatment of women with HDP should involve ongoing monitoring of the mother and fetus and early identification of signs of disease progression. International guidelines focus on correct measurement of blood pressure, evaluation of proteinuria and other maternal clinical features, appropriate drug treatment and monitoring of foetal status and prompt referral where necessary, depending on the severity of the disease [3,5]. Antenatal care is a good platform for the integration of these clinical activities and health education, counselling and promotion of self-care. Person-centred care, effective communication, health promotion, screening and management of complications of pregnancy are the key components of the WHO antenatal-care framework [6].

Maternal knowledge and self-care behaviours are also significant aspects of the management of HDP. Women should be aware of the nature of hypertension in pregnancy, the warning signs which need urgent medical attention, the importance of taking prescribed medicine, dietary measures, and the need to monitor blood pressures and attend regular antenatal check-ups. Lack of knowledge and/or late recognition of symptoms can be a factor in their not seeking care in time or complications that might have been prevented. The nurse-led care can offer a chance for repeated education, individual counseling, and monitoring and reinforcement of recommended self-care behaviors. There has been recent evidence that nursing interventions may be beneficial in women with gestational hypertension. One study, which involved a systematic review and meta-analysis of 13 studies and 1,458 women, showed positive effects of various nursing interventions, such as home-based comprehensive nursing, case management, training programmes and clinical nursing pathways, but this varied in terms of the content of the interventions and the design of the studies [7].

One more vital management aspect of HDP is blood pressure monitoring. However, regular checks can help identify fluctuations in blood pressure and ensure timely reporting to healthcare professionals. Self or home monitoring can also help to get women more engaged in their care. Self monitoring of blood pressure (SMBP) was generally assessable and acceptable to women with HDP and health care providers in a systematic review of available evidence, with the available evidence largely located in high-income contexts [8]. Another systematic review and meta-analysis of 5,335 women found that, for certain outcomes, home blood pressure monitoring may benefit, such as induction of labour and postpartum readmission [9]. These results advocate for systematic blood pressure surveillance and follow-up from the nurses, as part of the comprehensive prenatal services.

Lifestyle changes can be used as another part of the treatment. During pregnancy, physical activity has been studied in the context of the prevention of HDP and cardiovascular health; there is some evidence suggesting that physical activity, when

used appropriately, depending on maternal and obstetric status, might be beneficial [10–12]. Women with HDP, however, should receive personalized advice and clinical supervision, especially with respect to the integration of physical activity into their antenatal care. Lifestyle counselling therefore is an integral rather than exclusive component of a nurse-led programme and should not be used to replace recommended medical management.

High-risk pregnancy is also related to psychological stress. High blood pressure during pregnancy can create anxiety, uncertainty and psychological burden, and maternal stress can impact health behaviours and well-being. Non-pharmacological interventions (NPI) including mind-body techniques such as mindfulness, relaxation and breathing exercises have therefore been the focus of greater interest during pregnancy. Twenty-eight RCTs with a total of 1,944 pregnant women were included in a systematic review and meta-analysis, which were linked to reduced antenatal stress, anxiety and depression, though there was significant study heterogeneity [13]. A number of more recent SRI and MA have also found evidence for potential benefits of MBIs for psychological outcomes during pregnancy [14–16].

Although there is increasing evidence for each piece of antenatal care, there is a need for integrated interventions addressing antenatal care from a clinical point of view, maternal knowledge, treatment adherence, lifestyle practices and psychological well-being of women with HDP. This need may be of significant importance in community and resource-limited environments where multiple encounters with trained nurses may be able to help ensure continuity of care, further reinforce self-management and ensure timely referral. There is also existing evidence that suggests that there is an opportunity for further study of blood-pressure self-monitoring in resource limited settings [8].

Because of this, the present study aimed to assess a multicomponent nurse-led intervention that was delivered using a community-based healthcare service. The intervention consisted of maternal education, dietary counselling, blood-pressure monitoring, medication-adherence counselling, lifestyle modification, mindful walking, Pranava Pranayama, guided mindful meditation, and systematic follow-up. The intervention was applied for eight weeks, including active intervention in the first few weeks, adherence monitoring, and reinforcement and follow up support.

This study took pregnant women with HDP from selected health care centres in Deshapran Block, Purba Medinipur, West Bengal as study population. The objective was to assess if this integrated nurse-led approach was linked to a change in maternal knowledge, physiological parameters and stress and to explore possible correlations between these and maternal and fetal/neonatal outcomes. The study goals and the outcome domains were designed a priori for knowledge, physiological parameters, maternal stress, maternal outcomes, perinatal outcomes, selected demographic and obstetric characteristics.

Study Objective

The main aim of this study was to assess the impact of a multi-component nurse-led intervention on knowledge, physiological parameters, maternal stress and maternal and perinatal outcomes in pregnant women with a history of hypertensive disorders of pregnancy.

2. MATERIALS AND METHODS

2.1 Study Design

A multicomponent nurse-led intervention was implemented in a quantitative quasi-experimental one-group pretest–posttest design to assess intervention effectiveness in pregnant women with hypertensive disorders of pregnancy (HDP). Baseline assessment was performed prior to the intervention, the multicomponent programme was implemented and post intervention assessment took place.

2.2 Study Setting

This study was carried out in selected healthcare centres of Deshapran block of Purba Medinipur District, West Bengal, India. Basantia Block Primary Health Centre (BPHC) with its sub centres was the study area. The women were screened for eligibility and recruited for the study at the community health facilities, which were selected, at the time of their antenatal visit.The women were screened during their antenatal visit to the selected community healthcare facilities, for eligibility and recruited for the study.

2.3 Study Population

The target population consisted of pregnant women who were diagnosed to have hypertensive disorders of pregnancy. In the selected healthcare centres of Deshapran block, pregnant women attending these centres who met the predetermined criteria were selected for the accessible population.

2.4 The sample size and sampling technique

The 66 pregnant women with HDP were selected for the study. A non-probability purposive sampling was used to recruit the participants. Eligibility criteria were determined to assure the hypertensive condition of the participants was clinically relevant but not severe enough, and they could participate safely in the intervention and follow-up programme.

2.5 Eligibility Criteria

Inclusion Criteria

- ✓ The women had to meet the following criteria to participate in the study;
- ✓ Medical History: Pregnancy Associated Hypertension – Blood Pressure 140/90 – 159/109.
- ✓ A gestational age of 24–28 weeks at the time of recruitment.
- ✓ Antenatal care received at the selected Healthcare Centres on a regular basis.
- ✓ Consent to take part in the study and to give informed written consent.
- ✓ Availability of the intervention and follow-up.

Exclusion Criteria

Women were not included in the study if they had any of the following:

- ✓ Raised blood pressure ≥ 160/110 mmHg; severe pre-eclampsia; eclampsia; HELLP syndrome or obstetric emergency for immediate hospital admission or referral.
- ✓ Many pregnancies or antepartum haemorrhage.
- ✓ Medical conditions which are likely to be serious enough to negatively impact participation or study results.
- ✓ Psychiatric disorder or mental retardation that interferes with participation in the study.
- ✓ Failure to be able to do mindful walking, Pranava Pranayama or guided mindful meditation because it is contraindicated.
- ✓ Hearing loss which impaired ability to participate in guided meditation.
- ✓ Fetal congenital anomalies known to the woman**.**

2.6 Study Variables

The intervention was a multicomponent nurse-led intervention, the independent variable.

The dependent variables that were included were:

- Knowledge regarding HDP
- Systolic blood pressure
- Diastolic blood pressure
- Proteinuria
- Edema
- Headache
- Epigastric pain
- Maternal stress
- Maternal outcomes and
- Fetal/neonatal outcomes.

Sociodemographic factors that were selected were age, educational status, occupation, family income, type of family, type of work, religion, dietary pattern, type of marriage and previous exposure to information about HDP.

Obstetric and clinical factors selected were gestational age at delivery, gravida, abortion history, number of living children, history of hypertension, previous history of HDP, pregnancy complications, body mass index (BMI), systolic blood pressure, diastolic blood pressure, proteinuria, edema, headache and epigastric pain.

2.7 Multicomponent Nurse-Led Intervention

The intervention was tailored to be an integrated antenatal nursing programme comprising of clinical, educational, Behaviour and psychological aspects of HDP.

The intervention comprised:

1. Structured maternal education on HDP including definition, risk factors, cause, signs and symptoms, blood pressure monitoring and educating the importance of blood pressure monitoring, Medication adherence counselling, Dietary counselling and guidance about appropriate dietary practices, lifestyle modification;

2. Mindful walking;

3.Pranava Pranayama;

4. Mindful mediation with the guidance; and

5. Follow-up, reinforcement and referral support on a regular basis.

The active intervention took place in weeks 1-4. Follow up and reinforcement was followed up in weeks 5-8 with weekly contacts, adherence reminders, adherence records, further education reinforcement, participant concerns addressed and referral as clinically necessary.

2.8 Intervention Schedule

The intervention was presented sequentially to allow for gradual learning and uptake of self-care skills.

In the first phase participants were provided with structured education on HDP and warning signs. Next sessions were focused on blood-pressure monitoring, adherence to medication, dietary recommendations, and stress management and lifestyle modification. Mindful walking, Pranava Pranayama and guided mindful meditation were subsequently introduced and reinforced. During the later phase, weekly home visits and follow-up calls were employed to encourage adherence to the intervention and to discuss participant concerns.

2.9 Data Collection Procedure

Baseline data was taken after consenting. Before starting intervention, the sociodemographic, obstetric and clinical data were recorded. Knowledge about HDP, physiological parameters and maternal stress were measured in a pre test.

After baseline assessment the multicomponent nurse-led intervention was given to the participants following a predetermined protocol. Follow up adherence to intervention was checked by home visits, sub centre visits, phone prompts and record of participation.

The post test assessment of knowledge, physiological parameters and maternal stress was conducted after the completion of intervention and follow-up period. Maternal and perinatal outcomes were evaluated after 24 hours of giving birth.

2.10 Outcome Assessment

The main outcome domains included changes in maternal knowledge, physiological parameters and maternal stress due to the intervention.

Physiological evaluation consisted of systolic and diastolic blood pressure as well as proteinuria, headache and epigastric pain, and edema. Afterwards, maternal and fetal/neonatal outcomes were evaluated to check the association between the maternal clinical and psychological features and pregnancy outcomes.

2.11 Statistical Analysis

Descriptive and inferential statistical analysis methods were used to organise and analyse data. Sociodemographic, obstetric and clinical features were recorded and summarized with descriptive statistics.

The paired t-test was used to compare pre test and post test scores of knowledge. Categorized physiological parameters changes were evaluated by chi-square test. The Pearson's correlation coefficient was used to test the relationships between posttest maternal knowledge, physiological parameters, maternal stress and maternal/fetal-neonatal outcomes. Chi-square or Fisher's exact test was used to determine associations between selected maternal characteristics and maternal outcomes.

A two-sided P value <.05 was deemed statistically significant.

3. Results

Table 1. Sociodemographic Characteristics of Pregnant Women with HDP (n = 66)

Characteristic	Category	n (%)
Age (years)	18–25	48 (72.7)
	26–30	12 (18.2)
	>30	6 (9.1)
Education	High school	50 (75.8)
	Higher secondary	10 (15.2)
	Graduate and above	6 (9.1)
Occupation	Homemaker	45 (68.2)
	Employed	21 (31.8)
Family income	₹5,001–10,000	36 (54.5)
Type of work	Moderate	54 (81.8)
Type of family	Joint	44 (66.7)
	Nuclear	22 (33.3)

There were 66 pregnant women with HDP who were included in the analysis. Most participants were aged 18–25 years (72.7%), while 18.2% were aged 26–30 years and 9.1% were aged above 30 years. In terms of educational qualification, 75.8% had completed high school, 15.2% higher secondary education and 9.1% were graduates and above.

Most of the participants (68.2%) were homemakers and 31.8% were working. The majority of the participants were in the monthly family-income category of ₹5001–10,000 (54.5%). The physical activity level experienced by most participants was moderate (81.8%) and 66.7% of them were associated with joint families.

3.2 Obstetric Characteristics

Table 2. Obstetric Characteristics of Participants (n = 66)

Characteristic	Category	n (%)
Gravida	Primigravida	50 (75.8)
	Multigravida	16 (24.2)
Previous abortions	Nil	63 (95.5)
	One	3 (4.5)
	>1	0 (0.0)
Number of living children	Nil	51 (77.3)

	One	13 (19.7)
	Two	2 (3.0)
	≥3	0 (0.0)
Family history of hypertension	Yes	15 (22.7)
	No	51 (77.3)
History of medical disorders	Yes	10 (15.2)
	No	56 (84.8)
History of hypertension	Yes	7 (10.6)
	No	59 (89.4)
Previous HDP	Yes	7 (10.6)
	No	59 (89.4)
Complications in previous pregnancy	Yes	6 (9.1)
	No	60 (90.9)
Previous adverse maternal outcome	Yes	14 (21.2)
	No	52 (78.8)
Previous adverse fetal outcome	Yes	7 (10.6)
	No	59 (89.4)

The majority of the participants were primigravida (75.8%) and none of subjects had ever experienced abortion (95.5%). Most did not have any children alive (77.3%). Twenty-two.7% of participants had a family history of hypertension. Ten percent (10.6%) reported a previous history of hypertension and 10% a history of hypertensive disorders of pregnancy.

3.3 Clinical Characteristics

Table 3. Baseline Clinical Characteristics (n = 66)

Clinical characteristic	Category	n (%)
BMI	Overweight (25–29.9 kg/m²)	32 (48.5)
Systolic BP	150–159 mmHg	34 (51.5)
Diastolic BP	100–109 mmHg	34 (51.5)
Respiratory rate	18–24/min	52 (78.8)
Heart rate	100–120/min	48 (72.7)

The 48.5% of the subjects were overweight based on BMI at baseline. Over half were taking blood pressure medications with systolic pressures ranging from 150-159 mmHg (51.5%) and diastolic pressures from 100-109 mmHg (51.5%). In 78.8% respiratory rate was observed to be 18–24 br/min and 72.7% had heart rate of 100–120 bpm.

3.4 Effect of the Intervention on Knowledge

Table 4. Comparison of Pretest and Posttest Knowledge Scores (n = 66)

Outcome	Pretest Mean ± SD	Posttest Mean ± SD	Mean Difference	Paired *t*	*p*-value
Knowledge score	6.74 ± 2.08	17.86 ± 1.42	11.12	34.82	0.001

The intervention had no significant impact on the knowledge of the participants.

The multicomponent nurse-led intervention led to a significant increase in knowledge about HDP. The mean score for knowledge went up from 6.74 ± 2.08 at pretest to 17.86 ± 1.42 at the post test and the mean increase was 11.12 points.

The paired t-test showed that there was a statistically significant difference between pretest and post test knowledge score ($t = 34.82$, $p < 0.001$), suggesting that the knowledge was significantly improved after the intervention.

3.5 Effect of the Intervention on Physiological Parameters

Table 5. Changes in Physiological Parameters Following the Intervention (n = 66)

Parameter	Category	Pretest n (%)	Posttest n (%)	χ^2	*p*-value
Systolic BP	Normal	0 (0.0)	47 (71.2)	74.43	0.000
	Mild–moderate HDP	66 (100.0)	19 (28.8)		
	Severe HDP	0 (0.0)	0 (0.0)		
Diastolic BP	Normal	0 (0.0)	46 (69.7)	72.59	0.001
	Mild–moderate HDP	66 (100.0)	20 (30.3)		
	Severe HDP	0 (0.0)	0 (0.0)		
Proteinuria	Negative	7 (10.6)	48 (72.7)	57.21	0.000
	Trace	13 (19.7)	5 (7.6)		
	1+	29 (43.9)	13 (19.7)		
	2+	17 (25.8)	0 (0.0)		
Edema	Grade 0	3 (4.5)	41 (62.1)	75.17	0.000
	Grade 1+	21 (31.8)	25 (37.9)		
	Grade 2+	41 (62.1)	0 (0.0)		
	Grade 3+	1 (1.5)	0 (0.0)		
Headache	Score 0	2 (3.0)	45 (68.2)	82.57	0.000
	Score 1–4	9 (13.6)	15 (22.7)		
	Score 5–8	17 (25.8)	5 (7.6)		
	Score 9–12	21 (31.8)	1 (1.5)		
	Score 13–16	17 (25.8)	0 (0.0)		
Epigastric pain	Nil	1 (1.5)	47 (71.2)	103.66	0.000
	Mild	9 (13.6)	19 (28.8)		
	Moderate	42 (63.6)	0 (0.0)		
	Severe	14 (21.2)	0 (0.0)		

The effect of the intervention on physiological parameters was measured.

All of the assessed physiological manifestations of HDP showed significant improvement after the intervention.

The percent of those who were classified as NSBP at pretest rose to 71.2% at post test. Likewise, the percentage of those with normal DBP rose from 0% to 69.7%.

The percentage of patients with a negative proteinuria rose from 10.6% pretest to 72.7% posttest. Improvements were also noted in edema with Grade 0 edema rising from 4.5% to 62.1% and Grade 2+ edema falling from 62.1% to 0%.

Participants also had improvements in headache scores, with no headache scores increasing from 3.0% at pretest to 68.2% at posttest. Likewise, the percentage of those who did not have epigastric pain rose from 1.5% to 71.2%.

Statistically significant pretest–posttest differences were observed for systolic blood pressure, diastolic blood pressure, proteinuria, edema, headache and epigastric pain (all $p < 0.001$).

3.6 Relationship between Maternal Variables and Maternal Outcomes

Table 6. Correlation of Posttest Maternal Variables with Maternal Outcomes

Maternal variable	Mean ± SD	Pearson's *r*	*p*-value	Interpretation
Posttest knowledge	15.8 ± 2.4	0.62	0.001	Significant positive correlation
Systolic BP	132.4 ± 6.8	−0.66	0.001	Significant negative correlation
Diastolic BP	86.2 ± 5.9	−0.66	0.001	Significant negative correlation
Maternal stress	3.2 ± 1.5	−0.58	0.003	Significant negative correlation

There was a significant positive correlation between posttest maternal knowledge and maternal outcomes ($r = 0.62$, $p = 0.001$). Systolic blood pressure and diastolic blood pressure, on the other hand, had a significant negative correlation with maternal outcomes ($r = −0.66$, $p = 0.001$ for both). Maternal stress also significantly and negatively correlated with maternal outcomes ($r = −0.58$, $p = 0.003$). The results showed that higher post test knowledge was related to better maternal outcomes while higher blood pressure and higher maternal stress were related to poorer outcomes.

3.7 Relationship between Maternal Variables and Fetal/Neonatal Outcomes

Table 7. Correlation of Posttest Maternal Variables with Fetal/Neonatal Outcomes

Maternal variable	Mean ± SD	Pearson's *r*	*p*-value	Interpretation
Posttest knowledge	15.8 ± 2.4	0.62	0.001	Significant positive correlation
Systolic BP	132.4 ± 6.8	−0.66	0.001	Significant negative correlation
Diastolic BP	86.2 ± 5.9	−0.66	0.001	Significant negative correlation
Maternal stress	3.2 ± 1.5	−0.58	<0.001	Significant negative correlation

Fetal/neonatal outcomes was positively correlated with post test knowledge ($r= 0.62$, $p= 0.001$). Systolic and diastolic blood pressure were negatively correlated with fetal/neonatal outcomes ($r = −0.66$, $p = 0.001$ for both).

Stress by the mother was also negatively correlated with fetal/neonatal outcomes ($r = −0.58$, $p < 0.001$).

3.8 Association between Selected Maternal Characteristics and Maternal Outcomes

Table 8. Association between Selected Characteristics and Maternal Outcomes (n = 66)

Characteristic	Test statistic	*p*-value	Inference
Age	$\chi^2 = 2.483$	0.478	Not significant
Education	$\chi^2 = 2.972$	0.226	Not significant
Occupation	$\chi^2 = 0.429$	0.807	Not significant
Monthly family income	$\chi^2 = 0.220$	0.896	Not significant
Physical activity	$\chi^2 = 0.219$	0.896	Not significant
Type of family	$\chi^2 = 0.123$	0.726	Not significant
Religion	$\chi^2 = 2.235$	0.135	Not significant
Consanguinity	$\chi^2 = 1.384$	0.239	Not significant

In the association analysis, not all maternal characteristics were significant and age, education, occupation, monthly family income, physical activity, type of family, religion and consanguinity were not significantly associated with maternal outcomes. The statistical significance of all the p values were higher than 0.05.

3.9 Summary of Principal Findings

The principal findings are summarized below.

The overall study proved that the multicomponent nurse-led intervention had a significant effect on improving the knowledge of mothers. There were also substantial increases in the measured physiological parameters from pretest to posttest. Additionally, higher maternal and fetal/neonatal outcomes were positively correlated with knowledge gained in the posttest, while blood pressure and maternal stress had negative correlations with the fetal/maternal outcomes. Maternal outcome was not statistically significantly associated with any of the selected sociodemographic factors in the study.

4. DISCUSSION

This is the first study to assess a nurse-led intervention that combines mindful walking, Pranava Pranayama, guided mindful meditation, structured follow-up, lifestyle modification, dietary guidance, blood-pressure monitoring and medication-adherence counselling for pregnant women with hypertensive disorders of pregnancy (HDP). The main findings were a significant increase in knowledge, significant changes in selected physiological signs and symptoms of HDP, and significant correlations between knowledge, blood pressure and selected maternal and fetal/neonatal outcomes and maternal stress. The results indicate that an integrated approach to nursing, covering both the clinical and behavioural aspects might be beneficial in a community-based antenatal care. This is an indicator of improvement in maternal knowledge.

The one that stands out the most is the increase in awareness on HDP. The mean score on the knowledge section at pre-test was 6.74 ± 2.08, which was elevated to 17.86 ± 1.42 at post-test, with a highly significant mean change of 11.12 points (paired $t = 34.82$, $p < 0.001$).

The enhancement could be linked to the standardized and repetitive design of the educational aspect of the intervention. The intervention, instead of a single educational session, included information on nature of HDP, risk factors, warning signs, BP monitoring, adherence to medications, diet and self-care, and reinforcement was provided on subsequent contacts. Repeated interactions with the nurse from the participant can be used to correct misconceptions, remind key warning signs and promote active involvement in antenatal care.

The finding is clinically significant since knowledge is one of the important prerequisites for appropriate self-care and timeous seeking of medical help. Women with HDP should be aware of the symptoms that include severe headache, visual disturbances, epigastric pain and worsening edema and know the need to have regular blood-pressure checks and receive prescribed

treatment. The results of the present study are thus indicative of the education and facilitation role of the nurse in relation to self-management in antenatal services.

4.3 Improvement in Blood Sugar Level

The intervention resulted in a significant improvement in the systolic and diastolic blood-pressure categories after the study. The percentage of women with a normal systolic blood pressure rose from 0 to 71.2% ($p < 0.001$) and the percentage with a normal diastolic blood pressure rose to 69.7% ($p < 0.001$). Significant improvements were also observed in proteinuria, edema, headache and epigastric pain.

The results are comparable to the overall evidence which encourages active monitoring and nurse-supported management of hypertension. A systematic review of SBP use among women with HDP found potential feasibility and acceptability of SBP monitoring but noted several uncertainties, including inconsistent methods used and clinical thresholds [8].

There also has been a growing body of evidence in recent years. A systematic review and meta analysis of 5335 women in 2023 reported that home blood pressure monitoring had a negative association with induction of labour and a non-positive association with maternal, foetal and neonatal adverse outcomes in some of the analyses [9]. A recent systematic review and meta-analysis of 18 studies involving 28,094 women on remote blood-pressure monitoring found that remote monitoring could reduce outpatient visits and hospital admissions during pregnancy, with no increased risk of adverse outcomes for the mother or the fetus, though the authors noted the high level of heterogeneity in the studies and expressed the need for larger, higher-quality trials [17].

The present intervention was not a mere monitoring alone, but it was a combination of blood pressure monitoring, education, counselling to take medicine, diet counseling, lifestyle modification and follow-up. Thus, the effect observed should not be considered as being due to the blood-pressure monitoring itself, but rather to the blood-pressure programme as a whole.

There is an improvement in proteinuria, oedema, headache and epigastric pain (4.3).

The clinically relevant parameters of improvement are proteinuria, edema, headache and epigastric pain, which are all symptoms of the progression of hypertensive disease. The proportion of negative proteinuria rose from 10.6% to 72.7% and the proportion of participants who did not have headache rose from 3.0% to 68.2% in the present study. The percentage saying that there was no epigastric pain rose from 1.5% to 71.2%. All comparisons reported were statistically significant at the $p<0.001$ level.

Results could be due to the synergistic effect of better adherence to treatment, dietary counselling, clinical monitoring, lifestyle changes and raising awareness of symptoms. Another possible effect that might have occurred through follow-up is that participants may have been more likely to report symptoms at an earlier point and to stick to the clinical care recommendation.

The results must be interpreted with caution, however. Spontaneous changes over gestation, regression to the mean and other temporal factors cannot be completely ruled out, as the study did not include a concurrent control group. Thus, the results show important pretest–posttest gains, but cannot alone confirm that the gains were due to the intervention.

The authors discuss the role played by lifestyle modification and mindful walking in this context.The authors introduce lifestyle modification and mindful walking in this regard.

As part of the intervention, lifestyle modifications and mindful walking were included. The addition of physical activity is warranted by the increasing evidence of the beneficial effects of the appropriately prescribed prenatal exercise on the maternal cardiovascular health. A systematic review and meta-analysis of randomized controlled trials found that exercise in pregnancy was linked to a decreased risk of hypertensive disorders and small decreases in blood pressure (systolic and diastolic) [18].

Previous studies have also shown that pregnancy women who engaged in aerobic exercise during pregnancy had a lower risk of developing gestational hypertensive disorders [19]. Support for the potential benefits of prenatal exercise continues in more recent evidence: a large 2026 systematic review and meta-analysis of 88 randomized controlled trials that exercise interventions decreased the occurrence of hypertensive disorders of pregnancy [20].

The present study thus offers a clinically relevant illustration of the ways in which an appropriately supervised programme of physical activity can be integrated into a wider nursing programme. However, due to the current design, it is not possible to calculate the effect of mindful walking alone.

4.5 Role of Stress Management and Mindfulness Based Components: The role of stress management and mindfulness based components is also considered and discussed.

Pranava Pranayama and guided mindful meditation were used as a strategy for psychological support in the intervention. There was a significant negative correlation between maternal stress and maternal outcomes ($r = -0.58$, $p = 0.003$) as well as fetal/neonatal outcomes ($r = -0.58$, $p < 0.001$).

These results are in line with the earlier studies indicating that mind-body practices may have a beneficial impact on emotional health and well-being in pregnancy. Perinatal mindfulness-based and other mind-body interventions have been reported in systematic reviews to have potential benefits for stress, anxiety and depressive symptoms. However, different studies over the past that have been conducted on this topic have tested a range of different interventions, which differ in content, length and delivery.

It is important to note that the current results do not necessarily suggest that a reduction in stress directly led to an improvement in the maternal or fetal outcomes, but rather provide evidence that maternal stress was associated with pregnancy outcomes. However, adding a structured stress-management procedure to nursing care could prove beneficial as psychological health is a crucial part of comprehensive antenatal care.

4.6 Relationship between Knowledge and Maternal Outcomes

There was a good positive correlation between the post test knowledge and maternal outcomes ($r = 0.62$, $p = 0.001$). The finding indicates that those women who had greater knowledge after the intervention had more positive maternal outcomes.

A possible explanation is that more knowledge would help with compliance of medication, diet advice, antenatal visits, blood-pressure checks and early warning. This relationship may have been further reinforced because of the nurse-led aspect of the programme whereby the learning of knowledge was linked to activities of self-care.

The cross-sectional nature of the correlation does not imply a temporal causation, however. Other desirable features like engagement with health care or adherence may co-occur with higher knowledge. In future, controlled studies need to investigate the possibility that an improvement in knowledge is a mediator of clinical outcomes.

The relationship between blood pressure and maternal and fetal/neonatal outcomes will be discussed.The relationship between blood pressure and maternal and fetal/neonatal outcomes will be discussed.

There were significant negative correlations between systolic and diastolic blood pressure, and maternal and fetal/neonatal outcomes ($r = -0.66$, $p = 0.001$).

Such relationships are clinically plausible since poor control of hypertension during pregnancy puts women at risk for complications of pregnancy and poor fetal outcomes. The results highlight the need for ongoing BP monitoring and medical management during pregnancy.

Studies of home blood pressure and remote BP monitoring further emphasize the need for structured blood pressure monitoring. Monitoring, however, should be integrated within a clinical pathway that establishes the appropriate thresholds for communication, assessment and treatment, and not as an autonomous self-care practice [8,9,17].

4.9 Pre- and Post-Pregnancy Weight Gain of Mother and Fetus

There was a negative relationship between maternal stress and maternal and fetal/neonatal outcomes, suggesting the higher the maternal stress, the less positive the outcomes.

One potential reason is that psychological stress could occur in conjunction with lower self-care, sleeping problems, lower adherence or higher perception of pregnancy-related symptoms. On the other hand, women who are having clinical issues may spontaneously be more stressed. This relationship is not intended to imply any directionality in the present study, and should thus be considered as an association.

However, the result strengthens the notion of incorporating psychological evaluation as part of the holistic care for women experiencing HDP. Treatment of hypertension should not only include blood pressure, but should take into account the woman's physical and psychological needs.

4.9 Maternal and Fetal/Neonatal Outcomes

The overall positive association of posttest knowledge with fetal/neonatal outcomes and the negative association between blood pressure, stress and fetal/neonatal outcomes highlights the potential role of fetal/neonatal outcomes for maternal clinical and behavioral characteristics.

Results confirm the clinical significance of HDP for the growth of the fetus and the gestational age and well-being of the newborns. Thus, the management of maternal hypertension can have implications beyond just maternal health.

However, the present study cannot answer the question whether the intervention stood alone as a successful intervention in fetal/neonatal outcome as there was no concurrent comparison group and the intervention was multi-component. Randomized or controlled designs and pre-specified clinically relevant perinatal outcomes at delivery (gestational age, birth weight, Apgar, NICU admission, neonatal morbidity) are recommended for future research.

This indicated that there were no significant associations found between the outcome and the sociodemographic characteristics.

The study revealed that there was no statistically significant relationship between the selected characteristics such as age, education, occupation, monthly family income, physical activity and type of family and religion of mother and her outcomes.

Statistically non-significant associations could be attributed to the fact that each characteristic showed no clear distinction between the observed changes related to the intervention in the sample of children included in the study. The relatively small sample size might, however, have restricted statistical power in detecting differences among subgroups. Thus, the results of this study should not be viewed as a definitive statement of the nonrelationship of demographic factors to maternal outcomes.

4.12 Community Support Services

The results have implications for community-based nursing practice. Nurses are in a good position to repeat education, check blood pressure, remind patients about taking their pills, encourage good behavior, and recognize symptoms when they are present, and make appropriate referrals. The present intervention shows that these activities can be successfully integrated into a structured stress-management intervention for an antenatal programme.

A multi-component approach might be especially appropriate in the community if women have difficulty attending hospital-based services often. However, nurse-led interventions should be administered in accordance with existing clinical procedures and women with significant hypertension or those who have symptoms of severe pre-eclampsia must be medically assessed and referred.

The strengths of the study will be demonstrated in the following ways:

One of the strengths of the study is that several aspects of the HDP management are combined in a single nurse-led programme. The intervention included education, clinical monitoring, adherence counselling, dietary advice, lifestyle changes and psychological support, but was not focused on a single outcome. The community-based implementation and follow up also make primary and community health more relevant.

4.13 Limitations

The results should be taken with some reservations. First, the one-group pre test – post test design is not a design with a concurrent control group, which makes it difficult to determine causal effects. Second, purposive sampling and the limited sample size (n = 66) means that findings may not be generalizable to other populations and healthcare environments. Third, there were several components of the intervention and it would be difficult to conclude what effect each component (such as mindful walking, Pranava Pranayama or meditation) had alone. Fourth, some effects might have been affected by concurrent medical treatment and routine antenatal care. Lastly, the study was carried out in a particular community health care system in West Bengal, which might not be directly applicable to other geographical or health care systems.

4.14 Future Research

Randomized controlled and/or controlled quasi-experimental designs with larger, multicentre samples should be used in future studies. The impact of intervention fidelity, adherence, sustainability and cost-effectiveness should be explored also. Comparisons may be made to figure out the relative contribution of education, self-monitoring, lifestyle modification, and mindfulness-based components. Further evaluation of longer follow-up would further help to delineate if improvement is maintained in the postpartum period, and if the intervention affects longer term maternal cardiovascular risk.

5. CONCLUSION

This current study tested the effectiveness of a multi-component nurse-led intervention to pregnant women with a history of hypertensive disorders of pregnancy in a community health care environment. The mean knowledge score improved significantly from 6.74 ± 2.08 before the intervention to 17.86 ± 1.42 after the intervention ($p < 0.001$). There was also a significant improvement in systolic and diastolic blood pressure, proteinuria, headache and epigastric pain (all $p < 0.001$), and in edema ($p = 0.005$). In addition, maternal knowledge was significantly and positively associated with maternal and fetal/neonatal outcomes, while blood pressure was significantly and negatively associated with these outcomes, as was maternal stress.

The results suggest that a nurse-led integrated model that includes education, clinical surveillance, medication adherence counseling, dietary interventions, lifestyle changes and stress-reduction strategies could be a valuable part of a community-based antenatal care for women with HDP. The results, however, should be viewed in the light of the one group pretest–post test design. In order to determine effectiveness, sustainability and generalizability of the intervention, controlled multicentre studies with larger samples are necessary.

DECLARATIONS

Ethics Approval

Ethical Approval was done by the relevant institutional ethics committee before the study was undertaken.

Participants signed informed consent prior to their participation. The participants were informed about the purpose and procedure of the study and the voluntary participation. The subject of women with severe hypertension, severe pre-eclampsia, eclampsia, HELLP syndrome and obstetric emergencies were excluded and referred for appropriate management of the situation.

Ethical clearance was obtained from the Institutional Human Ethics Committee (IHEC) of Vivekananda Nursing Institute (VNI), vide Ethical Clearance No. VNI067/IHEC08/2023–24, prior to the commencement of data collection.

Informed Consent

All subjects gave written informed consent prior to participation in the study.

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Conflict of Interest

To be completed: "The authors declare that they have no conflict of interest."

Data Availability

The data that support the findings of this study will be made available on reasonable request from the corresponding author on the understanding that restrictions may apply for institutional or ethical reasons.

Author Contributions

To be fulfilled by each author in relation to his/her conceptualization, methodology, data collection, analysis, interpretation, and preparation of the manuscript and final approval.

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