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Adherence and blood pressure control in hypertensive patients: a cross-sectional study

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ABSTRACT: In 2023, the prevalence of hypertension in the Special Region of Yogyakarta was 31.8%, with 24% of patients showing inconsistent adherence to therapy. This cross-sectional study examined the link between adherence to medication and lifestyle changes with blood pressure control among 120 hypertensive patients in the Hypertension Class Program at Bambanglipuro Primary Health Center using an adherence questionnaire. Most participants exhibited low adherence to medication (54.2%) and lifestyle interventions (73.3%). The cutoff point for grouping respondents into low and high adherence was based on the median value of the respondents' questionnaire scores (because the data were not normally distributed). Uncontrolled blood pressure was prevalent, with a mean systolic pressure of 151.95±11.45 mmHg and and a mean diastolic pressure of 87.14±10.45 mmHg. Spearman's rho analysis revealed a statistically significant relationship between adherence and blood pressure control ($p < 0.001$), with a strong negative correlation observed for medication adherence ($r = -0.530$) and a moderate negative correlation for lifestyle adherence ($r = -0.404$). Furthermore, low adherence was associated with a substantially increased risk of uncontrolled blood pressure, with odds ratios of 11.30 (95% CI: 4.70–27.21) for medication adherence and 6.82 (95% CI: 2.77–16.80) for adherence to lifestyle changes. These findings underscore the critical importance of improving patient adherence to pharmacological and non-pharmacological management strategies to achieve optimal blood pressure control.

KEYWORDS: Adherence; blood pressure; hypertension; lifestyle.

INTRODUCTION

The World Health Organization (WHO) defines hypertension as a condition in which the systolic pressure is greater than 140 mmHg and/or the diastolic pressure is greater than 90 mmHg [1]. Hypertension has a high prevalence, reaching 30-45%, and increases with age. WHO recorded hypertension rates of 47% in developing countries and 49% in developed countries, with predictions of reaching 60% by 2025 [2]. As predicted by the WHO, Indonesia, a developing country, has a high number of people with hypertension. The 2023 Indonesian Health Survey reported a prevalence of hypertension of 13% based on doctors' diagnosis and 31.8% based on measurement in Daerah Istimewa Yogyakarta (DIY), aged ≥ 18 years [3]. Data from the Yogyakarta Health Office in 2023 recorded 191,573 cases of hypertension, with the highest number in Bantul Regency (49,306 people). Adherence is the extent to which patients follow therapeutic recommendations, which is formed through understanding and agreement with health workers [4]. Medication adherence in people with hypertension refers to the extent to which individuals adhere to treatment recommendations. Adherence to medication consumption includes the type of medication taken and one's ability to adhere to medication guidelines. Low adherence is linked to the incidence of hypertension, leading to ineffective blood pressure control [5]. Ultimately, treatment outcomes will be better if the patient adheres to the therapy [6].

For many people with hypertension, taking medication is considered a hassle; therefore, they often become frustrated and quit prematurely. This is often due to a lack of understanding that medication must be taken for life to maintain stable blood pressure [7]. This is in line with data from the 2023 Indonesian Health Survey, which showed that in DIY, 24.0% of hypertensive patients aged ≥15 years did not take medication regularly, and 23.1% did not take medication at all [3].

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Non-adherence to medication use can lead to therapeutic failure and an increased frequency of hospitalization. Monitoring clinical outcomes is essential in patients with chronic diseases. Nonadherence also leads to decreased body function, quality of life, and increased risk of death [8].

Non-pharmacologic treatments, such as reducing sodium (salt) intake or avoiding smoking cigarettes, are important for reducing the risk of complications and controlling blood pressure. In addition to successfully lowering blood pressure, non-pharmacological therapies, when used in conjunction with antihypertensive drugs, can increase their effectiveness [9]. There are several studies about evaluating medication, but there is limited evidence evaluating medication adherence among hypertensive patients enrolled in community-based hypertension programs in Bantul Regency.

This study aims to assess medication adherence and its associated factors among hypertensive patients participating in the Hypertension Class Program at Bambanglipuro Health Center. Preliminary studies conducted at the Bantul Regency Health Office showed that the Bambanglipuro Health Center had the highest number of people with hypertension. In addition, researchers conducted a preliminary study at the Bambanglipuro Health Center. The Hypertension Class Program at the Bambanglipuro Health Center is routinely attended by hypertensive patients. Researchers will use patients who are part of the Hypertension Class program as the sample population because of the routine visits every month.

▪ MATERIALS AND METHODS

This study employed an observational analytic design with a cross-sectional approach involving a total of 1,038 patients enrolled in the Hypertension Class Program at the Bambanglipuro Public Health Center. A cluster sampling technique was used to select the study participants, yielding a final sample of 120 respondents. Data analysis was performed using Spearman's rho correlation test to examine the association between adherence and blood pressure control, with p-values <0.050 considered statistically significant. Additionally, the Mantel–Haenszel method was used to calculate the odds ratio (OR) to estimate the likelihood of uncontrolled blood pressure according to adherence level.

Blood pressure outcomes were obtained from the patients' medical records. Adherence was assessed using a structured questionnaire consisting of two components: pharmacological and non-pharmacological (lifestyle) adherence. The pharmacological adherence component was adapted from a combination of the Morisky Medication Adherence Scale (MMAS) and the Probabilistic Medication Adherence Scale (PROMAS). The non-pharmacological adherence component was developed based on the 2020 American Heart Association (AHA) guidelines, encompassing key lifestyle recommendations for hypertension management. This study was approved by the Ethics Committee of Alma Ata University (ethical clearance number KE/AA/VIII/10111994/EC/2024). All research procedures were conducted in accordance with the principles of ethical research involving human participants.

The level of adherence among respondents was assessed using a structured questionnaire comprising 20 dichotomous items with "yes" and "no" response options. The questionnaire was designed to evaluate both medication adherence and lifestyle (non-pharmacological) adherence. The items were categorized into two types of statements: favorable and unfavorable statements. For favorable statements, a "yes" was assigned a score of 1, while a response of "no" was scored 0. In contrast, for unfavorable statements, a "yes" response was scored 0, and a "no" response was scored 1. The total adherence score was calculated by summing the scores across all items, with higher scores indicating greater adherence to the prescribed hypertension management practices.

The results of the normality test indicated that the data were not normally distributed. Therefore, we categorized the respondents' adherence based on a median questionnaire score of 15. This score served as the cutoff point to distinguish between high and low adherence categories. Additionally, we grouped respondents according to their medication adherence and lifestyle adherence, using 10 and 5 as the cut-off points for each category, respectively, based on the median scores of the questionnaires.

The questionnaire used in this study had previously undergone validity and reliability testing to ensure its suitability for measuring adherence to the Mediterranean diet. The validity test was conducted on a sample of 30 hypertensive patients at the Kasihan 1 Public Health Center in Yogyakarta, Indonesia. Using the Pearson

product-moment correlation, the critical r-value for the given sample size was 0.361. The results demonstrated that all items in the adherence questionnaire had calculated correlation coefficients exceeding the r-threshold (r >0.361), indicating that each item was statistically significant. Reliability testing was performed using Cronbach's alpha to assess internal consistency. The analysis yielded a Cronbach's alpha coefficient of 0.848, surpassing the commonly accepted threshold of 0.6, which confirmed that the questionnaire items were reliable and consistent for use in this study.

▪ RESULTS

Respondents' characteristics

The demographic and clinical characteristics of the respondents are summarized in Table 1 and include variables such as age, sex, education level, occupation, hypertension type, presence of comorbidities, type of antihypertensive therapy, smoking history, and body mass index (BMI). Descriptive analysis revealed that most respondents exhibited low adherence to both medication and lifestyle recommendations. Regarding medication adherence, the pre-elderly (23 respondents, 53.5%) and elderly (42 respondents, 54.5%) groups predominantly fell into the non-adherent category. Similarly, low adherence was observed among males (18 respondents, 56.3%), females (47 respondents, 53.4%), individuals with elementary to junior high school education (36 respondents, 61%), and unemployed respondents (42 respondents, 56%). Furthermore, respondents with a history of smoking (61%) and those classified as obese (65.2%) demonstrated low medication adherence.

In terms of lifestyle adherence, the proportion of non-adherent respondents was notably high. Most pre-elderly (74.4%) and elderly (72.7%) participants were noncompliant with lifestyle modifications. This trend was also observed among females (75%), unemployed individuals (76%), passive or active smokers (89.6%), and obese respondents (91.3%).

Table 1. Frequency distribution of patients with hypertension class at the Bambanglipuro Health Center.

Variable	Category	Medication adherence		P-Value	OR	95% CI	Lifestyle adherence		P-value	OR	95% CI
		Low (%)	High (%)				Low (%)	High (%)			
Age	Pre-elderly (45-59 years old)	23 (53.5)	20 (46.5)	0.911	0.96	0.45-2.03	32 (74.4)	11 (25.6)	0.841	1.09	0.47-2.55
	Seniors (>60 years old)	42 (54.5)	35 (45.5)				56 (72.7)	21 (27.3)			
Gender	Male	18 (56.3)	14 (43.8)	0.782	1.12	0.50-2.53	22 (68.8)	10 (31.3)	0.494	0.73	0.30-1.78
	Female	47 (53.4)	41 (46.6)				66 (75)	22 (25)			
Education	SD-SMP	36 (61)	23 (39)	0.139	1.73	0.84-3.57	43 (72.9)	16 (27.1)	0.912	0.96	0.42-2.25
	SMA-Scholar	29 (47.5)	32 (52.5)				45 (73.8)	16 (26,2)			
Employment	Not working	42 (56)	33 (44)	0.603	1.22	0.58-2.55	57 (76)	18 (24)	0.394	1.43	0.63-3.26
	Work	23 (51.1)	22 (48.9)				31 (68.9)	14 (31.1)			
Types of hyper-tension	Non-complications	65 (54.2)	55 (45.8)	-	-	-	88 (73.3)	32 (26.7)	-	-	-
	Complications	0 (0)	0 (0)				0 (0)	0 (0)			
Comorbidities	None	60 (52.6)	54 (47.4)	0.141	0.22	0.02-1.96	83 (72.8)	31 (27.2)	0.570	0.53	0.06-4.77
	There is	5 (83.3)	1 (16.7)				59 (83.3)	1 (16.7)			
Antihypertensive dayHigh). therapy	Mono-therapy (amlodipine)	56 (51.9)	52 (48.1)	0.127	0.36	0.09-1.40	79 (73.1)	29 (26.9)	0.891	0.91	0.23-3.59
	Therapy combination (amlodipin + captopril)	9 (75)	3 (25)				9 (75)	3 (25)			
History smoking	No	18 (41.9)	25 (58.1)	0.043	2.18	1.02-4.65	19 (44.2)	24 (55.8)	0.001	10. 89	4.22-28.10
	Passive/active smokers	47 (61)	30 (39)				69 (89.6)	8 (10.4)			

Variable	Category	Medication adherence		P-Value	OR	95% CI	Lifestyle adherence		P-value	OR	95% CI
		Low (%)	High (%)				Low (%)	High (%)			
BMI	*Underweight*	3 (42.9)	4 (57.1)	0.465	-	-	4 (57.1)	3 (42.9)	0.139	-	-
	Ideal	33 (49.3)	34 (50.7)				46 (68.7)	21 (31.3)			
	Overweight	14 (60.9)	9 (39.1)				17 (73.9)	6 (26.1)			
	Obesity	15 (65.2)	8 (34.8)				21 (91.3)	2 (8.7)			

Description: OR = Odds Ratio, CI = Confidence Interval with 95% confidence level; data were analyzed using the chi-square test.

Distribution of respondents answers

The levels of medication and lifestyle adherence among respondents were assessed using a structured questionnaire consisting of dichotomous "yes" or "no" response options. The distribution of the respondents' answers is presented in Table 2.

Table 2. Distribution of respondents' answers based on the adherence questionnaire.

Indicator	Yes (%)	No (%)
Forgetting to take medicine		
I sometimes forget to take my hypertension medication	89 (74.2)	31 (25.8)
I have intentionally not taken my hypertension medication for the past two weeks	39 (32.5)	81 (67.5)
I sometimes forget to bring my hypertension medication when traveling	21 (17.5)	99 (82.5)
Stop taking medication		
I have stopped or reduced the amount of hypertension medication without informing my doctor	44 (36.7)	76 (63.3)
I stop taking my hypertension medication when I feel better	35 (29.2)	85 (70.8)
I stopped taking my hypertension medication when I felt the side effects of the medication	15 (12.5)	105 (87.5)
Perception of treatment		
I feel bothered by the obligation to take hypertension medication	17 (14.2)	103 (85.8)
I feel that taking hypertension medication can make me dependent	33 (27.5)	87 (72.5)
I feel that taking hypertension medication can interfere with daily activities	33 (27.5)	87 (72.5)
Take medicine as recommended		
I am confident that I have taken all the hypertension medications that I am supposed to take	100 (83.3)	20 (16.7)
I feel better when I take hypertension medication	109 (90.8)	11 (91.2)
Time to take medicine		
I take my hypertension medication at the same time every day	98 (81.7)	22 (18.3)
Sometimes I take my hypertension medication at a different time than prescribed (e.g., it's supposed to be taken at night but I take it in the morning)	96 (80)	24 (20)
Body Mass Index (BMI)		
I strive to achieve and maintain an ideal weight	100 (83.3)	20 (16.7)
Implementation of the DASH diet		
I eat vegetables and fruits daily.	109 (90.8)	11 (91.2)
I still often consume fatty/fried foods and preserved foods	94 (78.3)	26 (21.7)
Reduce salt consumption		
I make sure that my salt intake is no more than 2.4 grams (about one teaspoon) in 1 day	94 (78.3)	26 (21.7)
Physical activity		
I do regular exercise. such as walking, cycling, or swimming. for at least 30 minutes in 1 day	111 (92.5)	9 (7.5)
Avoid consumption of alcohol and packaged beverages		
I avoid consuming alcohol and bottled drinks to maintain my health	109 (90.8)	11 (91.2)
Quit smoking		
I try to quit smoking/avoid exposure to cigarette smoke	37 (30.8)	83 (69.2)

Based on the data presented in Table 2, the two most frequently reported areas of non-adherence among respondents were medication intake and dietary habits. Specifically. Of the respondents, 89 (74.2%) acknowledged that they occasionally forgot to take their antihypertensive medications. indicates suboptimal adherence and inconsistent medication use. This irregularity may adversely affect the therapeutic efficacy and impede effective blood pressure control. Additionally. 94 respondents (78.3%) reported frequent consumption

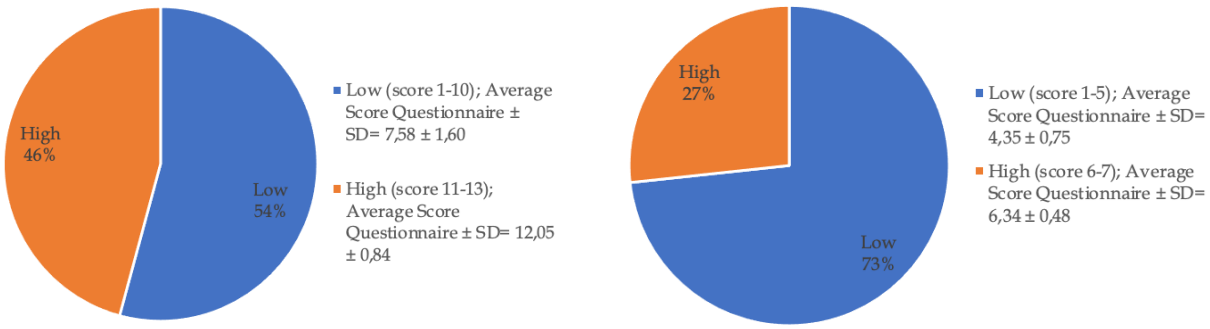
of high-fat foods. fried foods. and preserved foods. reflecting poor adherence to the recommended dietary modifications.

Medication adherence level

The assessment of treatment adherence among respondents participating in the Hypertension Class Program is summarized in Figure 1. Based on the results shown in Figure 1 (A), It shows that as many as 65 respondents (54.2%) had low treatment adherence, with an average adherence score of 7.58. As many as 55 respondents (45.8%) had high treatment adherence, with an average score of 12.05.

Lifestyle adherence level

The assessment of lifestyle adherence among respondents enrolled in the Hypertension Class Program is shown in Figure 1(B). The data indicated that 88 respondents (73.3%) exhibited low lifestyle adherence. with a mean adherence score of 4.35. Conversely. A total of 32 respondents (26.7%) demonstrated high adherence to lifestyle. with a mean adherence score of 6.34.



(A) **(B)**

Figure 1. Treatment adherence level of hypertension class program patients at bambanglipuro health center (A) and Lifestyle adherence level of hypertension class program patients at bambanglipuro health center (B).

Therapy outcome

The therapeutic outcome in this study was defined as the blood pressure control status of hypertensive patients enrolled in the Hypertension Class Program, as shown in Table 3. The results indicate that the majority of respondents (n = 67. The majority (55.8%) of the patients exhibited uncontrolled blood pressure. with a mean systolic pressure of 151.95 mmHg and a mean diastolic pressure of 87.14 mmHg. In contrast, 53 respondents (44.2%) achieved controlled blood pressure. with a mean systolic pressure of 124.71 mmHg and a mean diastolic pressure of 72.49 mmHg.

Table 3. Outcome of Therapy in Hypertensive Patients of Hypertension Class Program at Bambanglipuro Health Center

Variable	Category	Mean TD ± SD		Frequency (n)	Percentage (%)
		Systolic	Diastolic		
Blood pressure	Uncontrolled (≥130/≥80 mmHg)	151.95±11.45	87.14±10.45	67	55.8
	Controlled (<130/<80 mmHg)	124.71±12.89	72.49±8.77	53	44.2

Relationship between adherence level and therapy outcome

The association between adherence levels and therapeutic outcomes. specifically blood pressure control. among hypertensive patients participating in the Hypertension Class Program are presented in Table 4. The analysis revealed a statistically significant relationship between both medication and lifestyle adherence and blood pressure control ($p < 0.001$). Patients with low medication adherence were 11.31 times more likely to have uncontrolled blood pressure. Low adherence to lifestyle modifications was associated with a 6.81-fold increased risk of uncontrolled blood pressure. The negative correlation

coefficients further indicated that higher adherence levels corresponded with improved blood pressure control.

Table 4. Relationship between adherence level and therapeutic outcome in hypertensive patients of the hypertension class program at Bambanglipuro Health Center.

Variable	Category	Blood pressure		P-Value	Coefficient correlation	OR	95% CI
		Uncontrolled	Controlled				
Medication adherence	Low	55 (84.6)	10 (15.4)	0.000	-0.530	11.31	4.70-27.21
	High	18 (32.7)	37 (67.3)				
Lifestyle adherence	Low	64 (72.7)	24 (27.3)	0.000	-0.404	6.81	2.76-16.80
	High	9 (28.1)	23 (71.9)				

OR: Odds Ratio. CI= Confidence Interval with 95% confidence level. *= indicated a significant relationship data analyzed used the Spearman Rho test. and the Odds Ratio (OR) was estimated using the Mantel–Haenszel method.

▪ DISCUSSION

The most striking finding of this study was the role of smoking history as a significant predictor of both medication and lifestyle adherence. A statistically significant relationship was observed between smoking status and medication adherence (p = 0.043). Non-smokers and passive/active smokers showed different adherence rates. with an odds ratio (OR) of 2.18. suggesting that smoking status more than doubled the likelihood of non-compliance compared with the reference group. This relationship was even more pronounced in lifestyle adherence (p = 0.001). An OR of 10.89 indicates a very strong association between the two variables. This suggests that individuals with a smoking history are significantly less likely to adhere to recommended lifestyle changes. Interestingly. Traditional demographic variables (age, gender, and education) and clinical variables (type of therapy and BMI) did not show a statistically significant impact on compliance in this study population (p>0.05).

Medication adherence was higher among the pre-elderly than among elderly individuals. This may be because pre-elderly individuals are still productive and have better cognitive functions. In contrast, older adults are more prone to memory decline and reduced motivation [10]. The physical health of older adults is declining. This makes it more difficult for them to understand the medication instructions [11]. Meanwhile, lifestyle adherence was low in both groups without a significant difference. indicating that lifestyle changes were more influenced by social and environmental support rather than age factors [12].

Medication adherence rates were higher in the pre-elderly age group than in the elderly group (>60 years). This suggests that age may influence patient adherence to hypertension therapy. The pre-elderly group was generally still in their productive years. had relatively good cognitive and physical ability. and were more aware of the importance of managing chronic diseases, such as hypertension.

Respondents with a high school to university education showed higher medication and lifestyle adherence than those with an elementary to junior high school education. This is in line with previous studies that stated that the higher the education level. the better the understanding and adherence to hypertension management [10]. The odds ratio of 1.68 showed that higher education increased the likelihood of medication adherence. Highly educated individuals tend to have a better understanding of medical information. followed the advice of healthcare professionals. and have better access to information than their older counterparts. Lower education levels could limit the understanding of the benefits of long-term therapy [13].

Respondents who were employed showed higher adherence to lifestyle. This may be because work routines encourage physical activity and regular schedules. Conversely. Medication adherence was higher among unemployed respondents. as they had more time to focus on medication schedules and health monitoring. Employment influenced adherence to hypertension therapy, and work-related busyness and stress hindered medication adherence. In contrast, unemployed individuals have more flexibility in managing their time and receive more support from their families [14].

All respondents were patients with uncomplicated hypertension. Therefore, there was no comparison based on the type of hypertension. However. Patients without comorbidities showed higher medication and lifestyle adherence than those with comorbidities. such as myalgia, dyspepsia, cough, and cold. Type 2

diabetes mellitus and headaches. Comorbidities increase the burden and complexity of therapy. and the risk of side effects. This could reduce adherence to hypertension medications [15].

The type of antihypertensive therapy influenced the adherence. where patients undergoing monotherapy tended to be more adherent than those undergoing combination therapy. because the number of medications was lower and the side effects were milder. This finding is aligned with previous studies that stated that the complexity of combination therapy could reduce adherence [16]. In this study. Amlodipine (5 mg) was the most commonly used monotherapy. The combination of amlodipine (5 mg) and captopril (25 mg) was used in combination therapy. Amlodipine, a CCB class drug, was effective because of its long duration of action and once-daily dosing. The combination of CCB and ACEI, such as amlodipine and captopril, was effective in lowering blood pressure and protecting target organs [17].

In terms of nutritional status, respondents with an ideal BMI were more adherent than those who were overweight and obese. Obesity often becomes a barrier to maintaining a healthy lifestyle. These findings confirm that clinical and behavioral factors, such as therapy type, are important. Smoking and nutritional status significantly impacted adherence among patients with hypertension [18].

This study used a questionnaire to assess adherence to antihypertensive medication among patients with hypertension. which was divided into two aspects: adherence to medication and lifestyle factors. In the medication aspect. One of the most frequently non-adhered statements was 'sometimes forgetting to take antihypertensive medication,' with a percentage of 74.2%. This finding shows that forgetting to take medication is a major challenge in hypertension management. Although this seems simple. This habit can significantly impact blood pressure stability and therapy success. Various factors influenced this outcome. such as daily busyness. lack of routine habits. and memory impairment. Especially in elderly patients [19]. These results are aligned with previous studies that stated that irregular medication consumption is a common barrier to medication adherence. Therefore, intervention strategies are needed. such as the use of reminder tools. Education on the importance of taking medication regularly. and involving family members in supporting treatment to improve patient adherence [20].

Lifestyle adherence to controlling blood pressure involves a balanced diet. regular exercise. and avoiding smoking and excessive alcohol consumption. Based on the analysis. One of the most frequently non-adhered questionnaire items was the frequent consumption of fried and fatty foods. with a percentage of 78.3%. Fatty foods. especially in saturated fats. increased blood pressure by affecting the lipid balance. worsening of vascular resistance. and increasing the risk of obesity [21]. Excessive fat consumption increases LDL levels. which form atherosclerotic plaques. obstructed blood flow. and triggers vasoconstriction and increases blood pressure [22]. Previous studies have shown that a diet high in saturated fat is associated with increased blood pressure. while a low-fat. A high-fiber diet can lower blood pressure in hypertensive patients [23]. Therefore, education on healthy eating habits should include limiting the consumption of fried foods. was important for improving adherence to non-pharmacological therapy.

Most respondents experienced uncontrolled blood pressure, putting them at a high risk for complications such as stroke. heart disease. and kidney failure. This could have been caused by poor adherence to medication. unhealthy lifestyle. or stress. Blood pressure measurements are influenced by various factors. including the body position. cuff size. physical activity. stress. and its surrounding environment. For accurate results. It is important to ensure optimal conditions during measurements. such as resting for several minutes beforehand. and paying attention to the timing and location of the measurements [24].

The data analysis results showed a significant relationship between patients' adherence to medication and lifestyle with therapy outcomes in terms of blood pressure. Most respondents with low medication adherence had uncontrolled blood pressure. Conversely, among respondents with high adherence to the guidelines. Most patients had controlled blood pressure. Statistical analysis yielded a p-value of <0.001, indicating a highly significant relationship between medication adherence and blood pressure control. A correlation coefficient of -0.530 indicates a strong negative direction. A higher score indicates higher adherence to medication. The greater the likelihood of controlled blood pressure.

The OR value of 11.31 showed that patients with low adherence had an 11 times greater chance of experiencing uncontrolled blood pressure compared to patients with high adherence. The 95% Confidence Interval (CI) ranged from 4.70 to 27.21, which did not include the value of 1. This indicates that the relationship

was statistically significant and that high medication adherence was a protective factor for achieving controlled blood pressure.

The results of this study were consistent with previous research that found a correlation value of -0.209 and a p-value of 0.041. indicates a weak negative relationship. This suggests that the hypertensive patients were more adherent to their medication. the better their blood pressure control [25]. However. The results of this study contradict those of another study, which stated that adherence to hypertension therapy was not significantly associated with blood pressure control. with a p-value of 0.901 [26].

Blood pressure control was closely related to the level of adherence to antihypertensive medications. The risk of complications. including stroke, heart attack, and kidney failure. Decreases in patients who diligently took their medication because their blood pressure was usually more stable and within the normal range [27]. Several factors influenced clinical outcomes. including the accuracy of drug prescriptions (type, dose, and frequency). adherence to medication. lifestyle. stress levels. physical activity. and other unpredictable factors [28].

A similar pattern was also observed in lifestyle adherence. Patients with low lifestyle adherence mostly experienced uncontrolled blood pressure. while those with high adherence mostly had controlled blood pressure. A p-value of <0.001 indicated a highly significant relationship between lifestyle adherence and blood pressure control. The correlation coefficient of -0.404 indicates a moderate negative relationship between the two variables. The higher the adherence to lifestyle is. The better the blood pressure control is.

The OR value of 6.815 indicated that patients with low lifestyle adherence had approximately 6.8 times greater a chance of experiencing uncontrolled blood pressure compared with patients with high adherence. The 95% Confidence Interval (CI) ranged from 2.76 to 16.80, which also does not include the value 1. This reinforces the statistical significance of the relationship.

The findings of this study were consistent with those of previous studies that indicated a significant and strong relationship between lifestyle and blood pressure in adults (p-value = 0.000; correlation coefficient = 0.607). Lifestyle was proven to be related to blood pressure. Therefore, maintaining a healthy lifestyle is equivalent to preserving blood pressure health [29].

One of the main steps in controlling blood pressure is avoiding factors that could cause uncontrolled blood pressure. Patients must limit their consumption of high-salt foods, reduce stress, and maintain an ideal body weight. and exercise regularly. In addition. Adherence to taking antihypertensive medication as prescribed by the doctor was also very important. This can be achieved by increasing awareness and adopting a healthy lifestyle. Hypertensive patients can better manage their condition. to reduce the risk of complications. and improve their chances of living a higher-quality life [30].

Overall. The high OR values and confidence intervals (CIs) that did not cross the value of 1 for both variables confirmed that adherence to medication and lifestyle played important roles in the success of hypertension therapy outcomes. The OR value was 11.31 for medication adherence and 6.8 for lifestyle adherence. This difference in OR values could be explained by the pharmacological mechanisms and the consistency of the drug effects. Regular use of antihypertensive medications has a direct and measurable effect on lowering blood pressure [31], meanwhile. Lifestyle changes require time and consistency. Therefore, their effects tend to be slower and less potent than those of medications [32].

On the other hand. Adherence to medication and lifestyle still showed significant relationships with therapy outcomes. as indicated by p-values of 0.001 and 0.001 (< 0.05) and Confidence Intervals (CIs) of 4.70–27.21 and 2.76–16.80 (which did not include the value 1). This means that both medication and lifestyle adherence contribute to blood pressure control. However, medication adherence appeared to have a greater influence in this study.

A limitation of this study was that blood pressure measurements were based solely on medical record data at the time of data collection. without accounting for the prior history. This limited the ability to determine whether high blood pressure was persistent or situational. given the many factors that could affect blood pressure measurement results.

CONCLUSION

There is a significant relationship between medication adherence and therapeutic outcomes. with high medication adherence strongly correlated with effective blood pressure control. The same finding is also demonstrated by the study results. which found a significant relationship between lifestyle adherence and therapeutic outcomes in hypertensive patients at the Bambanglipuro Community Health Center.

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