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EFFECTIVENESS OF AMLODIPINE WITH CONCOMITANT HERBAL THERAPY (BAY LEAVES, CELERY, CUCUMBER) IN HYPERTENSIVE PATIENTS IN SURAKARTA

Efektivitas Amlodipin dengan Terapi Penyerta Tanaman Obat (Daun Salam, Seledri, Mentimun) Pasien Hipertensi di Surakarta

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ABSTRAK

Hipertensi merupakan penyakit kronis yang memerlukan pengelolaan jangka panjang. Penggunaan tanaman obat sebagai terapi komplementer mulai banyak dilirik, namun bukti ilmiahnya masih terbatas. Penelitian ini bertujuan untuk mengevaluasi efektivitas amlodipin dengan terapi penyerta tanaman obat (daun salam, seledri, dan/atau timun) dibandingkan dengan monoterapi amlodipin pada pasien hipertensi. Desain penelitian adalah kohort retrospektif dengan menggunakan data dari rekam medis dan kuesioner pada pasien di tiga puskesmas Kota Surakarta. Efektivitas terapi diukur dari pencapaian target tekanan darah selama tiga bulan. Analisis dilakukan menggunakan uji bivariat dan regresi logistik multivariat. Hasil menunjukkan efektivitas klinis lebih tinggi pada kelompok amlodipin dengan terapi penyerta tanaman obat berupa daun salam, seledri, dan/atau mentimun (78,4%) dibandingkan monoterapi amlodipin (68,8%), meskipun tidak signifikan secara statistik (p=0,160). Faktor yang berhubungan signifikan dengan efektivitas adalah kepatuhan terapi (p<0,001), tekanan darah sistolik awal (p<0,001), dan tingkat pendidikan (p=0,047). Penggunaan tanaman obat sebagai terapi penyerta pada pasien yang menjalani terapi amlodipin menunjukkan potensi tambahan dalam menurunkan tekanan darah, namun belum terbukti signifikan. Penelitian prospektif atau uji klinis diperlukan untuk menilai manfaat dan keamanannya lebih mendalam.

***Kata kunci**: amlodipin, efektivitas, hipertensi, obat herbal*

ABSTRACT

Hypertension is a chronic disease that requires long-term management. The use of medicinal plants as complementary therapy is increasingly recognized, although scientific evidence remains limited. This study aimed to evaluate the effectiveness of amlodipine with concomitant herbal therapy (bay leaves, celery, and/or cucumber) compared with amlodipine monotherapy in hypertensive patients. A retrospective cohort design was employed using medical record data and patient questionnaires from three community health centers in Surakarta. Treatment effectiveness was measured by the achievement of the target blood pressure over three months. Data were analyzed using bivariate tests and multivariate logistic regression. The results showed that clinical effectiveness was higher in the amlodipine group with concomitant herbal therapy (bay leaves, celery, and/or cucumber) at 78.4% compared to amlodipine monotherapy at 68.8%, although the difference was not statistically significant (p=0.160). Factors significantly associated with treatment effectiveness were medication adherence (p<0.001), baseline systolic blood pressure (p<0,001), and educational level (p=0,047). Concomitant herbal therapy with amlodipine showed potential blood pressure–lowering effects, though not statistically significant. Prospective studies or clinical trials are warranted to further assess the benefits and safety of this therapeutic approach.

Keywords: amlodipine, effectiveness, herbal medicine, hypertension

INTRODUCTION

The prevalence of hypertension in Indonesia has doubled over the past three decades, from 25.8% in 2013 to 34.1% in 2018.[1,2] Hypertension is also a major cause of non-communicable

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diseases (NCDs) in various regions, including Surakarta City, which requires more integrated control measures to reduce the risk of cardiovascular complications such as heart disease and stroke.[3] Hypertension management usually involves pharmacological and non-pharmacological therapy to lower blood pressure and reduce the risk of cardiovascular complications.[4] Amlodipine is an antihypertensive agent in the Calcium Channel Blocker (CCB) class that is widely used because its effectiveness and safety have been proven, especially in elderly people with hypertension.[5,6]

In the management of hypertension therapy, there is a growing trend of using herbal medicines as adjuvants to enhance the effectiveness of therapy. This trend is growing globally, driven by the perception that herbal medicines are safe and have therapeutic benefits.[7–9]This practice is increasingly popular globally, including in Indonesia, with the proportion of herbal medicine use in hypertension patients reaching 47.5%.[10] Medicinal plants are a type of herbal medicine that has long been used to treat diseases and improve health,[11] especially in Indonesia which is rich in plant varieties, where as many as 15% of plant species have been used for traditional medicine.[12]

Bay leaves, celery, and cucumber are some types of medicinal plants that have long been used traditionally to lower blood pressure.[13–15] The processing of these medicinal plants is done minimally, such as by boiling, or consuming them directly.[16] Bay leaves (Syzygium polyanthum (Wight) Walp) contain active compounds such as quercetin which work through adrenergic receptors and the NO pathway.[17], celery (Apium graveolens L.) contains apigenin and 3-n-butylphthalide (NBP) with diuretic and vasodilator effects[18], while cucumber (Cucumis sativus L.) has the ability to inhibit the Renin Angiotensin System and influence vasodilation of blood vessels.[13]Pre-experimental research in Jember shows that boiled bay leaf water can lower systolic blood pressure in the elderly,[19] while cucumber has the ability to block the increase in blood pressure caused by Angiotensin II.[13] Administration of celery for three months also showed a significant decrease in blood pressure values in geriatric patients with hypertension,[20] and its effectiveness is said to be similar to that of CCBs. Celery's diuretic effect is superior to other diuretics because it doesn't disrupt the body's sodium and potassium balance.[18]

The combination of amlodipine and medicinal plants has the potential to increase the antihypertensive effect, but also carries the risk of interactions or antagonistic effects.[21] In the context of hypertension management, understanding the interaction mechanisms between these two drugs is crucial to optimize hypertension therapy, as it can also potentially reduce the effectiveness of antihypertensive drugs. To date, scientific evidence regarding the effectiveness of combinations of synthetic antihypertensives with medicinal plants is still limited, particularly regarding plants commonly used by local communities. Furthermore, few studies have retrospectively evaluated the effectiveness of combination therapy in the context of healthcare in Indonesia. Therefore, this study aimed to evaluate the effectiveness of the combination of amlodipine with medicinal plants (bay leaves, celery, cucumber) compared with amlodipine monotherapy, and to identify factors associated with the success of antihypertensive therapy.

METHODS

Study Design

This study was an observational study with a retrospective cohort design. Data collection was conducted from April to May 2025 at three community health centers in Surakarta City: Sibela Community Health Center, Gambirsari Community Health Center, and Pajang

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Community Health Center. The medical record data analyzed covered the period from January to May 2025, with patient blood pressure monitoring for the three months prior to the study visit. The three study sites were selected based on two criteria: the highest number of outpatient visits and the highest number of hypertension cases among all community health centers in Surakarta City in 2023.[3]

Subject

The subjects of this study were outpatients diagnosed with essential hypertension at three community health centers designated as study sites. Respondents were selected using consecutive sampling from a population of patients undergoing amlodipine therapy for at least three months, either with or without medicinal plants (bay leaves, celery, cucumber).

Inclusion criteria included patients diagnosed with essential hypertension, aged at least 18 years, regularly taking amlodipine for at least three months as their sole antihypertensive, and having complete blood pressure data for the past three months. Exclusion criteria included patients with comorbidities that could significantly impact blood pressure regulation, such as chronic kidney disease or congestive heart failure, pregnant or breastfeeding patients, and patients who were unwilling to sign informed consent after receiving an explanation. Furthermore, patients who had used medicinal plants for less than three months were excluded from the study.

The sample size is calculated using the hypothesis test formula for the difference in proportions of two groups with a significance level (∝)of 5% and the test power (1-β) of 80%. The proportion of therapeutic effectiveness in the amlodipine group was 46.2%, as referred to in the study by Ueng et al. (2008)[22], while in the amlodipine group with accompanying herbal therapy, the rate was 68%, referring to the study by Nagawa et al. (2021).[23] Based on these calculations, the minimum number of samples required is 70 subjects for each group.

Patients were categorized as having hypertension because they were diagnosed with essential hypertension in the SIMPUS system. Median changes in systolic and diastolic blood pressure over the four-month follow-up are shown in Figure 1. Subjects were assigned to the medicinal plant group based on patient questionnaire data regarding their regular consumption of medicinal plants for at least three months. Data were collected individually to minimize bias due to contact between participants, given that the plants studied were commonly consumed by the public.

Ethical Considerations

This study has received ethical approval from the Ethics Committee of the University of Indonesia Hospital with the number: S-109/KETLIT/RSUI/IV/2025. Administrative approval was also obtained from the Surakarta City Health Office with number: PN.01.01/953/III/2025 for the location of the study. All participating respondents have signed an informed consent form as a form of voluntary agreement after being given complete information regarding the purpose and procedures of the study.

Instrument

This study has one dependent variable, namely therapeutic effectiveness, which is determined based on the achievement of essential blood pressure targets according to the 2021 National Consensus on Hypertension Management.[24] Independent variables include type of therapy (monotherapy or with accompanying herbal therapy), age, gender, education level, occupation, body mass index (BMI), duration of amlodipine therapy, presence of comorbidities, number of routine medications consumed, smoking habits, alcohol consumption, systolic and

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diastolic blood pressure in the first month of therapy, and the level of patient compliance with treatment.

The variables were measured using two main instruments. The first was the Indonesian version of the Hil-Bone High Blood Pressure Compliance Scale questionnaire, which was used to assess patient compliance. The questionnaire has three subscales: antihypertensive medication adherence, control adherence, and dietary adherence.[25.26] The second instrument was a semi-structured questionnaire developed by the researchers to gather information on medicinal plant use, including the type of plant consumed, dosage form, frequency, dosage, and duration of consumption. Herbal consumption was recorded without specifying dosage or ingredient amounts, due to the observational nature of the study. Objective data such as blood pressure, type of therapy, and patient demographic characteristics were obtained through a review of medical records.

Data Collection Procedures

Data collection was carried out using two methods, namely reviewing medical records to obtain blood pressure data, therapy regimens, and demographic characteristics, as well as distributing questionnaires directly to patients during outpatient visits after providing an explanation and signing informed consent.

Respondents were divided into two groups based on their therapy: monotherapy (amlodipine) and combination therapy (amlodipine with medicinal plants). The term "combination" in this study is used to differentiate patient groups based on their consumption of medicinal plants, and does not indicate a standardized drug combination. The plants consumed included bay leaves (Syzygium polyanthum) and celery (Apium graveolens), which are categorized as medicinal plants for lowering blood pressure, and cucumber (Cucumis sativus) as a supporting herb.

Based on questionnaire results, most patients consumed herbs in the form of brews or water decoctions made from fresh ingredients, once or twice daily. In this study, medicinal plant consumption was carried out singly or in combination, following community herbal practices, with varying amounts, additions, and amounts of water.

Statistical Analysis

Data analysis was performed using IBM SPSS version 27 software. Univariate analysis was used to describe the characteristics of the subjects. Bivariate tests were conducted to determine the relationship between independent variables and therapy effectiveness, with a significance level of $p<0.05$. Variables with a p-value <0.25 in the bivariate analysis were entered into a multivariate logistic regression test to assess the simultaneous influence between variables on therapy effectiveness.

RESULT

During the study period, 234 respondents were recruited and divided into two groups based on the type of therapy: amlodipine monotherapy (n=160) and a combination of amlodipine and medicinal plants (n=74). Respondent characteristics are presented in Table 1. The majority of respondents were female (74.4%), with the highest proportion in the combination group (83.8%). Most respondents were aged ≥60 years (64.5%) and unemployed (75.6%), with similar proportions in both therapy groups. The high proportion of unemployed respondents may be due to the majority of respondents being women aged ≥60 years who were housewives or retired. In terms of education, 56.8% of respondents had less than a high school education, and this percentage was higher in the combination group (68.9%). The majority of respondents had a BMI of ≥23 kg/m² (70.1%), reflecting overweight

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and obesity. Respondents without comorbidities comprised 70.9% of the total sample, with the combination group having a higher proportion of comorbidities (37.8%). Furthermore, the combination group also demonstrated higher therapy adherence (67.6%) compared to the monotherapy group (59.4%), as measured using the Hill-Bone High Blood Pressure Compliance Scale.

Table 1. Characteristics of Research Respondents (n=234)

Characteristics	Total (n=234) n (%)	Amlodipine (n=160) n (%)	Amlodipine + Medicinal Plants (n=74) n (%)
Age			
<60 years	83 (35.5)	53 (33.1)	30 (40.5)
≥60 years	151 (64.5)	107 (66.9)	44 (59.5)
Gender			
Male	60 (25.6)	48 (30.0)	12 (16.2)
Female	174 (74.4)	112 (70.0)	62 (83.8)
Level of education			
Less than high school	133 (56.8)	82 (51.2)	51 (68.9)
High school or higher	101 (43.2)	78 (48.8)	23 (31.1)
Occupation			
Employed	57 (24.2)	42 (26.3)	15 (20.3)
Unemployed	177 (75.6)	118 (73.8)	59 (79.7)
Body Mass Index			
<23 kg/m2	70 (29.9)	52 (32.5)	18 (24.3)
≥23 kg/ m2	164 (70.1)	108 (67.5)	56 (75.7)
Duration of antihypertensive therapy			
≤5 years	173 (73.9)	115 (71.9)	58 (78.4)
>5 years	61 (26.1)	45 (28.1)	16 (21.6)
Comorbidities			
Present	68 (29.1)	40 (25.0)	28 (37.8)
Absent	166 (70.9)	120 (75.0)	46 (62.2)
Number of Routine Medications			
≤2 drugs	200 (85.5)	137 (85.6)	63 (85.1)
≥3 drugs	34 (14.5)	23 (14.4)	11 (14.9)
Therapy Adherence			
More adherent	145 (62.0)	95 (59.4)	50 (67.6)
Less adherent	89 (38.0)	65 (40.6)	24 (32.4)
Alcohol Consumption			
Yes	0 (0.0)	0 (0.0)	0 (0.0)
No	234 (100.0)	160 (100.0)	74 (100.0)
Smoking Status			
Yes	14 (6.0)	10 (6.3)	4 (5.4)
No	220 (94.0)	150 (93.8)	70 (94.6)

The effectiveness of antihypertensive therapy in this study was analyzed based on the criteria of the 2021 Consensus on the Management of Hypertension.[24] Table 2 presents the results of the proportion of therapeutic effectiveness between groups. In the monotherapy group, 68.8% of patients achieved the essential target, while in the combination group, this figure increased to 78.4%.

To ensure that both groups were comparable at baseline, a comparability analysis was performed on the first-month blood pressure data. Based on the results of the Independent t-test, there was no significant difference in systolic blood pressure between the

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monotherapy and combination groups (p=0.127). For diastolic blood pressure, because the data were not normally distributed, the Mann-Whitney U test was used, which also showed no significant difference (p=0.939). These results confirm that both groups were equivalent at baseline. Furthermore, the blood pressure trend over the four months of observation is shown in Figure 1.

Table 2. Proportion of Therapeutic Effectiveness

Types of Therapy	Essential Goal n(%)	
	Achieved	Not achieved
Amlodipine (n=160)	110 (68.8)	50 (31.3)
Combination of Amlodipine + medicinal plants (n=74)	58 (78.4)	16 (21.6)

Both groups showed a median decrease in blood pressure from the first to the fourth month. In the monotherapy group, median systolic blood pressure decreased from 148.0 mmHg (IQR: 138.0–160.0) to 134.0 mmHg (IQR: 128.0–143.0). In the combination group, the decrease occurred from 143.0 mmHg (IQR: 137.0–155.3) to 133.0 mmHg (IQR: 125.0–138.3). Diastolic blood pressure also decreased to a median of 80.0 mmHg by the fourth month in both groups, with a more dominant decrease in the amlodipine monotherapy group. These results indicate that both types of therapy were effective in lowering blood pressure during the observation period.

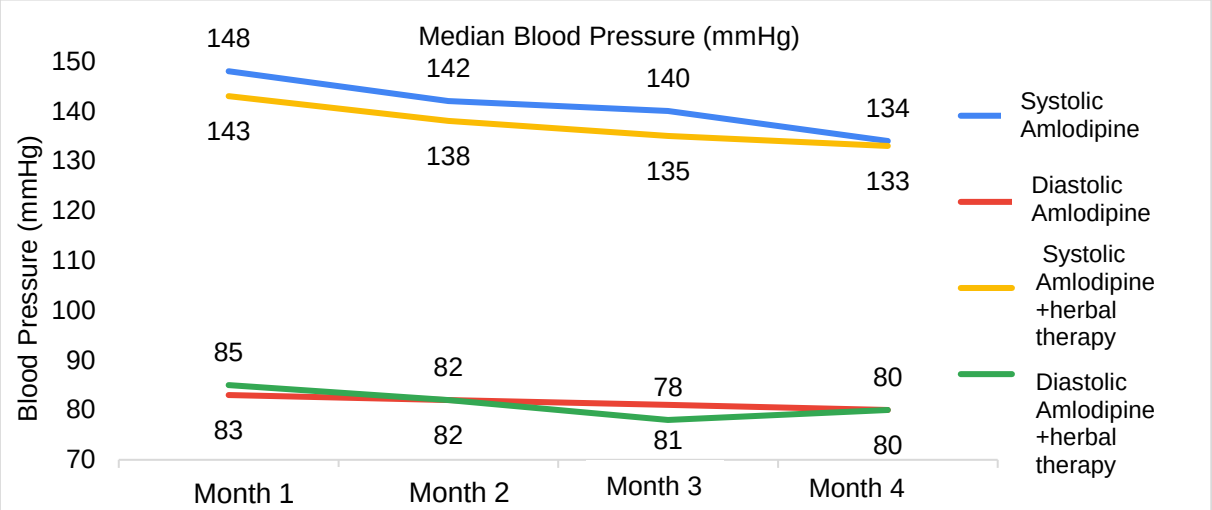

Figure 1. Median Systolic and Diastolic Blood Pressure in Months 1-4 (mmHg)

Table 3 presents the results of a bivariate test on the relationship between therapy type and therapeutic effectiveness. The analysis showed that the relationship was not statistically significant (p=0.160). OR value of 0.607 (95%CI: 0.318-1.159) indicates that the monotherapy group had a 0.6 times lower chance of achieving therapeutic effectiveness than the combination group.

Although these results were not statistically significant, they remain relevant. Descriptively, the combination group had a higher proportion of effectiveness (78.4%) compared to monotherapy (68.8%). This trend indicates a potential contribution from the accompanying herbal therapy (bay leaves, celery, cucumber), although the difference was not yet strong enough to reach statistical significance. The results of this study can serve as a basis for further research with a larger sample size.

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Table 3. Bivariate Analysis of the Effect of Therapy Type on Therapy Effectiveness

Antihypertensive therapy	Effective	Ineffective	p-value	OR (95% CI)
Amlodipine monotherapy (n=160)	110 (68.8)	50 (31.3)	0.160	0.607 (0.318-1.159)
Amlodipine-herb combination (n=74)	58 (78.4)	16 (21.6)		

Table 4 presents the results of bivariate logistic regression on various independent variables. Several variables showed a significant relationship to therapy effectiveness (p<0.05), namely education level (p=0.014), first-month systolic blood pressure (p<0.001), first-month diastolic blood pressure (p=0.041), and therapy adherence (p<0.001). In addition to these variables, there were also several variables with p values <0.25, which were statistically still considered for inclusion in the multivariate logistic regression model, namely smoking (p=0.217), type of antihypertensive therapy (p=0.130), and duration of medicinal plant use (p=0.238). The variable duration of medicinal plant use was decided to be discontinued in the multivariate logistic regression analysis. This decision was based on the high potential for recall bias because the data were obtained from patient self-reports, which could affect the validity of the results.

Considering statistical significance, theoretical relevance, and data source limitations, six variables could be further analyzed in multivariate logistic regression. These variables were: education level, smoking habits, first-month systolic and diastolic blood pressure, type of therapy, and adherence to therapy.

Table 4. Bivariate Logistic Regression

Variables	-2 Log-Likelihood	Chi-suare (G)	df	p-value	Exp (B)
Age	277,315	1,089	1	0.301	0.725
Gender	277,176	0.470	1	0.490	0.799
Education	272,054	6,350	1	0.014*	0.467
Work	278,307	0.097	1	0.755	0.901
Body Mass Index	278,095	0.309	1	0.580	1,195
Duration of anti-HTN therapy	278,399	0.005	1	0.946	0.978
Comorbidities	277,910	0.494	1	0.486	1,256
Amlodipine dosage	277,577	0.827	1	0.359	1,367
Smoke	276,941	1,463	1	0.217*	0.500
Systole of the first month	226,998	51,406	1	<0.001*	1,078
Diastole of the first month	274,050	4,354	1	0.041*	1,031
Therapy compliance	256,140	22,264	1	<0.001*	4,100
Types of antihypertensive therapy	276,015	2,389	1	0.130*	0.607
Medicinal plant routine	76,463	0.804	1	0.355	3,800
Duration of medicinal plants	75,771	1,496	1	0.238*	2,118

Based on Table 5, multivariate logistic regression analysis shows that several variables have a significant influence on the effectiveness of antihypertensive therapy. The education level variable has an Exp(B) of 2.067 with a 95% CI of 1.010–4.230, indicating that patients with a high school education or more have a 2-fold chance of achieving therapeutic effectiveness compared to patients with less than a high school education, after controlling

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for other variables in the model (p=0.047). Therapeutic adherence has an Exp(B) of 4.085 with a 95% CI of 2.106–7.923, indicating that patients who adhere to the therapeutic regimen have a four-fold chance of achieving therapeutic effectiveness compared to patients who are less adherent (p<0.001).

Systolic blood pressure in the first month (Systolic Month I) showed a strong effect, with Exp(B) of 12.214 and 95% CI 3.526–42.300, indicating that patients with systolic <140 mmHg in the first month had a 12-fold greater chance of achieving therapeutic effectiveness compared to patients with systolic ≥140 mmHg (p<0.001). In contrast, the variables of type of therapy, diastolic pressure in the first month, and smoking status did not show a statistically significant relationship.

Table 5. Multivariate Logistic Regression Analysis

Variables	B	SE β	p-value	Exp(B)	95% CI Exp(B)
Level of education	0.726	0.365	0.047	2,067	1,010-4,230
Less than high school					
High school or higher (ref)					
Therapy compliance	1,407	0.338	<0.001	4,085	2,106-7,923
Less obedient					
More obedient (ref)					
Types of Therapy	-0.409	0.384	0.287	0.664	0.313-1.410
Amlodipine (ref)					
Amlodipine + Medicinal Plants					
Systolic Month I	2,503	0.634	<0.001	12,214	3,526-42,300
< 140 mmHg (ref)					
≥ 140 mmHg					
Diastolic Month I	0.136	0.356	0.703	1,146	0.570-2.302
< 90 mmHg (ref)					
≥ 90 mmHg					
Smoke	0.819	0.643	0.203	2,268	0.643-7.999
Yes					
No (ref)					
Constant	-4,051	0.682	<0.001	0.017	

DISCUSSION

This study found that combination therapy with amlodipine and medicinal plants showed higher effectiveness in hypertensive patients in Surakarta (78.4%) compared to amlodipine monotherapy (68.8%). Systolic blood pressure decreased more in the combination group, while diastolic reduction was greater in the monotherapy group. However, the differences were not statistically significant (p = 0.160), and therapy type was not a significant predictor in multivariate analysis (p = 0.287). These findings suggest that while medicinal plants may offer additional benefits, their contribution is not strong enough to be distinguished from the main effect of amlodipine. This aligns with prior evidence, such as Xiong et al. (2015), which showed clinically meaningful but not consistently significant blood pressure reductions with herbal medicine, partly due to methodological limitations.[27] The insignificant contribution of medicinal plants in this study is in line with trends reported in the global literature, which show variations in results and inconsistent findings.

The strong pharmacological effect of amlodipine may explain why the additional contribution of medicinal plants was not statistically significant in this study. As a dihydropyridine CCB, amlodipine has a long half-life (35–50 hours) and more than 24 hours of action, ensuring stable blood pressure control even with occasional non-compliance. It has proven effective across diverse

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patient groups, including the elderly, those with diabetes, and chronic kidney disease, while also offering cardiovascular protection by reducing the risk of stroke and myocardial infarction.[28]

Theoretically, the three medicinal plants studied (bay leaves, celery, and cucumber) have potential antihypertensive effects. Bay leaves contain quercetin and phenolic compounds that can increase nitric oxide production and decrease adrenergic receptor activity, thus causing vasodilation.[14,29–31] Celery contains 3-n-butylphthalide and apigenin which work as vasodilators and mild diuretics through the NO and prostaglandin pathways.[18] Meanwhile, cucumbers contain potassium, cucurbitacin, and flavonoids such as kaempferol, which support antihypertensive effects through inhibition of the renin-angiotensin system and antioxidant activity.[13] The combination of these three herbs should provide a synergistic effect, but it does not appear to be strong enough to statistically outweigh the single effect of amlodipine.

One of the main limitations of this study is the uncontrolled variation in the type, form, dose, frequency, and method of consumption of medicinal plants. Plants such as bay leaves, celery, and cucumber are readily available and commonly consumed, making it difficult to clearly distinguish between routine consumption and the research intervention. This heterogeneity can bias the results due to the lack of standardization. Consequently, it is difficult to ensure consistent exposure to the active compounds they contain. This variation may be one factor causing the additional contribution of medicinal plants to be insufficient to produce a statistically significant difference in the primary effect of amlodipine.

A total of 51.4% of respondents had used medicinal plants for 6-12 months, with the majority using bay leaves (56.8%). Differences were also found in many aspects, such as the number of leaves or stems used and the variety of additional ingredients, such as mixtures of other leaves and so on.

For bay leaves, most respondents boiled 5–10 fresh leaves and consumed the decoction once daily, often adding ingredients such as pandan, lemongrass, cinnamon, soursop leaves, or more complex mixtures including moringa, turmeric, ginger, cardamom, cloves, and coriander. This reflects traditional practices passed down through generations. Celery was typically prepared using 1–3 stalks, either boiled or steeped in hot water and consumed once daily, while cucumber was consistently consumed fresh.

Multivariate analysis in this study showed that three main factors significantly influencing therapy effectiveness were adherence, systolic blood pressure in the first month, and education level. More adherent patients were four times more likely to achieve therapeutic effectiveness ($p<0.001$). High adherence allows patients to take medications consistently, on time, and at the correct dosage, thereby maximizing their pharmacological effects. These findings align with previous research suggesting that non-adherence to therapy can lead to treatment failure.[32] The analysis of compliance among 234 respondents showed that 62% were considered more compliant. This high proportion was due to the fact that the respondents selected for this study were hypertension patients with complete medical records, including regular monthly check-ups at the community health center, particularly in the last four months.

High baseline systolic blood pressure may be a barrier to achieving therapeutic effectiveness, in line with previous findings that baseline blood pressure is one of the main predictors of difficulty in controlling blood pressure.[33] Education level also significantly influenced therapy effectiveness

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(p=0.047). Education contributes to improved health literacy, including patients' ability to understand their medication regimen, access healthcare services, and adopt a healthy lifestyle.[34] Although not all variables in this study were statistically significant, the findings are still important to consider in developing a comprehensive hypertension management strategy.

This study has several limitations, one of which is the low power of the test for the medicinal plant group, which likely contributed to the insignificant results for the therapy type variable. Furthermore, the retrospective study design also has the potential to introduce recall bias, particularly in the collection of data on patients' self-consumption of medicinal plants. Nevertheless, in the context of clinical research in the community, these findings still provide a meaningful contribution.

This study reflects the real use of medicinal plants as complementary therapy among hypertension patients in primary care. While the type of therapy was the initial focus, it was not a significant determinant of effectiveness after adjusting for other variables. Instead, adherence, education, and baseline blood pressure played a greater role. Future research should use prospective or randomized controlled trials (RCTs) to evaluate the efficacy and safety of combining amlodipine with medicinal plants and explore molecular and pharmacokinetic interactions. Such studies can provide stronger evidence to guide the development of integrated, safe, and effective hypertension therapy guidelines.

CONCLUSION

This study shows that combination therapy with amlodipine and medicinal plants in hypertensive patients in Surakarta has a higher clinical effectiveness rate than amlodipine monotherapy, although the difference was not statistically significant. Factors that significantly influenced the effectiveness of therapy were adherence to therapy, education level, and baseline systolic blood pressure. These results emphasize the importance of an individualized approach in hypertension management and open up opportunities for the use of medicinal plants as a complementary therapy. Further studies with prospective designs are needed to more comprehensively evaluate the benefits and safety of this combination.

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