

Republic of Iraq
Ministry of higher education
& Scientific research
Al-Zahrawi university college
Department of pharmacy



**(Evaluation of awareness and knowledge of hypertensive patients
regarding antihypertensive drug compliance in the middle
Euphrates area).**

**A research submitted to the pharmacy department council as part of the
bachelor's degree.**

By students:

- محمد هشام كامل
- مصطفى حامد علي
- يوسف صادق هاشم
- زهراء منار صباح

Under the supervision of:

MSc. Ghasaq Jaafar

Abstract

Hypertension is one of the most prominent global health problems affecting public health in both developing and developed countries. It is referred to as the "silent killer" due to its serious complications, which can lead to cardiovascular disease and damage to vital organs such as the brain, kidneys, and eyes. Despite the effectiveness of available treatments, poor medication adherence is a major challenge that hinders satisfactory treatment outcomes, increases the risk of complications, and places an additional burden on health systems. This study aims to assess the level of awareness and adherence among hypertensive patients in the Middle Euphrates region, highlighting the factors influencing medication adherence.

Methods:

The study adopted a cross-sectional design covering three Iraqi cities: Babylon, Karbala, and Najaf. Data were collected from November 2024 to February 2025 using a 21-question questionnaire, which measured demographic information, knowledge, and patient attitudes toward treatment. Data were supplemented by direct interviews with patients in outpatient clinics, hospitals, and health centers. Statistical analyses were used to determine the associations between the various factors and adherence levels, with a significance level of $P < 0.05$.

Results:

The study showed that 75% of patients take their medications regularly, while 70% visit their doctors regularly. Statistical analysis indicated a strong association between regular medical follow-ups and adherence levels ($P < 0.0001$). Patients' sense of control over their blood pressure also enhanced adherence ($P = 0.0184$). However, a significant proportion of patients experience medication side effects (75%), highlighting the need to improve treatment options. The results also showed that reliance on non-medical methods reduces adherence, reinforcing the importance of guiding patients toward medical treatments supported by lifestyle changes.

Conclusion:

The study highlights the importance of adherence to treatment for patients with hypertension and its role in improving blood pressure control and reducing associated health risks. The results showed that regular medical visits and a sense of control over blood pressure enhance adherence to treatment, while medication side effects represent a challenge that must be addressed by improving treatment options. The study also showed that reliance on non-medical methods reduces adherence, reinforcing the need to raise awareness of the importance of medical treatments and their key role in disease control. Finally, the study highlights the need for further research to explore the psychological and social factors influencing adherence to develop effective and comprehensive solutions that improve patients' quality of life.

1- Introduction

Hypertension High blood pressure is a silent killer, a time bomb threatening public health worldwide, in both developed and developing countries. It is one of the most serious risk factors for cardiovascular disease, damaging target organs such as the blood vessels in the heart, brain, kidneys, and eyes, increasing rates of cardiovascular morbidity and mortality [1]. These complications can arise as a result of patients' failure to adhere to their medications, which can lead to the development of atherosclerosis or other forms of cardiovascular disease [1].

Regardless of the effectiveness and efficacy of antihypertensive treatment, poor adherence to medication leads to unsatisfactory clinical outcomes. Studies indicate that less than 25% of patients receiving treatment for hypertension in many countries are able to achieve optimal blood pressure levels [2]. Adherence has been defined as the “active, voluntary, and collaborative involvement of the patient in a mutually acceptable course of behavior to produce a therapeutic result [3,4]. This definition implies that the patient has a choice and that both patients and providers mutually establish treatment goals and the medical regimen [3]. Medication adherence usually refers to whether patients take their medications as prescribed, as well as whether they continue to take a prescribed medication. Medication adherence behavior has thus been divided into two main concepts, namely, adherence and persistence. Although conceptually similar, adherence refers to the intensity of drug use during the duration of therapy, whereas persistence refers to the overall duration of drug therapy [5,6].

Adherence to long-term therapy for chronic illnesses in developed countries averages 50%. In developing countries, the rates are even lower [7]. It is undeniable that many patients experience difficulty in following treatment recommendations.

Poor adherence to long-term therapies severely compromises the effectiveness of treatment making this a critical issue in population health both from the perspective of quality of life and of health economics [7]. There are many different methods for assessing adherence to medications Oster Berg [8]. categorized these methods as either direct or indirect. Direct methods include directly observed therapy, measurement of the level of medicine or metabolite in blood, and measurement of the biological marker in blood [8]. Although these direct methods are considered to be more robust than indirect methods, there are also limitations to these direct methods of adherence assessment. For example, patients may hide pills in their mouth and discard them later, or there may be variations in metabolism that can affect serum levels. Furthermore, these direct methods are not practical for routine clinical use. Indirect methods of adherence assessment include patient questionnaires, self-reports, pill counts, rate of prescription refills, assessment of the patient's clinical response, electronic medication monitors, measurement of physiological markers, and patient diaries [8]. The most commonly used indirect methods include patient self-report, pill counts, and pharmacy refills. Studies on patient's antihypertensive medication adherence in hypertension have been undertaken in some parts of the country.

Improving public knowledge and awareness of hypertension (HTN), its early identification, proper treatment and control significantly reduces the mortality rate caused by cardiovascular diseases [9]. In many countries, national high systolic blood pressure (SPB) education programs have been introduced to improve public knowledge and awareness of HTN [10]. through which significant positive results were achieved [11,12]. Recognition of the importance of SBP level has been considered as one of the major public health challenges in the prevention and treatment of HTN [13]. Despite of improving general knowledge and awareness,

some studies indicate that most of the patients with HTN don't control the SBP [14-15]. and have poor drug compliance [16].

The World Health Organization (WHO) in 2019 reported that the number of people with hypertension in the world was around 1.13 billion. The WHO predicted that the prevalence of hypertension will continue to increase, and by 2025 as many as 29% of adults in the world have hypertension [17].

Hypertension is an increase in systolic blood pressure of more than 140 mmHg and diastolic blood pressure of more than 90 mmHg. It is called a silent killer with symptoms that can vary in each individual [18]. The hypertension criteria used in case determination refer to the JNC VIII 2014 diagnostic criteria. The normal blood pressure that one should have is <140/90 mmHg, and the standard blood pressure for patients with chronic kidney disease and diabetes is 130/80 mmHg [19]. In general, hypertension treatment is given by using a class of drugs that block the angiotensin-converting enzyme, calcium channel blockers, diuretics, beta-blockers, alpha-blockers, and angiotensin II receptor antagonists. Each of these drug groups consists of several types of drugs with different pharmacological and pharmacodynamic properties. In addition, hypertension is treated using non-pharmacological therapies or a healthy lifestyle. Both medical and behavioral therapies are effective steps to treat hypertension [19]. The success of hypertension treatment is influenced by several factors, one of which is adherence to treatment [20].

Adherence to hypertension treatment is important because patients need to control their blood pressure to avoid complications that may lead to death. In addition, blood pressure can be controlled by taking regular antihypertensive drugs for long-term medication. Patients who control blood pressure can reduce the risk of damage to important body organs such as the brain, heart, and kidneys [18]. Adherence to

treatment is an open behavior that is classified as public health behavior. According to Lawrence Green (1993) in Notoatmodjo (2014), one of the factors that influence adherence is knowledge [21].

The WHO shows that around 50-70% of patients with hypertension did not adhere to treatment [17]. Their adherence might be influenced by several factors such as knowledge, motivation, and family support.

Mathavan and Pinatih (2017) assert that some problems cause patients to have low knowledge about hypertension [22].

The purpose of the study was to assess the awareness and knowledge of hypertensive patients regarding adherence to antihypertensive medications in the Middle Euphrates region.

2- methods

➤ Study Design

This is a cross-sectional study aimed to determine the level of knowledge, awareness, attitude and medication adherence among patients diagnosed with hypertension. The study was conducted in three cities in Iraq; Babylon, Karbala and Najaf. Information was collected from patients via questionnaire in November 2024 to February 2025.

A comprehensive questionnaire was distributed to a group of patients with hypertension where the questionnaire mainly contained questions consisting of about 21 items and was divided into two parts. Participants were targeted from outpatient clinics, hospitals and community health centers within the selected cities

➤ Data Collection

Data were collected from participating patients from outpatient clinics, hospitals and community health centers within the selected cities through face-to-face interviews with the patient and a multi-component questionnaire was completed. Each interview took approximately 15-30 minutes. Informed consent was obtained to complete the questionnaire.

The sample size was calculated according to the following formula

$$[16]. n = (Z_{1-\alpha})^2 \times P(1-P) / d^2$$

Inclusion and Exclusion Criteria

Inclusion Criteria:

Patients aged 18 years or older and with a confirmed diagnosis of hypertension.

Patients who signed an informed consent form to participate in the study.

Exclusion Criteria:

Patients with cognitive impairments and/or severe comorbid conditions that are likely to limit their ability to respond to the questionnaire.

Patients who do not wish to participate.

➤ **Questionnaire**

A validated structured questionnaire with open-ended questions was developed with input from subject-matter experts. The questionnaire consisted of the following sections:

1. Demographic and Clinical Information:

- Age, gender, smoking status, body mass index (BMI), pregnant woman for female, residence, family history of hypertension, and Other Disease
- Serum cholesterol and triglycerides levels were also documented.

2. Knowledge and Awareness:

- Questions assessing participants' understanding of hypertension, its complications, and lifestyle management.

3. Attitude:

- Questions to evaluate participants' attitudes toward managing their condition and adhering to treatment.

4. Medication Compliance:

- Questions adapted from the Morisky Medication Adherence Scale (MMAS-8), including:
 - Forgetfulness in taking medication.
 - Adherence during travel.
 - Stopping medication when feeling better.
 - Perceptions of the burden of daily medication use.

➤ **Statistical analysis:**

Categorical data was described as frequency and percentage, association between these categorical variables was assessed by using chi-square test. A cut-off p-value of less than 0.05 was used as significance threshold. Statistical analysis was carried out by using XLSTAT 2019 software.

3. Results:

➤ Demographic characteristics of participants

The study included a sample of 400 participants distributed across different age groups. The largest group was elderly at 50% (200 participants), followed by middle-aged participants at 43.5% (174 participants), and finally the youth group at only 6.5% (26 participants).

As for gender, the majority were males at 56.75% (227 participants), while females constituted 43.25% (173 participants). As for smoking status, the results showed that most of the participants were non-smokers at 61% (244 participants), while smokers constituted 39% (156 participants).

Regarding the body mass index (BMI), more than half of the participants were overweight (54.75%) (219 participants), while 24.25% were within normal weight (97 participants), and 21% were obese (84 participants). The study also showed that most of the participants resided in Babylon and Karbala with a large percentage of 95.25% (381 participants), while a small percentage resided in Najaf (4.75%). For the participating women, the percentage of pregnant women was only 17.75% (31 women out of 173).

Table 1: Demographic characteristics.

Variable	Category	Frequency	Percentage
Age	Young	26	6.5%
	Middle-aged	174	43.5%
	Old	200	50%
Gender	Male	227	56.75%
	Female	173	43.25%
Smoking Status	Smokers	156	39%
	Non-Smokers	244	61%
BMI	Normal Weight <25	97	24.25%
	Overweight 25–29.9	219	54.75%
	Obese ≥30	84	21%
Residency	Najaf	19	4.75%
	Babil/Karbala	381	95.25%
Pregnancy	Yes	31	17.75%
	No	142	82.25%

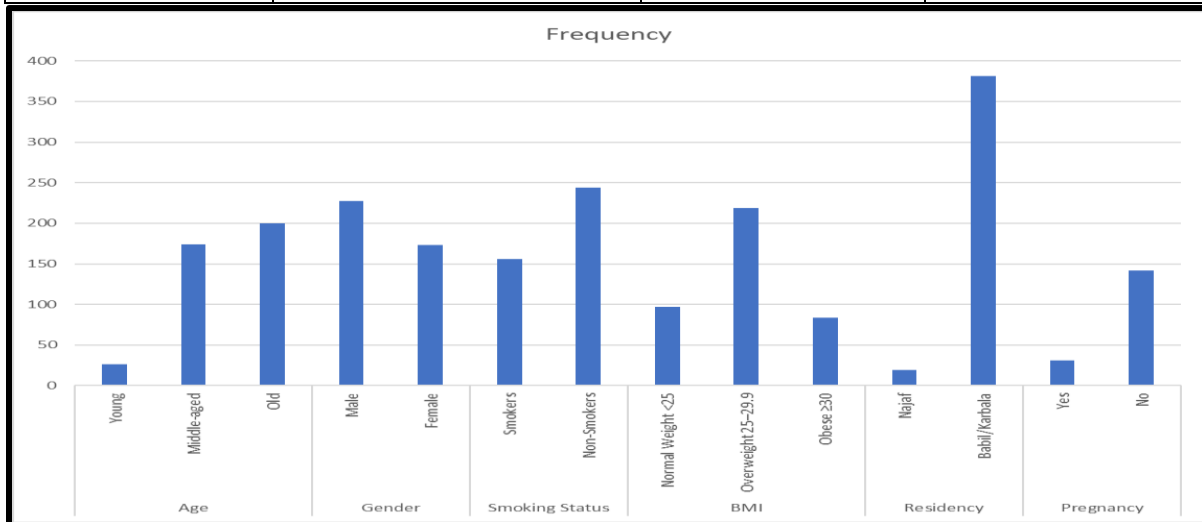


Figure 1: Demographic characteristics.

➤ **Clinical characteristics**

The results showed that the most commonly used medications among the participants were Candesartan (Atacand) with 27.75% (111 participants), followed by Lisinopril with 19% (76 participants), and Amlodipine (Norvasc) with 18% (72 participants). The least common medication was spironolactone at 11% (44 participants).

With regard to family history of diseases, the results showed that 62.25% of participants had a family history of chronic diseases (249 participants), compared to 37.75% who had no family history (151 participants). As for cholesterol levels, the majority were within the normal range (140–199 mg/dL) at 87.75% (351 participants), while only 5.5% had levels below 140 mg/dL, and 6.75% had levels above 200 mg/dL.

Table 2: Clinical characteristics.

Variable	Category	Frequency	Percentage
Medication used	Candesartan (Atacand)	111	27.75
	Lisinopril	76	19
	Amlodipine (Norvasc)	72	18
	Valsartan (Diovan, Angiozar)	50	12.5
	Hydralazine	47	11.75
	Spironolactone	44	11
Family History	Yes	249	62.25
	No	151	37.75
Blood cholesterol Level	Below 140 mg/dL	22	5.5
	140–199 mg/dL	351	87.75
	≥ 200 mg/dL	27	6.75
Blood triglyceride level	Below 100 mg/dL	68	17
	100–150 mg/dL	97	24.25
	151–199 mg/dL	181	45.25
	≥ 200 mg/dL	54	13.5
Other Disease	Diabetes Mellitus (DM)	75	18.75
	No Disease	67	16.75
	Hypothyroidism	14	3.5
	Angina	13	3.25
	Other diseases	231	57.75

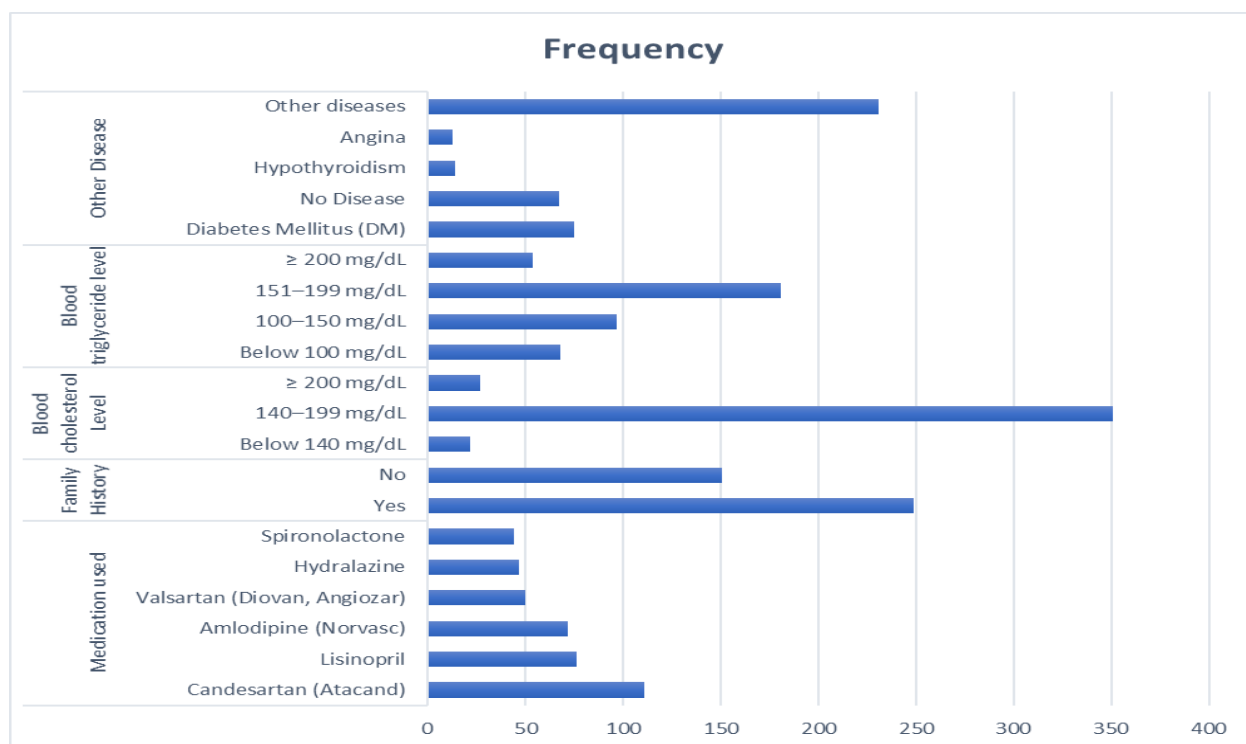


Figure 2: Clinical characteristics.

➤ Patient Adherence and Health Behavior

The study revealed a high adherence rate among participants; 75% of participants (300 participants) indicated that they take their medications regularly, while the percentage of regular doctor visits was 70% (280 participants). However, the study indicated that a large proportion of patients (75%) suffered from side effects resulting from medications, while reliance on non-medical methods to manage high blood pressure was minimal (15%).

Table 3: Patient compliance and health behavior.

Question	Answer	
	Yes	No
Do you take your medication regularly?	300	100
Do you visit your doctor regularly?	280	120
Do you think your blood pressure is under control?	240	160
Do you rarely miss medication doses?	120	280
Do you forget to take your medication doses?	280	120
Do you feel that the medication is effective?	260	140
Do you experience side effects from the medication?	300	100
Do you rely on non-medical methods to manage hypertension?	60	340

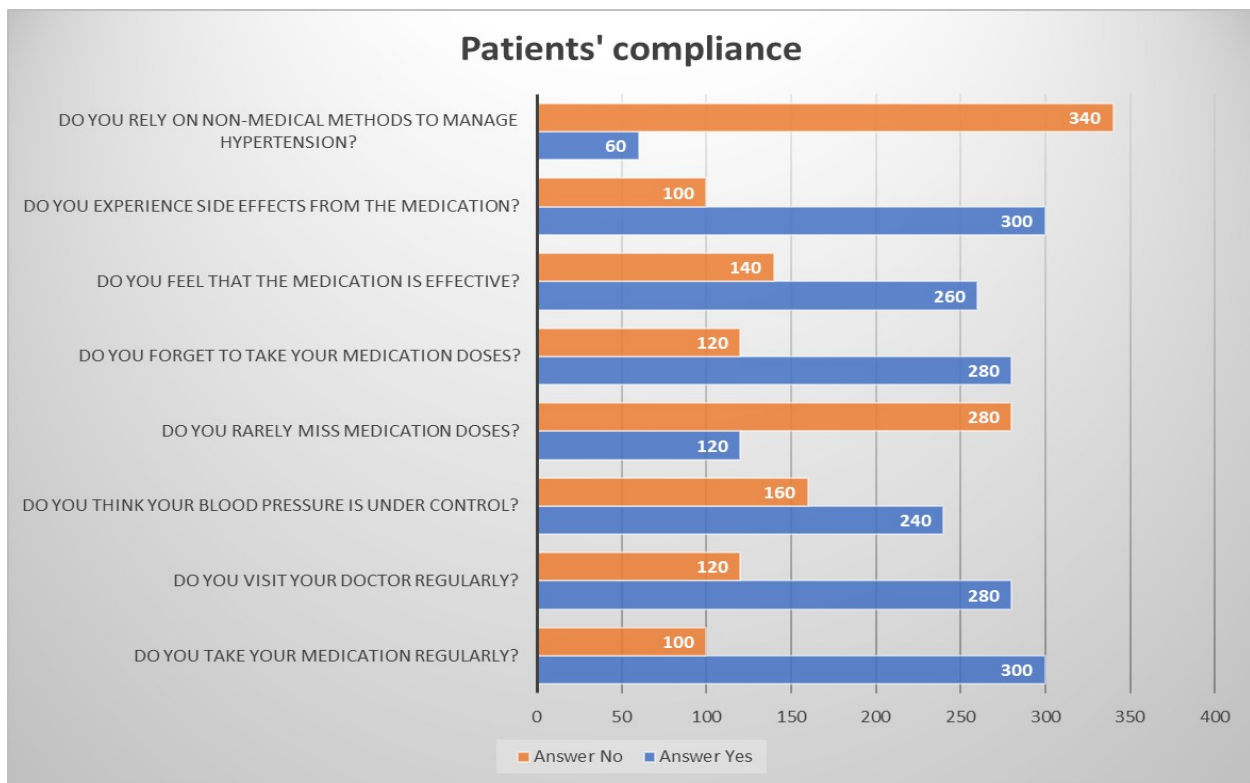


Figure 3: Patient compliance and health behavior.

➤ Statistical analysis of association

A comprehensive analysis of the relationship between patients' adherence to taking their medications and various influencing factors was conducted using the Chi-square test to determine the presence of a statistically significant association between these variables. Values less than $P < 0.05$ were considered statistically significant, and odds ratios (Odds Ratios) were calculated with a confidence interval of 95%. The main results are as follows:

1. The relationship between adherence and regular doctor visits:

The results showed that patients who visit the doctor regularly are more adherent to taking their medications. Of the 280 patients who visit the doctor regularly, 245 of them were adherent (87.5%). The statistical value ($P\text{-value} < 0.0001$) showed a strong association between regular doctor visits and medication adherence. The odds ratio was 8.27, which means that patients who visit the doctor regularly are about 8 times more likely to adhere to their medications than those who do not visit the doctor. This indicates the importance of regular follow-up with the doctor in enhancing adherence.

Table 4: Association analysis between patients' compliance and regular visit to physician.

CI: confidence interval.

Data analyzed	Compliance-yes	Compliance-No	Total	P-value	Odds ratio, 95% CI
Visit doctor regularly	245	35	280	<0.0001	8.27 (4.96- 13.40)
Not visit doctor regularly	55	65	120		
Total	300	100	400		

2. The relationship between belief that blood pressure is under control and adherence:

The study revealed that patients who believe that their blood pressure is under control show higher levels of medication adherence. Among 240 patients who believe that their blood pressure is under control, 190 of them were adherent (79.2%). The P-value = 0.0184, indicating that there is a statistically significant relationship. The odds ratio was 1.72, indicating that patients who believe that their blood pressure is under control are more than 1.7 times more likely to adhere than those who believe that their blood pressure is not controlled.

Table 5: Association analysis between patients' compliance and their thinking that blood pressure is under control.

Data analyzed	Compliance-yes	Compliance-No	Total	P-value	Odds ratio, 95% CI
Think BP under control	190	50	240	0.0184	1.72 (1.08- 2.75)
Not think BP under control	110	50	160		
Total	300	100	400		

3. The relationship between medication side effects and adherence:

The results showed that medication side effects were a positive factor in adherence, as 215 out of 300 patients with side effects were adherent (71.7%).

The P-value = 0.0077, indicating that there is a statistical significance.

The odds ratio was 0.44, meaning that patients without side effects were 56% less likely to adhere.

Table 6: Association analysis between patients' compliance and their experience to medication side effects.

Data analyzed	Compliance-yes	Compliance-No	Total	P-value	Odds ratio, 95% CI
Side effect-yes	215	85	300	0.0077	0.44 (0.24-0.80)
Side effect-no	85	15	100		
Total	300	100	400		

4. Relationship between the use of non-medical methods and adherence:

The study showed that patients who relied on non-medical methods (such as herbs or lifestyle changes) to manage hypertension showed lower adherence. The statistical value P-value = 0.0036 showed a strong significance for this relationship. The odds ratio was 3.43, indicating that non-reliance on non-medical methods increases the likelihood of adherence by more than 3 times. This could be related to the increased health awareness of this group of patients.

Table 7: Association analysis between patients' compliance and their use of non-medical methods.

Data analyzed	Compliance-yes	Compliance-No	Total	P-value	Odds ratio, 95% CI
Non-medical methods-yes	54	6	60	0.0036	3.43 (1.49-7.68)
Non-medical methods-no	246	94	340		
Total	300	100	400		

4- Discussion

Based on the study results, it can be noted that the distribution of participants reflects an interesting demographic diversity, with the elderly constituting the largest proportion, highlighting the impact of the studied topic on this particular age group. Regarding gender, the proportion of males was higher than females, which may reflect the disparity in health needs between the sexes.

Regarding body mass index (BMI), the majority were overweight, a finding that may open the door to discussing the relationship between obesity and the health conditions studied. Furthermore, most participants were residents of Babil and Karbala governorates, underscoring the importance of directing efforts to improve healthcare in these areas.

Regarding clinical characteristics, the results showed a clear preference for certain medications, such as candesartan and lisinopril, indicating their effective role in treating the conditions under study. Furthermore, the presence of a family history of chronic diseases in a large proportion of participants highlights the critical importance of genetic and hereditary factors. Interestingly, the majority of participants had cholesterol levels within the normal range, which may be a result of health awareness or the effectiveness of therapeutic interventions.

In terms of behavioral and health compliance, the study showed that most participants take their medications regularly and visit their doctors regularly, reflecting a good level of health awareness. However, the large percentage experiencing medication side effects indicates the need to review treatment strategies to reduce these effects.

Through statistical analysis, it was found that regular doctor visits have a significant positive impact on medication compliance, with the results showing strong statistical significance supporting this relationship. The study also showed that a sense of control over blood pressure enhances adherence, although medication side effects

were a factor that increased adherence for some. This may seem unexpected, but it may be explained by the importance of treatment for patients.

Conversely, the results showed that reliance on non-medical methods reduces adherence, highlighting the need to raise awareness about the importance of medical treatments. Based on these findings, recommendations can be directed toward improving treatment strategies, raising awareness of the importance of regular doctor visits, and mitigating side effects to ensure effective adherence.

5- Conclusion

This study highlights the importance of medication adherence for patients with hypertension, as it contributes to improved blood pressure control and reduced associated health risks such as cardiovascular disease. The results indicate that regular physician visits are a key factor in increasing medication adherence. Furthermore, the sense of control over blood pressure plays a positive role in enhancing adherence. However, it was revealed that medication side effects may be a contributing factor, calling for improved treatment strategies to mitigate these effects. The study emphasizes the importance of raising patient awareness of the importance of medical treatment and moving away from reliance on non-medical methods that have been shown to reduce adherence. Despite significant progress in some areas, there is a pressing need for further research to shed light on the social and psychological challenges that impact patient adherence and develop comprehensive solutions to improve health outcomes.

6- Recommendations

Based on the study results, a set of recommendations can be focused on enhancing treatment adherence and improving health awareness levels. It is recommended to promote regular medical visits, as the study showed that patients who follow up with their doctors regularly are more adherent to taking their medications. It is also suggested to improve public awareness of the risks of high blood pressure by launching media campaigns aimed at increasing individuals' awareness of the importance of treatment. Efforts can also be made to reduce the side effects of medications by improving treatment strategies and providing more appropriate treatment options. It is also emphasized that focusing on medical treatment as the primary means of controlling high blood pressure is important, while directing efforts towards encouraging patients to adopt a healthy lifestyle that contributes to improved treatment outcomes. Finally, further research on the psychological and social factors that influence treatment adherence is essential to developing more effective strategies.

Reference

1. Zeind, CS & Carvalho, MG 2018, *Applied Therapeutics: The Clinical Use of Drugs*, 11th edn, Lippincott Williams & Wilkins, a Wolters Kluwer business, accessed 15 March 2025.
2. Sternberg, RJ 2025, 'Human intelligence', *Encyclopedia Britannica*, 13 March 2025, available at: <<https://www.britannica.com/science/human-intelligence-psychology>>, accessed 15 March 2025.
3. Delamater, AM 2006, 'Improving patient adherence', *Clinical Diabetes*, vol. 24, no. 2, p. 71.
4. Moore, TR & Amado, RS 2021, 'A conceptual model of treatment adherence in a behavior analytic framework', *Education & Treatment of Children*, vol. 44, no. 1, pp. 1–17.
5. Caetano, PA, Lam, JM & Morgan, SG 2006, 'Toward a standard definition and measurement of persistence with drug therapy: Examples from research on statin and antihypertensive utilization', *Clinical Therapeutics*, vol. 28, pp. 1411–1425.
6. Cramer, JA, Roy, A, Burrell, A, Fairchild, CJ, Fuldeore, MJ, Ollendorf, DA & Wong, PK 2008, 'Medication compliance and persistence: Terminology and definitions', *Value in Health*, vol. 11, pp. 44–47.
7. World Health Organization 2003, *Adherence to long-term therapies: Evidence for action*, WHO, Geneva.
8. Osterberg, L & Blaschke, T 2005, 'Adherence to medication', *The New England Journal of Medicine*, vol. 353, no. 5, pp. 487–497.
9. Gaziano, JM 2001, 'Global burden of cardiovascular disease', in Braunwald, E, Zipes, DP & Libby, P (eds), *Heart Disease: A Textbook of Cardiovascular Medicine*, 6th edn, WB Saunders Company, Philadelphia, pp. 1–17.

10. Roccella, E & Horan, M 1988, 'The National High Blood Pressure Education Program: Measuring progress and assessing its impact', *Health Psychology*.
11. Hunink, MG 1997, 'The recent decline in mortality from coronary heart disease, 1980–1990: The effect of secular trends in risk factors and treatment', *JAMA*, vol. 277, no. 7, p. 535, doi: 10.1001/jama.1997.03540310033031.
12. Burt, VL, Whelton, P, Roccella, EJ, et al. 1995, 'Prevalence of hypertension in the US adult population: Results from the Third National Health and Nutrition Examination Survey, 1988–1991', *Hypertension*, vol. 25, no. 3, pp. 305–313, doi: 10.1161/01.hyp.25.3.305.
13. Alsuwaida, A & Alghonaim, M 2011, 'Gender disparities in the awareness and control of hypertension', *Clinical and Experimental Hypertension*, vol. 33, no. 5, pp. 354–357, doi: 10.3109/10641963.2010.531857.
14. Alexander, M, Tekawa, I, Hunkeler, E, et al. 1999, 'Evaluating hypertension control in a managed care setting', *Archives of Internal Medicine*, vol. 159, no. 22, pp. 2673–2677, doi: 10.1001/archinte.159.22.2673.
15. Sadeghi, C, Khan, HA, Gudleski, G, et al. 2020, 'Multifaceted strategies to improve blood pressure control in a primary care clinic: A quality improvement project', *International Journal of Cardiology Hypertension*, vol. 7, article 100060, doi: 10.1016/j.ijchy.2020.100060.
16. Pirasath, S, Sugathapala, AGH & Wanigasuriya, K 2020, 'Descriptive cross-sectional study on knowledge, awareness, and adherence to medication among hypertensive patients at a tertiary care centre in Colombo District, Sri Lanka', *International Journal of Hypertension*, vol. 2020, article 1320109, doi: 10.1155/2020/1320109.
17. World Health Organization 2019, *Hypertension*, WHO, Geneva.
18. Ministry of Health, Republic of Indonesia 2018, *Information on Hypertension Data and Information*, Jakarta.

- 19.Sweetman, SC 2009, Martindale: The Complete Drug Reference, 36th edn, Pharmaceutical Press, London.
- 20.Hanum, S, Rahmaida, N & Marlinda, Y 2019, 'The relationship between knowledge, motivation, and family support with compliance with taking medicines for hypertension patients at Peukan Bada Health Center', Aceh International Journal of Science, vol. 10, pp. 30–35.
- 21.Notoatmodjo, S 2014, Ilmu Perilaku Kesehatan, Rineka Cipta, Jakarta.
- 22.Mathavan, J & Pinatih, G 2017, 'An overview of the level of knowledge on hypertension and medication adherence in patients with hypertension in the working area of the Kintamani I Health Center, Bangli-Bali', Medical Science Digest, vol. 8, pp. 176–180.