

Counseling and Watermelon Juice as Complementary Therapy for Pregnancy Hypertension in Aek Haruaya Village, Padang Lawas Utara

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ABSTRACT

Hypertension in pregnancy remains a leading cause of maternal morbidity and mortality, particularly in rural areas with limited healthcare access. This community service program aimed to improve knowledge and reduce blood pressure among hypertensive pregnant women through counseling and watermelon juice intervention in Aek Haruaya Village, North Padang Lawas. Thirty pregnant women with gestational hypertension, chronic hypertension, or mild preeclampsia (20–34 weeks gestation) participated in a 14-day program consisting of interactive health education sessions and consumption of 300 ml fresh watermelon juice twice daily. Knowledge was measured using a 20-item questionnaire pre- and post-counseling, while blood pressure was monitored at baseline and day 14. Results showed a significant increase in knowledge scores from 52.3 ± 8.7 to 84.6 ± 6.2 ($p < 0.001$). Systolic blood pressure decreased from 148.7 ± 10.2 mmHg to 132.4 ± 8.9 mmHg (mean reduction 16.3 mmHg, $p < 0.001$), and diastolic blood pressure decreased from 95.3 ± 7.1 mmHg to 84.6 ± 6.4 mmHg (mean reduction 10.7 mmHg, $p < 0.001$). No serious adverse effects were reported, and adherence reached 93.3%. The combination of culturally tailored counseling and locally available watermelon juice effectively improved knowledge and significantly reduced blood pressure in hypertensive pregnant women. This community-based intervention offers a low-cost, safe, and sustainable complementary strategy for managing pregnancy hypertension in underserved rural settings.

Keywords: pregnancy hypertension, watermelon juice, counseling, blood pressure, community service.

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INTRODUCTION

Hypertensive disorders of pregnancy (HDP) remain one of the leading causes of maternal mortality and morbidity worldwide, affecting approximately 10% of pregnancies (Sinkey et al., 2020). These disorders encompass chronic hypertension, gestational hypertension, and pre-eclampsia-eclampsia, with the latter defined as gestational hypertension accompanied by proteinuria after 20 weeks of gestation (Brown et al., 2018). In Indonesia, the prevalence of hypertension based on population estimates ranges from 34.1% to 55.2% across various age groups (Ministry of Health RI, 2020), and maternal mortality in rural areas remains disproportionately high, with approximately 64% of maternal deaths occurring in rural settings (Kusumaningrum & Siagian, 2022). The disparity between urban and rural areas is further evidenced by research showing that rural pregnant women face significantly different risk factor profiles, including higher parity, greater exposure to cigarette smoke, lower physical activity levels, and distinct dietary patterns compared to their urban counterparts (Laksono et al., 2019). These differences necessitate context-specific maternal health interventions that address the unique challenges faced by rural communities.

The rural-urban gap in maternal health outcomes is particularly pronounced in underserved regions such as Kabupaten Padang Lawas Utara, North Sumatra. A recent study conducted in Aek Haruaya Village identified significant relationships between hypertension in pregnant women and key factors including maternal age (P-Value=0.005), smoking history (P-Value=0.014), and body mass index (P-Value=0.004) (Siregar et al., 2023). These findings underscore the multifactorial nature of pregnancy-related hypertension in rural communities, where limited healthcare infrastructure, low health literacy, and socioeconomic constraints compound the clinical challenges. The village of Aek Haruaya represents a typical agrarian community with limited access to primary healthcare facilities, where pregnant women face substantial barriers to receiving timely and adequate antenatal care (Dinas Kesehatan Padang Lawas Utara, 2023).

In response to these challenges, community-based interventions utilizing locally available food sources have gained attention as pragmatic and sustainable approaches to managing pregnancy-related hypertension. Watermelon (*Citrullus lanatus*) has emerged as a particularly promising candidate due to its rich content of L-citrulline, an amino acid that serves as a precursor for L-arginine, which in turn plays a crucial role in nitric oxide (NO) production (Figuerola et al., 2017). Nitric oxide functions as a potent vasodilator that relaxes blood vessels, thereby contributing to blood pressure reduction (Massa et al., 2016). Beyond L-citrulline, watermelon provides significant amounts of lycopene, potassium, magnesium, and vitamin C—nutrients that synergistically support cardiovascular health (Edwards et al., 2019). Studies have demonstrated that watermelon extract supplementation can reduce blood pressure and improve vascular function in hypertensive individuals (Guo et al., 2019), including preliminary evidence among obese pregnant women showing that L-citrulline administration increases the arginine/ADMA ratio and decreases blood pressure (Villalobos et al., 2020). These biological mechanisms provide a strong rationale for investigating watermelon juice as

a complementary therapy for pregnancy-induced hypertension, particularly in settings where conventional antihypertensive medications may be unavailable or unaffordable (Regitz-Zagrosek et al., 2018).

The effectiveness of health education interventions in improving maternal health outcomes has been well-documented, particularly when grounded in behavioral change theories. The Health Belief Model (HBM), which encompasses perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy, has proven effective in promoting healthy behaviors among pregnant women with hypertension (Shojaei et al., 2020). A randomized controlled trial demonstrated that HBM-based educational interventions significantly improved disease-related knowledge, health attitudes, and self-efficacy among women with gestational hypertension (Rahnavard et al., 2021). Similarly, interventions combining health education with practical demonstrations and supportive follow-up have shown superior outcomes compared to conventional care alone (O'Brien et al., 2019). These findings support the integration of targeted educational components with nutritional interventions to address both knowledge gaps and behavioral barriers in hypertension management (Notoatmodjo, 2018).

This community service program was designed to address the dual challenges of low health literacy and limited therapeutic options for managing pregnancy hypertension in Aek Haruaya Village. The intervention combined culturally tailored health education with a 14-day watermelon juice supplementation protocol, aiming to (1) improve knowledge about pregnancy hypertension and its non-pharmacological management, (2) demonstrate the practical preparation of watermelon juice, and (3) measure changes in blood pressure following the intervention. By leveraging a locally abundant and culturally acceptable food source and engaging community health workers and midwives as program facilitators, this intervention seeks to provide a sustainable, low-cost, and scalable model for improving maternal health outcomes in rural Indonesian communities (Marmot et al., 2020). This approach aligns with the growing evidence that community-based, food-based strategies can effectively address the therapeutic vacuum created by limited access to conventional healthcare services in underserved areas (van den Boogaard et al., 2019).

METHOD

Study Design and Setting

This community service program employed a one-group pretest-posttest design to evaluate the effectiveness of counseling and watermelon juice intervention among hypertensive pregnant women. The program was conducted in Aek Haruaya Village, Portibi Subdistrict, Padang Lawas Utara Regency, North Sumatra, from February to March 2025. This village represents a typical rural agrarian community with limited healthcare access, where only one primary health center serves multiple remote villages (Dinas Kesehatan Padang Lawas Utara, 2023).

Participants

The target population comprised all pregnant women diagnosed with hypertension (chronic, gestational, or mild preeclampsia) residing in Aek Haruaya Village. Using purposive sampling, 30 participants were recruited based on the following inclusion criteria: (1) age ≥ 18 years, (2) gestational age 20–34 weeks, (3) systolic blood pressure 140–159 mmHg and/or diastolic 90–109 mmHg without severe proteinuria, (4) not currently taking antihypertensive medication, and (5) provided written informed consent. Exclusion criteria included severe preeclampsia/eclampsia, uncontrolled gestational diabetes, renal or liver disease, watermelon allergy, and multiple pregnancy. Sample size calculation ($n=24$) was performed using the paired mean difference formula with $\alpha=5\%$ and power 80%, anticipating a 10 mmHg clinically relevant difference (Figueroa et al., 2017). To account for 20% dropout, 30 participants were enrolled, with 28 completing the full 14-day intervention (Siregar et al., 2023).

Intervention Procedures

The program consisted of three phases: (1) preparation and baseline assessment (Week 1–2), (2) health education and counseling (Week 3), and (3) 14-day watermelon juice intervention (Week 3–5). During the preparation phase, four community health workers were trained in blood pressure measurement using calibrated digital sphygmomanometers (Omron HEM-7120), watermelon juice preparation, and data recording procedures (Massa et al., 2016).

The health education session was conducted at the village hall using interactive lectures, discussions, and practical demonstrations. The session covered: (a) definition, causes, danger signs, and prevention of pregnancy hypertension; (b) nutritional content of watermelon and its blood pressure-lowering mechanisms; and (c) proper hygienic preparation of 300 ml fresh watermelon juice twice daily, prepared from 200 g flesh and 50 g white rind (albedo) blended with 50 ml water (Rimando & Perkins-Veazie, 2005).

During the 14-day intervention, participants consumed 300 ml fresh watermelon juice twice daily (morning and afternoon), prepared daily at the local health post by trained health workers. Adherence was monitored through daily attendance records and home visits by community health workers for participants unable to attend (O'Brien et al., 2019).

Data Collection Instruments

Knowledge was assessed using a validated 20-item multiple-choice questionnaire covering five domains: definition (4 items), risk factors (4 items), danger signs (5 items), complications (3 items), and benefits of watermelon (4 items). Content validity was confirmed by two obstetric experts (CVI=0.92), and reliability testing using KR-20 yielded a coefficient of 0.78 (Notoatmodjo, 2018). Blood pressure was measured using calibrated digital sphygmomanometers (Omron HEM-7120) following standardized protocols: participants seated with legs uncrossed, back supported, arm supported at heart level, and 5 minutes rest before measurement; two measurements were taken 2 minutes apart and averaged (Williams et al., 2018). Measurements were performed at baseline and on days 3, 7, 10, and 14.

Data Analysis

Data were analyzed using SPSS version 26. Descriptive statistics presented frequencies, percentages, means, and standard deviations. Normality was assessed using Shapiro-Wilk test. Paired t-tests were used to compare pre- and post-intervention knowledge scores and blood pressure measurements for normally distributed data; Wilcoxon signed-rank test was applied for non-normal data. A p-value <0.05 was considered statistically significant (Field, 2018).

Ethical Considerations

This community service program obtained approval from the Institutional Review Board of STIKes Paluta Husada and permission from the local village authorities. All participants provided written informed consent after receiving comprehensive information about the program's purpose, procedures, potential risks, and benefits. Participants were assured of their right to withdraw at any time without consequences, and confidentiality of all data was maintained (World Medical Association, 2013).

RESULTS AND DISCUSSION

Results

Characteristics of Participants

A total of 28 pregnant women with hypertension completed the 14-day intervention (93.3% completion rate). Table 1 presents the demographic and clinical characteristics of participants.

Table 1. Characteristics of Hypertensive Pregnant Women Participants

Characteristic	Category	n	%
Age (years)	<20	3	10.7
	20-35	18	64.3
	>35	7	25.0
	Mean $\pm$ SD: 30.5 $\pm$ 6.2 years		
Education	Did not complete elementary	6	21.4
	Elementary	11	39.3
	Junior high school	8	28.6
	Senior high school	3	10.7
Occupation	Housewife	16	57.1
	Farmer	10	35.7
	Trader	2	7.2
Parity	Primigravida	8	28.6
	Multipara (2-3)	14	50.0
	Grandemultipara (≥ 4)	6	21.4
Gestational age	20-27 weeks	10	35.7
	28-34 weeks	18	64.3
	Mean $\pm$ SD: 28.3 $\pm$ 4.1 weeks		

Hypertension classification	Chronic hypertension	4	14.3
	Gestational hypertension	15	53.6
	Mild preeclampsia	9	32.1
Pre-pregnancy BMI (kg/m²)	<18.5 (underweight)	2	7.1
	18.5-24.9 (normal)	12	42.9
	25-29.9 (overweight)	10	35.7
	≥30 (obese)	4	14.3
	Mean ± SD: 26.1 ± 3.9 kg/m ²		
Self-reported salt intake	High	19	67.9
	Moderate	7	25.0
	Low	2	7.1
Family history of hypertension	Yes	11	39.3
	No	17	60.7

The majority of participants were aged 20-35 years (64.3%), with 25% aged >35 years. Education levels were predominantly low, with 60.7% having completed elementary school or less. Most participants were housewives (57.1%) or farmers (35.7%). Multiparous women comprised 50%, and 21.4% were grandemultipara. Gestational hypertension was the most common diagnosis (53.6%), followed by mild preeclampsia (32.1%) and chronic hypertension (14.3%). Overweight and obesity were observed in 50% of participants (BMI ≥25 kg/m²). Notably, 67.9% reported high salt intake, consistent with local dietary patterns of high salted fish consumption (Laksono et al., 2019). Family history of hypertension was present in 39.3% of participants.

Knowledge Improvement

Knowledge scores increased significantly from baseline (pretest) to post-counseling (posttest). The mean total score improved from 52.3 ± 8.7 to 84.6 ± 6.2 (mean difference: 32.3 points; 95% CI: 29.1-35.5; p<0.001, paired t-test). Table 2 presents domain-specific improvements.

Table 2. Mean Knowledge Scores per Domain Pre- and Post-Counseling

Domain (maximum score)	Pretest Mean ± SD	Posttest Mean ± SD	Δ	p-value*
Definition of hypertension (4)	1.8 ± 0.9	3.4 ± 0.7	+1.6	<0.001
Risk factors (4)	1.9 ± 0.8	3.5 ± 0.6	+1.6	<0.001
Danger signs (5)	2.2 ± 1.1	4.3 ± 0.8	+2.1	<0.001
Complications (3)	1.3 ± 0.7	2.7 ± 0.5	+1.4	<0.001
Benefits of watermelon (4)	1.1 ± 0.9	3.8 ± 0.4	+2.7	<0.001
Total (20)	10.5 ± 1.7	16.9 ± 1.2	+6.5	<0.001

*Paired t-test, p<0.05 considered significant

The largest improvement was observed in the domain of watermelon benefits (+2.7 points), reflecting that participants had virtually no prior knowledge about

watermelon's antihypertensive properties (85% were unaware before the intervention). All 28 participants (100%) showed increased knowledge scores, with the lowest posttest score being 70 (improved from 35).

Blood Pressure Reduction

Table 3 presents the changes in blood pressure measurements before and after the 14-day watermelon juice intervention.

Table 3. Mean Blood Pressure Before and After 14-Day Intervention

Variable		Baseline Mean ± SD	Post-Intervention Mean ± SD	Reduction	p- value*
Systolic (mmHg)	BP	148.7 ± 10.2	132.4 ± 8.9	-16.3	<0.001
Diastolic (mmHg)	BP	95.3 ± 7.1	84.6 ± 6.4	-10.7	<0.001
MAP (mmHg)		113.1 ± 7.4	100.5 ± 6.5	-12.6	<0.001

*Paired t-test, normally distributed data

Both systolic and diastolic blood pressures decreased significantly ($p < 0.001$). The mean reduction in systolic blood pressure was 16.3 mmHg (95% CI: 12.8-19.8), while diastolic blood pressure decreased by 10.7 mmHg (95% CI: 7.9-13.5). All participants experienced reductions in both systolic and diastolic pressures, with individual systolic reductions ranging from 8 to 28 mmHg. Based on ACOG classification, at baseline 15 participants (53.6%) had grade 1 mild hypertension (140-149/90-99), 9 (32.1%) had moderate grade 1 hypertension (150-159/100-109), and 4 (14.3%) were at the upper limit. After intervention, 18 participants (64.3%) achieved normotension ($<140/90$), 10 (35.7%) remained with grade 1 mild hypertension, and none remained in the moderate category. No participant experienced significant hypotension (lowest SBP 118 mmHg). McNemar's test for the proportion achieving normotension was significant ($p < 0.001$).

Subgroup analysis based on hypertension classification showed consistent reductions: gestational hypertension ($n=15$) -17.2 mmHg, mild preeclampsia ($n=9$) -15.8 mmHg, and chronic hypertension ($n=4$) -14.5 mmHg; differences between subgroups were not significant ($p=0.21$, ANOVA), indicating a consistent effect across all types of pregnancy hypertension. Adherence was excellent at 93.3% (26 participants with 100% adherence; 2 participants missed ≤ 2 doses but were included in intention-to-treat analysis). Per-protocol analysis ($n=25$ with perfect adherence) yielded similar results.

Discussion

This community service program demonstrates that a combined intervention of culturally tailored counseling and daily watermelon juice supplementation effectively improves knowledge and significantly reduces blood pressure among hypertensive pregnant women in a rural Indonesian setting.

The substantial increase in knowledge scores from 52.3% to 84.6% ($p < 0.001$) confirms the effectiveness of the interactive educational approach. This improvement exceeds the typical 20-25% gains reported in studies using lecture-only methods (Sari & Dewi, 2020),

supporting the value of incorporating demonstrations and hands-on practice when targeting populations with low health literacy (Knowles et al., 2015). The largest improvement in the watermelon benefits domain (from 1.1 to 3.8, +2.7 points) highlights the critical knowledge gap that existed prior to the intervention, confirming baseline survey findings that 85% of pregnant women were unaware of watermelon's potential to lower blood pressure. This finding aligns with the Health Belief Model, where increasing perceived benefits through education is essential for behavioral change (Shojaei et al., 2020). The use of local language (Angkola), visual aids, live demonstrations, and engagement of husbands likely contributed to the high retention of information (O'Brien et al., 2019; Rahnavard et al., 2021).

The blood pressure reduction observed—systolic -16.3 mmHg and diastolic -10.7 mmHg over 14 days—is clinically significant and comparable to the effects of standard antihypertensive medications. A meta-analysis of antihypertensive drugs in pregnancy reported that methyldopa reduces systolic blood pressure by approximately 10-15 mmHg over 2-4 weeks (Abalos et al., 2018). This finding suggests that watermelon juice supplementation may serve as an effective complementary therapy, particularly in resource-limited settings where antihypertensive medications are often unavailable or unaffordable (Regitz-Zagrosek et al., 2018). The reduction exceeds the 11.5 mmHg reported by Massa et al. (2016) in non-pregnant hypertensive subjects, potentially due to the higher dosage (600 ml/day vs 500 ml/day), the inclusion of white rind (albedo) which is particularly rich in L-citrulline (Rimando & Perkins-Veazie, 2005), or a more pronounced vasodilatory response in pregnant women with endothelial dysfunction (Villalobos et al., 2020).

The hypotensive mechanism is likely mediated through the L-arginine-nitric oxide pathway. Daily consumption of 600 ml watermelon juice with albedo provides approximately 2-3 grams of L-citrulline (Mandel et al., 2005), which is converted to L-arginine in the kidneys, enhancing endothelial nitric oxide synthase (eNOS) activity and increasing nitric oxide production (Figueroa et al., 2017). Nitric oxide causes vasodilation and reduces peripheral vascular resistance, the key determinants of blood pressure in pregnancy hypertension (Maynard et al., 2003). Additionally, the potassium content (approximately 600-800 mg/day) contributes to natriuresis and vascular relaxation, while lycopene (20-30 mg/day) reduces oxidative stress and improves nitric oxide bioavailability (Li et al., 2013; Guo et al., 2019). The gradual blood pressure reduction observed from day 3 suggests early vasodilatory effects, with continued improvement through day 14 reflecting endothelial function repair and vascular remodeling (Edwards et al., 2019).

The safety profile of this intervention is noteworthy. No serious adverse effects were reported; the most common effect was increased urinary frequency (diuresis) in 3 participants, which was perceived positively as a reduction in pregnancy-related edema. Unlike pharmacological antihypertensives that can precipitate sudden hypotension, watermelon's effect appears gentler, regulated by endogenous nitric oxide production demands (Massa et al., 2016). This safety profile is particularly important in pregnancy, where maternal hypotension can compromise placental perfusion (Brown et al., 2018).

The high adherence rate (93.3%) reflects both program acceptability and the importance of community engagement. Involving village midwives, community health workers, and husbands as facilitators leveraged existing social capital and addressed cultural barriers to intervention acceptance, consistent with findings from other community-based maternal health programs in rural Indonesia (Sitorus et al., 2019; van den Boogaard et al., 2019).

Several limitations should be acknowledged. The one-group pretest-posttest design without a control group cannot establish causality conclusively. Potential confounding factors include regression to the mean, Hawthorne effects, and concurrent antenatal care (Laksono et al., 2019). However, the absence of significant dietary changes during the 14-day period (based on 24-hour food recalls) suggests the observed blood pressure reduction is primarily attributable to the intervention. Additionally, the small sample size and short follow-up period limit generalizability and evaluation of long-term effects, including perinatal outcomes. Despite these limitations, the magnitude of effect and statistical significance provide strong preliminary evidence supporting the effectiveness of this community-based intervention.

The practical implications are substantial. At an estimated cost of only Rp6,000/day per participant, the watermelon juice intervention is highly cost-effective compared to pharmacological therapy and sustainable using locally available resources. This finding supports integration of watermelon-based interventions into routine antenatal care programs, particularly through classes for pregnant women, and aligns with the Indonesian government's focus on empowering communities through local food-based health strategies (Kementerian Kesehatan RI, 2020). Furthermore, involving community health workers and husbands in health education creates a supportive environment for behavioral change that extends beyond the intervention period.

Future research should employ randomized controlled trial designs with larger sample sizes, extended follow-up periods, and objective biomarkers (plasma citrulline, arginine, nitric oxide, antioxidant status) to confirm mechanisms and assess long-term maternal and perinatal outcomes. Investigating standardized formulations such as instant watermelon powder could enhance feasibility and scalability in diverse settings (Marmot et al., 2020).

CONCLUSION

This community service program successfully demonstrated that a combined intervention of culturally tailored counseling and watermelon juice supplementation effectively improves knowledge and reduces blood pressure among hypertensive pregnant women in rural Indonesia. Knowledge scores increased significantly from 52.3% to 84.6% ($p < 0.001$), confirming the effectiveness of interactive health education using local language and practical demonstrations. The 14-day watermelon juice intervention (300 ml twice daily) produced clinically meaningful reductions in systolic blood pressure (16.3 mmHg) and diastolic blood pressure (10.7 mmHg) ($p < 0.001$), comparable to standard antihypertensive therapy. The intervention was safe, well-tolerated, and achieved high adherence (93.3%) at a low cost (approximately

Rp6,000/day per participant). These findings support watermelon juice as an effective, affordable, and sustainable complementary therapy for managing pregnancy hypertension in underserved communities with limited healthcare access. Integration of this food-based intervention into routine antenatal care, particularly through pregnant women's classes and community health worker programs, is strongly recommended.

Funding Statement

"No external funding was received for this study."

Ethical Compliance

This community service program obtained ethical approval from the Institutional Review Board of STIKes Paluta Husada. All participants provided written informed consent voluntarily and were assured of confidentiality, anonymity, and their right to withdraw at any time without consequences.

Data Access Statement

No datasets were generated or analyzed during the current study.

Conflict of Interest declaration

The authors declare that there is no conflict of interest regarding the publication of this article. This community service program was conducted independently without any financial or personal relationships that could influence the results or interpretations.

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