Alqalam Journal of Medical and Applied Sciences. 2025;8(3):1879-1889
https://doi.org/10.54361/ajmas.258387

Original article

Predictors of Uncontrolled Hypertension Among Libyan Patients: A Cross-Sectional Study at Tripoli University Hospital

Rida Ben Fadel[1,2], Sana Taher Ashur[3*]

[1]*Department of Medicine, Faculty of Medicine, University of Tripoli, Tripoli, Libya*
[2]*Department of Cardiology, Tripoli University Hospital, Tripoli, Libya*
[3]*Department of Family and Community Medicine, Faculty of Medicine, University of Tripoli, Tripoli, Libya*
***Correspondence email**: drsana04@yahoo.com*

Abstract
Poorly controlled blood pressure is associated with adverse health outcomes and increased mortality. This study aimed to describe the socio-demographic, clinical, and self-care profiles of hypertensive patients attending Tripoli University Hospital, with a focus on their blood pressure control status. It also examined the contribution of selected patient characteristics and self-care factors to uncontrolled blood pressure. A cross-sectional study was conducted among 335 patients, using an interviewer-based questionnaire, review of medical records, anthropometric measurement, and blood pressure measurement. Data were analyzed using SPSS software. A high prevalence of uncontrolled blood pressure was observed (64.5%). Non-adherence to antihypertensive medications (p<0.001, OR=6.201, 95% CI: 2.680-14.348), following a traditional diet (p=0.027, OR=2.205, 95% CI: 1.093-4.447), and not receiving lipid-lowering therapy (P=0.009, OR=2.530, 95% CI: 1.266-5.056) were significant predictors of uncontrolled blood pressure. Uncontrolled hypertension remains prevalent among patients in Tripoli. The findings support the role of medication adherence and dietary modification in blood pressure control. Interventions that enhance patients' adherence to their prescribed treatment and adoption of antihypertensive dietary recommendations may reduce the burden of uncontrolled hypertension in Libya.
Keywords. Hypertension Control, Blood Pressure, Medication Adherence, Compliance.

Introduction

Hypertension is one of the most prevalent chronic diseases. The estimated overall prevalence of hypertension in the Middle East region and in the Arab countries is 24.63 % and 29.5% respectively [1,2]. In Libya, the most recent data from the May Measurement Month 2018 Campaign showed a hypertension prevalence of 35.3% [3]. A more representative nationwide survey conducted earlier reported a slightly higher prevalence of 40.6% [4]. These findings reflect the persistently high burden of hypertension in Libya.

Uncontrolled hypertension is a leading cause of death, contributing to both all-cause mortality and cardiovascular disease mortality [5]. The consequences of uncontrolled hypertension are both broad and severe. Persistently elevated blood pressure contributes to cardiovascular diseases like coronary heart disease [6] and heart failure [7,8]. It is also a major risk factor for other major health conditions like chronic kidney disease [9,10] and stroke [11]. Uncontrolled hypertension negatively impacts the quality of life of patients [12], and increases health-related costs [13].

Building on all of this, it is crucial to understand the factors that contribute to blood pressure control among hypertensive patients. Several studies have related specific characteristics and practices to blood pressure control, but the evidence is mixed. For instance, some studies reported an association between age and blood pressure control [14-16], whereas others found no association [17]. Inconsistent findings were also observed for clinical characteristics. For example, the number of medications has been reported to influence blood pressure control [18], although other studies did not find such an association [19]. Similarly, self-care practices, such as home blood pressure monitoring, are generally advisable, although some studies reported no significant contribution to blood pressure control [20].

Despite the high prevalence of hypertension in Libya, a recent systematic review of hypertension care in the Arab countries found no studies addressing the burden of uncontrolled hypertension in Libyan clinical settings [21]. Since then, a few studies have emerged and examined the rate of uncontrolled hypertension in Libya [3,22]. However, evidence remains limited, particularly regarding behavioral and lifestyle-related predictors. In addition, given the mixed findings about the predictors of uncontrolled blood pressure in other populations, it is important to examine whether similar patterns exist in Libya. The findings can inform health authorities, particularly in the Medical Centre where this study was conducted, to design targeted interventions, optimize healthcare services, and ultimately reduce the prevalence of uncontrolled blood pressure. Therefore, this study aimed to describe the socio-demographic, clinical, and self-care profiles of hypertensive patients attending Tripoli University Hospital, with emphasis on their blood pressure control status. It also examined the contribution of selected socio-demographic, clinical, and self-care factors to uncontrolled blood pressure.

***Received**: 29-06-2025 - **Accepted**: 25-08-2025 - **Published**: 02-09-2025*

Methodology

A cross-sectional study was conducted between June 2023 and December 2023 among hypertensive patients in the Cardiology Outpatient Department clinic in Tripoli University Hospital (TUH), one of the largest Tertiary hospitals in Libya. The study was conducted after obtaining the permission of the relevant authority in the TUH.

Sample size was computed using the Cochrane formula to estimate the proportion of uncontrolled blood pressure control, using a previously reported prevalence of 34.4% in Libyan settings [22]. The required sample was 347, which was increased to 409 to account for a 15% non-response rate. Hypertensive patients attending the Cardiology OPD were consecutively recruited. Participation was voluntary, and unwell patients, those with secondary hypertension, or pregnant women were excluded. Newly diagnosed hypertensive patients were also included to describe the overall socio-demographic, clinical, and blood pressure control profile of hypertensive patients in this setting. While some of these patients may not yet be on medication or routine follow-up, their inclusion reflects the real-world spectrum of patients encountered. However, for analyses focusing on medication and follow-up adherence, newly diagnosed individuals were excluded.

Data was collected by a research team of intern doctors using an interviewer-administered questionnaire and review of respondents' medical records. The questionnaire captured socio-demographic characteristics, respondents' perceptions, clinical characteristics, self-care practices, and healthcare follow-up data. Medication adherence was assessed by self-report using a single item in which respondents were asked about whether they regularly took their prescribed antihypertensive medications. Medical records were reviewed to verify some selected clinical data and to extract patients' most recent lipid profile results. Anthropometric measurements (weight, height, and waist circumference) were taken using standardized equipment and procedures, while blood pressure was measured with a standardized manual sphygmomanometer following the WHO recommendations.

The outcome variable was blood pressure control status, defined as a binary variable (controlled versus uncontrolled). Respondents with systolic blood pressure (SBP) ≥ 140 mmHg, and/ or diastolic blood pressure (DBP) ≥ 90 mmHg were classified as having uncontrolled blood pressure. This definition aligns with the World Health Organization (WHO) treatment goal for hypertension control [23].

Independent variables included socio-demographic (such as age, sex, and educational level), clinical factors (such as comorbidity, lipid profile, and anthropometric measurements), and behavioral factors reflecting hypertension self-care practices (medication adherence, dietary practice, physical activity, Home Blood Pressure Monitoring [HBPM], follow-up adequacy, and smoking status). Age was categorized using NCEP ATP III cardiovascular risk thresholds: ≥45 years for males and≥55 years for females [24]. Education was classified as low (no formal, primary, and preparatory), medium (secondary and high diploma), and high (university and higher). Occupation was grouped as professional workers (Teachers, doctors, nurses, engineers); manual or service workers (employees, farmers, laborers); and non-employed (unemployed, housewives, students). BMI was calculated as weight (kg)/ height (m^2) and categorized as non-obese (<30 kg/m2) and obese (≥30 kg/m2) [25]. Waist circumference (WC) indicates central obesity and no central obesity (≥ 94 cm in males or ≥ 80 cm in females) per WHO thresholds [25]. Follow-up frequency was initially recorded as: monthly, every 3-4 months; every 6 months; annually; newly diagnosed. For analysis, an adequate follow-up variable was defined as monthly or every 3-4 months; not adequate as ≥ 6 months, consistent with WHO guidance, which suggests monthly reviews during titration and 3–6-month intervals for stable patients [26]. Exploratory variables included in this study: follow-up healthcare settings, follow-up healthcare provider, perceived impact of hypertension on daily functioning, and perceived symptoms attributed to hypertension.

Data analysis was performed using SPSS version 26. Continuous variables with missing values less than 8% were managed using mean imputation; however, for serum lipids, where the percentage of missing values ranged from 11.9 to 27.2%, analyses were performed on valid cases. Descriptive statistics were used to summarize study variables according to their type and distribution. Chi-square test, independent t-test, and Mann-Whitney U test were used to examine the bivariate association between blood pressure control status and the study variables. Variables that showed a significant (≤0.05) association with poor blood pressure control were considered in the multivariate analysis. Binary logistic regression was used to identify the independent predictors of poor blood pressure control.

Results

Of the 409 recruited patients, only 335 were eligible and participated in the study, which gives a response rate of 81.90%. Both sexes were represented, and 60.0% of the respondents were in the age of cardiovascular risk (males≥ 45 years, females ≥ 55 years). Many patients had either medium (42.0%) or low education, and 52.7% were not employed. Only 323 patients reported their average monthly income, with 82.4% of them having low income (<2000 LD). Out of 326 respondents, 66.9% had a positive family history of hypertension. Most patients perceive no impact of hypertension on their life (91.9%), and a few of them perceived specific symptoms as being related to their hypertension (8.1%) (Table 1). Headache

Received: 29-06-2025 - **Accepted**: 25-08-2025 - **Published**: 02-09-2025

(66.67%) and fatigue (22.22%) were the most frequently reported symptoms, followed by epistaxis (7.41%) and tinnitus (7.41%).

Table 1: Socio-demographic characteristics and hypertension-related perceptions (n=335)

Variable	f	(%)	Range
Sex			
Males	137	(40.9)	
Females	198	(59.1)	
Age (years)*	54.28	± 10.43	19-85
Age risk groups			
No age risk (M<45yrs, F< 55)	134	(40.0)	
At risk age (M≥45yrs, F ≥55yrs)	201	(60.0)	
Educational levels (n=331) [a]			
Low education (No formal or basic education)	128	(38.7)	
Medium education (Secondary and high diploma)	139	(42.0)	
Higher education (University and higher)	64	(19.3)	
Employment status (n=330) [a]			
Professional and skilled workers	67	(20.3)	
Manual or service workers	89	(27.0)	
Non-Employed	174	(52.7)	
Income**	900	(600-1500)	130-5000
Low (<2000 LD)	276	(82.4)	
Middle (2000- 4000 LD)	55	(16.4)	
High (>4000 LD)	4	(1.2)	
Perceived impact on daily functioning (n=333) [a]			
No	306	(91.9)	
Yes	27	(8.1)	
Perceived symptoms attributed to hypertension (n=333)[a]			
No	306	(91.9)	
Yes	27	(8.1)	
Family history of hypertension (n=329) [a]			
Yes	220	(66.9)	
No	109	(33.1)	

** Continuous variables presented as mean±SD ($\bar{x}$ ±SD); ** Continuous variables presented as median (Interquartile Range) Mdn [IQR]); [a] Valid percentage presented*

The clinical profile of the respondents is shown in (Table 2). The median duration of hypertension is 6 years (IQR:2-20), and more than half of the patients have uncontrolled blood pressure (64.5%). Most of the respondents were taking at least one antihypertensive agent (97.3%). Of these, 42.7% were on monotherapy, 35.5% on two agents, and 20.9 % were on three or four agents. Lipid-lowering agents were taken by 38.8% of patients. Although 58.1 % of the respondents had at least another one comorbidity besides hypertension, polypharmacy (≥ 5 Medications) was observed in 7.5% of the sample.

Of the 198 (58.1%) respondents who have comorbidity, 64.6% have single morbidity, 27.3% have two morbidities, 7.6% have three morbidities, and one respondent (0.5%) had four morbidities. Regarding the types of comorbidities, the most common conditions were diabetes mellitus (28.7%), dyslipidemia (25.7%), and cerebrovascular accidents (CVA) (6.6%). Less frequent diseases included bronchial asthma (4.2%), hypothyroidism (3.0%), cardiovascular disease (CVD) (2.7%), and chronic kidney disease (CKD) (1.5%). Other conditions like ischemic heart disease, hyperuricemia, and rheumatic arthritis were found in 0.9% of respondents, while various other conditions were documented in 0.3% of them. Only 24 (7.2%) of respondents had a history of previous hospital admission, with 82.6% of them having been admitted once, 13.0% admitted twice, and 4.3% admitted three times. Of the 14 respondents who reported the cause of their admission, the most common reported causes were high blood pressure (28.6%), CVA (28.6%), or both (28.6%).

BMI ranged from 18.01 to 58.43 kg/m^2, with 59.7% of the patients being obese (BMI ≥30 kg/m^2). Based on sex-specific cut-offs, 83.8% of patients had central obesity, with increased (14.3%) and substantial (69.1%) cardiovascular risk. The median time since the last lipid profile test was 3 months (IQR: 1-7.75). The mean LDL, total cholesterol, and HDL levels among respondents were 96.69 mg/dl (SD=32.18), 161.22 mg/dl) (SD=38.33), and 45.70 mg/dl (SD=12.08) respectively. Triglycerides showed a positively skewed distribution with a median of 124.50 mg/dl (IQR: 86.75-158.25).

Received*: 29-06-2025 -* ***Accepted****: 25-08-2025 -* ***Published****: 02-09-2025*

https://doi.org/10.54361/ajmas.258387

Table 2. Clinical characteristics of respondents (n=335)

Variable	f	(%)	Range
Hypertension characteristics			
Hypertension Duration (Years) *	6	(2-20)	0.25-30
>5 Yrs	143	(42.7)	
5-10 Yrs	131	(39.1)	
>10 Yrs	61	(18.2)	
Systolic Blood Pressure (mmHg)**	141.46	±17.11	100-200
Diastolic Blood Pressure (mmHg)**	85.11	±8.84	60-110
Blood pressure control			
Controlled (SBP <140mmHg and DPB <90mmHg)	119	(35.5)	
Uncontrolled (SBP ≥140mmHg and/ or DPB ≥90mmHg)	216	(64.5)	
Medication Profile			
Number of antihypertensive drugs**	1.73	±0.85	0-4
No medications	9	(2.7)	
On one or more antihypertensive medications	326	(97.3)	
Lipid-lowering agents			
Yes	130	(38.8)	
No	205	(61.2)	
Total number of all medications**	2.50	±1.25	0-6
Polypharmacy			
≥ 5 Medications	25	(7.5)	
< 5 Medications	310	(92.5)	
Presence of comorbidities			
Yes	198	(58.1)	
No	137	(40.9)	
History of previous admission			
No	311	(92.8)	
Yes	24	(7.2)	
Weight (Kg)**	85.50	±15.82	48-156
Height (cm)**	163.76	±9.77	138-190
BMI (Kg/m^2)**	32.08	±6.48	18.01-58.43
Obese (BMI ≥30 Kg/m^2)	200	(59.7)	
Non obese (BMI<30 Kg/m^2)	135	(40.3)	
Waist Circumference (cm)**	101.09	±13.28	70-154
Waist circumference CVD risk categories (Sex specific cut-offs)			
No Risk: (Males <94cm or females <80 cm)	56	(16.7)	
Increased Risk (Males: 94-101.99 cm or female:80-87.99 cm)	48	(14.3)	
Substantial risk (Males ≥102cm or female ≥88 cm)	231	(69.0)	
Lipid profile			
Time since last lipid profile test (months)*	3.00	(1.00-7.75)	0-36
LDL (mg/dl)**	96.69	±32.18	38-219
Cholesterol (mg/dl)**	161.22	±38.33	87-299
TGD (mg/dl)*	124.50	(86.75-158.25)	45-404
HDL (mg/dl)**	45.70	±12.08	10-97

** Mdn (IQR), ** $\bar{x}$ ±SD*

Table 3 describes self-care practices for hypertension among respondents. Among the 326 respondents who were on antihypertensive medications, 324 reported their medication adhe status, with 34.3% being non-adherent. Of 334 respondents, almost half (48.5%) reported following the usual Libyan diet, reflecting

Received*: 29-06-2025 -* ***Accepted****: 25-08-2025 -* ***Published****: 02-09-2025*

poor adherence to hypertension dietary recommendations, while 51.5% reported following a modified low salt or low salt and fat diet. Among 330 patients with available data, 80.0% reported no engagement in physical activity. Likewise, among 316 respondents, more than half (51.9%) did not practice home blood pressure monitoring. Of 324 respondents who reported their follow-up frequency, 38.3% had non-adequate follow-up (six months and yearly). The healthcare provider most frequently seen was the cardiologist (48.1%). Only 326 respondents reported their follow-up healthcare settings, with 47.2% attending hospitals, and as few as 27.9 % attending primary health care units. Of 331, active smoking was disclosed only by 14.2 % respondents, and 70.2% of them were males.

Table 3: Self-care practices for hypertension among respondents(n=33)

Variable	f	(%)
Medication adherence (n= 324)[a]		
Yes	213	(65.7)
No	111	(34.3)
Dietary care practice (n=334) [c]		
The usual Libyan diet	162	(48.5)
Low salt diet	144	(43.1)
Low salt and fat diet	28	(8.4)
Physical activity engagement (n=330) [c]		
Yes	66	(20.0)
No	264	(80.0)
Home Blood Pressure Monitoring (HBPM) (n=316) [c]		
Yes	152	(48.1)
No	164	(51.9)
Adherence to follow-up (n=324) [b]		
Adherent (Monthly & 3-4 months)	200	(61.73)
Non-adherent (6 months & yearly)	124	(38.27)
Follow-up frequency (n=324) [c]		
Monthly	23	(7.10)
Every 3-4 months	177	(54.63)
Every 6 months	94	(29.01)
Once a year	30	(9.26)
Type of healthcare provider for follow-up (n=324) [c]		
Internal medicine specialist	76	(23.5)
Cardiologist	156	(48.1)
General practitioner	92	(28.4)
Follow-up healthcare settings (n=326) [c]		
Hospital	154	(47.2)
Private clinic	81	(24.8)
PHC	91	(27.9)
Smoking status (n=331) [c]		
Non smokers	284	(85.8)
Smoker	47	(14.2)
Sex distribution of smokers (n=47)		
Males	33	(70.2)
Females	14	(29.8)
Smoking duration (Years)*	23.00	±10.33
Number of cigarettes per day*	18.06	±6.94
Smoking cessation attempt among smokers (n=30)		
No	7	(23.3)
Yes	23	(76.7)

** $\bar{x}$ ±SD; [a] Valid %: Patients not yet on antihypertensive medications (n=9) and those with missing adherence data (n=2) were excluded from the denominator for medication adherence adequacy. [b] Valid %: newly diagnosed patients (n=3) and those who did not specify follow-up frequency (n=8) were excluded from the denominator for follow-up adequacy. [c] Valid %: other variables with missing responses were calculated after excluding those missing values from the denominator*

Received: 29-06-2025 - **Accepted**: 25-08-2025 - **Published**: 02-09-2025

https://doi.org/10.54361/ajmas.258387

Table 4 shows the bivariate association between the socio-demographic and clinical characteristics of patients with blood pressure control status. Income displayed a statistically significant association with blood pressure control status. Respondents with uncontrolled blood pressure have a lower median monthly income (Mdn=800 LD, IQR: 600-1200) than those with controlled blood pressure (Mdn=1000 LD, IQR:700-1700), and the difference was statistically significant (p=0.005). A lower proportion of uncontrolled blood pressure was observed among patients on lipid-lowering agents (55.4%) compared to those not receiving such agents (70.2%), with a statistically significant association (P=0.002). A higher proportion of uncontrolled blood pressure was observed among obese patients (71.0%) compared to non-obese patients (54.8%), with a statistically significant association (p=0.002) and correspondingly the mean waist circumference was higher among uncontrolled blood pressure group ($\bar{x}$=102.81, SD=12.75) compared to controlled group ($\bar{x}$=97.96, SD=13.72), and the mean difference was statistically significant (p=0.0010). The mean LDL level was higher among uncontrolled blood pressure group ($\bar{x}$=100.55 mg/dl, SD=33.9) compared to controlled group ($\bar{x}$=90.51 mg/dl, SD=29.81), and the mean difference was statistically significant (p=0.015), and the mean Cholesterol level was higher among uncontrolled blood pressure group ($\bar{x}$=164.83 mg/dl, SD=39.74) compared to controlled group ($\bar{x}$=155.07 mg/dl, SD=35.12), and the mean difference was statistically significant (p=0.035).

Table 4. Bivariate association between patients' socio-demographic and clinical characteristics with blood pressure control status

Independent Variable	Blood Pressure Control				P value
	Uncontrolled (SBP≥140 and/ or DBP≥90)		Controlled (SBP<140 and DBP<90)		
	F	(%)	F	(%)	
Sex					
Females	131	(66.2)	67	(33.8)	0.439
Males	85	(62.0)	52	(38.0)	
Age (mean ±SD)	54.15	±9.75	54.50	±11.60	0.780[a]
Educational levels (n=331)					
Low (No formal and basic)	88	(68.8)	40	(31.3)	0.376
Medium (Secondary or high diploma)	87	(62.6)	52	(37.4)	
University and higher	38	(59.4)	26	(40.6)	
Employment status (n=330)					
Professional and skilled workers	45	(67.2)	22	(32.8)	0.786
Manual or service workers	55	(61.8)	34	(38.2)	
Non-Employed	111	(63.8)	63	(36.2)	
Income (LD) median (IQR)	800	(600-1200)	1000	(700-1700)	0.005*[b]
Perceived impact on daily functioning					
Yes	19	(70.4)	8	(29.6)	0.511
No	196	(64.1)	110	(35.9)	
Family history of hypertension					
Yes	136	(61.8)	84	(38.2)	0.159
No	76	(69.7)	33	(30.3)	
Hypertension Duration (Years, median (IQR)	5	(2-9)	6	(3-10)	0.070 [b]
Treatment intensity [c]					
Mono therapy	91	(63.6)	52	(36.4)	0.989
Dual therapy	75	(63.0)	44	(37.0)	
Poly therapy	41	(64.1)	23	(35.9	
Lipid-lowering agents					
Yes	72	(55.4)	58	(44.6)	0.006*
No	144	(70.2)	61	(29.8)	
Polypharmacy					
≥ 5 Medications	14	(56.0)	11	(44.0)	0.357
< 5 Medications	202	(65.2)	108	(34.8)	
Presence of comorbidities					
Yes	120	(60.6)	78	(39.4)	0.075
No	96	(70.1)	41	(29.9)	
History of previous admission					
Yes	16	(66.7)	8	(33.3)	0.816
No	200	(64.3)	111	(35.7)	
BMI					

Received*: 29-06-2025 -* ***Accepted****: 25-08-2025 -* ***Published****: 02-09-2025*

Obese (BMI ≥30 Kg/m²)	142	(71.0)	58	(29.0)	0.002*
Non obese (BMI<30 Kg/m²)	74	(54.8)	61	(45.2)	
WC (mean ±SD)	102.81	±12.75	97.96	±13.72	0.001* [a]
LDL (mg/dl) (mean ±SD)	100.55	±33.09	90.51	±29.81	0.015* [a]
Cholesterol (mg/dl) (mean ±SD)	164.83	±39.74	155.07	±35.12	0.035* [a]
TGD (mg/dl) (median±(IQR)	130.00	(90.00-160.00)	121.00	(78.00-150.00)	0.279 [b]
HDL (mg/dl) (mean ±SD)	45.22	±11.32	46.40	±13.14	0.455 [a]

** p<0.05, [a] Based on an Independent t-test, [b] Based on a Mann-Whitney test, [c] Treatment intensity was defined as the number of antihypertensive agents prescribed. Only respondents on one or more agents were included (n=226), and respondents not on medications (n=9) were excluded*

Most self-care practices showed a significant association with blood pressure control status (Table 5). A much higher proportion of uncontrolled blood pressure was observed among patients who reported no adherence to their antihypertensive medications (85.6%) compared to adherent patients (52.1%), with a statistically significant association (p>0.001). Similarly, the prevalence of uncontrolled blood pressure was significantly higher in patients who reported no adherence to dietary recommendations (77.8%) than in those with adherence to a low salt or low salt and fat diet (52.3%), and the association between dietary adherence and blood control status was statistically significant (p< 0.001). A statistically significant association (p= 0.001) was observed between physical activity engagement and blood control status, with a higher prevalence of uncontrolled blood pressure found among patients who reported inadequate physical activity (68.2%) compared with those who reported being engaged in regular activity (47.0%). The prevalence of uncontrolled blood pressure was greater among patients who reported no home monitoring of their blood pressure (72.6%), compared to those who monitored their blood pressure at home (51.3%), and HBPM showed a statistically significant association with blood pressure status (p< 0.001). Furthermore, Adherence to follow-up was significantly associated with blood pressure control status (p< 0.001), with a greater proportion of uncontrolled blood pressure observed among patients who reported non-adherence to follow-up visits (81.5%) compared to those who were on follow-up monthly or every 3 to 4 months (52.0%). In addition, the follow-up healthcare setting displayed a statistically significant association with blood pressure control status (p= 0.001), with a least prevalence of uncontrolled blood pressure found in patients who reported private clinics as their usual place of follow-up (55.6%) compared to that in patients who reported follow up in hospitals (58.4%) or primary healthcare clinics (80.2%). Moreover, the type of healthcare provider was also significantly associated with blood pressure status (p< 0.001), with the least proportion of poor blood pressure control observed among patients on follow-up with a cardiologist (46.2%)

Table 5: Bivariate association between patients' self-care practices with blood pressure control status

Independent Variable	Blood Pressure Control				P value
	Uncontrolled (SBP≥140 and/ or DBP≥90)		Controlled (SBP<140 and DBP<90)		
	F	(%)	F	(%)	
Medication adherence (n=324)[a]					
Adherent	111	(52.1)	102	(47.9)	0.000**
Non-adherent	95	(85.;6)	16	(14.4)	
Dietary care practice (n=334)					
Adherent to dietary recommendations	90	(52.3)	82	(47.7)	0.000**
Not adherent to dietary recommendations	126	(77.8)	36	(22.2)	
Physical activity engagement (n=330)					
Yes	31	(47.0)	35	(53.0)	0.001*
No	180	(68.2)	84	(31.8)	
HBPM (n=316)					
Yes	78	(51.3)	74	(48.7)	0.000**
No	119	(72.6)	45	(27.4)	
Adherence to follow-up (n=324) [b]					
Adherent (Monthly & 3-4 months)	104	(52.0)	96	(48.0)	0.000*
Non-adherent (6 months & yearly)	101	(81.5)	23	(18.5)	
Type of healthcare provider (n=324)					
Internal medicine specialist	61	(80.3)	15	(19.7)	0.000**
Cardiologist	72	(46.2)	84	(53.8)	
General practitioner	73	(79.3)	19	(20.7)	

***Received**: 29-06-2025 - **Accepted**: 25-08-2025 - **Published**: 02-09-2025*

Follow-up healthcare settings (n=238)					
Hospital	90	(58.4)	64	(41.6)	0.001*
Private clinic	45	(55.6)	36	(44.4)	
PHC	73	(80.2)	18	(19.8)	
Smoking status (n=331)					
Non smokers	180	(63.4)	104	(36.6)	0.670
Smoker	30	(66.7)	15	(33.3)	

** p<0.05, ** p<0.001*

A binary logistic regression model for uncontrolled blood pressure predictors was built with the variables that showed significant associations with control status in the bivariate analysis. However, two variables, " type of healthcare provider" and "place of follow-up," showed strong collinearity, reflected by the extremely inflated standard errors (SE). This is expected, as in practice the type of healthcare provider is strongly determined by the healthcare setting (e.g. cardiologists and internal medicine specialists in private clinics and hospitals, while general practitioners usually work in PHC facilities). To manage this issue, the type of healthcare provider was omitted, and the regression was repeated (Chan 2004). The resulting model was statistically stable, as all SEs were in the acceptable range. The model correctly classified 77.9 % of cases, and explained 4.8% of the variance in blood pressure control. Three statistically significant predictors of uncontrolled blood pressure persisted in the adjusted analysis. Patients who reported non-adherence to their antihypertensive medications were six times more likely to have uncontrolled blood pressure compared with adherent patients (p<0.001, OR=6.201, 95% CI: 2.680-14.348). Those following an ordinary Libyan diet were twice as likely to have uncontrolled blood pressure compared with patients adhering to a low-salt and low-fat and fat diet (p=0.027, OR=2.205, 95% CI: 1.093-4.447). Finally, Patients who were not receiving lipid-lowering therapy were two and a half times more likely to have poor blood pressure control than those receiving these agents (P=0.009, OR=2.530, 95%CI: 1.266-5.056) (Table 6).

Table 6: Multiple regression model of uncontrolled blood pressure predictors

Variable	B	P	Adj. OR	(95% CI)
Income	0.000	0.882	1.000	(1.000-1.000)
Lipid Lowering therapy (No vs Yes)	0.928	0.009*	2.530	(1.266-5.056)
BMI (Obese vs Non obese)	0.554	0.219	1.741	(0.719-4.216)
WC	-0.004	0.794	0.996	(0.964-1,028)
LDL	0.010	0.262	1.010	(0.993-1.027)
Cholesterol	0.003	0.663	1.003	(0.989-1.017)
Medications adherence (Non- adherent vs Adherent)	1.825	0.000**	6.201	(2.680-14.348)
Dietary care practice (Non-adherent vs Adherent)	0.791	0.027*	2.205	(1.093-4.447)
Physical activity engagement (No vs Yes)	0.480	0.284	1.616	(0.671-3.888)
HBPM (No vs Yes)	0.420	0.254	1.522	(0.739-3.136)
Adherence to follow-up (Non-adherent vs Adherent)	0.418	0.291	1.519	(0.699-3.299)
Follow-up healthcare settings		0.432		
Private vs Hospital	-0.263	0.533	0.769	(0.336-1.758)
PHC vs Hospital	0.440	0.350	1.553	(0.617-3.910)
Constant	-3.152	0.052	0.043	

**p<0.05, **p<0.001*

Discussion

This study provides a comprehensive profile of hypertensive patients sampled at the cardiology OPD of a tertiary hospital in Tripoli, noting that many respondents usually follow up at other healthcare settings. Both sexes were represented, and over half of the respondents were in the age range associated with increased cardiovascular risk. A substantial proportion were unemployed, and the vast majority had low income. Clinically, the majority had hypertension for six years, most were receiving at least one antihypertensive medication, and about one-fifth were on intensive therapy with three or four agents. Over half had at least one chronic disease, most commonly diabetes and dyslipidemia, and around two-fifths were on lipid-lowering therapy. Over half of the patients were obese, and the majority had central obesity, reflecting increased or substantial CVD risk. Available lipid data suggest generally favorable levels in this cohort, although triglyceride values were positively skewed, indicating that a subgroup of patients has elevated levels.

About one-third of respondents reported non-adherence to antihypertensive therapy, almost half followed the usual Libyan diet, reflecting poor adherence to dietary recommendations, and the majority were not physically active. In addition, more than half did not practice home blood pressure monitoring, and about

Received*: 29-06-2025 -* ***Accepted****: 25-08-2025 -* ***Published****: 02-09-2025*

two-fifths did not adhere to adequate follow-up. These findings indicate generally low adherence to recommended self-care practices. This aligns with regional studies reporting similar suboptimal self-care practices in hypertensive patients [27-29].

Hospitals were the most frequent setting for follow-up, and cardiologists were the most consulted providers, while primary health and general practitioners played a relatively limited role. This pattern reflects the underutilization of primary care services in hypertension management. Only 30 patients reported their smoking status, with three-quarters of them disclosing being active smokers, the majority of whom were male. The limited responses point to likely underreporting.

Over half of the patients had uncontrolled blood pressure. Together with the high prevalence of central obesity and age above ATP III risk thresholds [24], this indicates that a considerable proportion of this cohort remains at increased cardiovascular risk. The prevalence of uncontrolled blood pressure in this study is like findings reported in Palestine [30] and Iran [31], but higher than that reported in Lebanon [32]. The observed difference may reflect variation in healthcare access, adherence to self-care practices, and population characteristics. A review by Tailakh et al. [2] reported uncontrolled hypertension rates in Arab countries ranging from 56% to 92%, highlighting the ongoing challenges in blood pressure management. Our findings, which fall in the lower half of this range, indicate the need for improved hypertension management strategies in this population.

This study identified three predictors of uncontrolled blood pressure. Patients not receiving lipid-lowering therapy were 2.5 times more likely to have poor blood pressure control than those receiving these agents. Similarly, an Ethiopian study reported better blood pressure control among statin users [33]. This association may partly reflect closer clinical monitoring of patients prescribed lipid-lowering therapy and their greater perception of cardiovascular risk, which could motivate stronger self-care practices, in line with the Health Belief Model

In line with theoretical expectation, patients who reported non-adherence to their antihypertensive medications were sixfold more likely to have uncontrolled blood pressure compared with adherent patients. This finding aligns with previous evidence [34]. Patients following a traditional Libyan diet were twice as likely to have uncontrolled blood pressure compared with patients adhering to a low-salt and low-fat and fat diet. This finding is consistent with recent evidence showing that salt intake among the Libyan population exceeds recommended health guidelines [35], suggesting that the high salt content of the Libyan diet may drive poor blood pressure control.

Conclusion and limitations

It was conducted at a major medical center in Tripoli, which enhances the clinical relevance of the findings. However, the study has some limitations. The sample was not randomly selected, which limits the generalizability of the findings. Self-care practices, including medication adherence, were self-reported, and no validated adherence scale was used. While this provides a direct measure of perceived adherence, this method is subject to social desirability bias, and adherence may therefore be over-reported. Additionally, although patients were recruited at this center's OPD, a considerable proportion of them reported receiving their routine follow-up at other healthcare facilities, including primary healthcare centers and private clinics. This heterogeneity may partly enhance the representativeness of the findings across different healthcare settings, although the non-random sampling still limits full generalizability. While the sample size was adequate for estimating the proportion of uncontrolled hypertension, it may not have been large enough to detect all associations with potential predictors. Further research should explore additional variables through a larger multicenter study to better understand the determinants of blood pressure control.

Conflict of interest. Nil

References

1. Okati-Aliabad H, Ansari-Moghaddam A, Kargar S, Mohammadi M. Prevalence of hypertension and pre-hypertension in the Middle East region: a systematic review & meta-analysis. J Hum Hypertens. 2022 Sep;36(9):794-804. doi: 10.1038/s41371-021-00590-9.
2. Tailakh A, Evangelista LS, Mentes JC, Pike NA, Phillips LR, Morisky DE. Hypertension prevalence, awareness, and control in Arab countries: a systematic review. Nurs Health Sci. 2014 Mar;16(1):126-30. doi: 10.1111/nhs.12060. PMID: 24118852; PMCID: PMC4445843.
3. Beaney T, Ster AC, Poulter NR, Xia X, Fageh H, Msalam O, et al. May Measurement Month 2018: an analysis of blood pressure screening in Libya. Eur Heart J Suppl. 2020 Aug;22(Suppl H):H77-H79. doi: 10.1093/eurheartj/suaa028.
4. World Health Organization. Libya STEPS Survey 2009: Fact Sheet [Internet]. Geneva: World Health Organization; 2009 [cited 2025 Aug 28]. Available from: https://cdn.who.int/media/docs/default-source/ncds/ncd-surveillance/data-reporting/libya/steps/libya-2009-steps-factsheet.pdf?sfvrsn=e8d78bfb_2
5. Zhou D, Xi B, Zhao M, Wang L, Veeranki SP. Uncontrolled hypertension increases risk of all-cause and cardiovascular disease mortality in US adults: the NHANES III Linked Mortality Study. Sci Rep. 2018;8(1):9418. doi: 10.1038/s41598-018-27377-2.

Received: *29-06-2025* - ***Accepted***: *25-08-2025* - ***Published***: *02-09-2025*

6. Egwumah O, Girgih A, Joshua V. Managing Hypertension: The Role of a Food Scientist and Nutritionist. AlQalam Journal of Medical and Applied Sciences. 2022 Jul 8:353-67.
7. Balha A, Fadhlullah A, Abdalgwad R. The Association Between Ischemic Heart Disease and Hypertension in Libyan Adults: A Cross-Sectional Study. AlQalam Journal of Medical and Applied Sciences. 2022 Apr 16:206-9.
8. Iyer AS, Ahmed MI, Filippatos GS, Ekundayo OJ, Aban IB, Love TE, et al. Uncontrolled hypertension and increased risk for incident heart failure in older adults with hypertension: findings from a propensity-matched prospective population study. J Am Soc Hypertens. 2010 Jan-Feb;4(1):22-31. doi: 10.1016/j.jash.2010.01.001.
9. Hanratty R, Chonchol M, Havranek EP, Powers JD, Dickinson LM, Ho PM, et al. Relationship between blood pressure and incident chronic kidney disease in hypertensive patients. Clin J Am Soc Nephrol. 2011 Nov;6(11):2605-11. doi: 10.2215/CJN.02240311.
10. Lee H, Kwon SH, Jeon JS, Noh H, Han DC, Kim H. Association between blood pressure and the risk of chronic kidney disease in treatment-naïve hypertensive patients. Kidney Res Clin Pract. 2022 Jan;41(1):31-42. doi: 10.23876/j.krcp.21.063.
11. Li C, Engström G, Hedblad B, Berglund G, Janzon L. Blood pressure control and risk of stroke: a population-based prospective cohort study. Stroke. 2005 Apr;36(4):725-30. doi: 10.1161/01.STR.0000158925.12740.87.
12. Pourmoghaddas A, Gharipour M, Garakyaraghi M, Yousefi A. Association between uncontrolled hypertension status and quality of life in hypertensive patients. Iran Heart J. 2014;15(2):6-11.
13. Wierzba W, Giernas B, Lipiak A, Karasiewicz M, Cofta M, Staszewski R. A global perspective on the costs of hypertension: a systematic review. Arch Med Sci. 2020 Aug 10;16(5):1078-1091. doi: 10.5114/aoms.2020.97689.
14. Gharipour M, Khosravi A, Sadeghi M, Roohafza H, Hashemi M, Sarrafzadegan N. Socioeconomic characteristics and controlled hypertension: evidence from Isfahan Healthy Heart Program. ARYA Atheroscler. 2013 Jan;9(1):77-81. PMID: 23696763; PMCID: PMC3653252.
15. Liew SJ, Lee JT, Tan CS, Koh CHG, Van Dam R, Müller-Riemenschneider F. Sociodemographic factors in relation to hypertension prevalence, awareness, treatment and control in a multi-ethnic Asian population: a cross-sectional study. BMJ Open. 2019 May 19;9(5):e025869. doi: 10.1136/bmjopen-2018-025869. PMID: 31110091; PMCID: PMC6530395.
16. Sivén SS, Niiranen TJ, Aromaa A, Koskinen S, Jula AM. Social, lifestyle and demographic inequalities in hypertension care. Scand J Public Health. 2015 May;43(3):246-53. doi: 10.1177/1403494815571031.
17. Dey S, Mukherjee A, Pati MK, Panda B, Sahoo KC, Pati S. Socio-demographic, behavioural and clinical factors influencing control of diabetes and hypertension in urban Mysore, South India: a mixed-method study conducted in 2018. Arch Public Health. 2022 Sep 2;80(1):234. doi: 10.1186/s13690-022-00996-y.
18. Bakris G, Sarafidis P, Agarwal R, Ruilope L. Review of blood pressure control rates and outcomes. J Am Soc Hypertens. 2014 Feb;8(2):127-41. doi: 10.1016/j.jash.2013.07.009.
19. Asgedom SW, Gudina EK, Desse TA. Assessment of Blood Pressure Control among Hypertensive Patients in Southwest Ethiopia. PLoS One. 2016 Nov 23;11(11):e0166432. doi: 10.1371/journal.pone.0166432.
20. Li J, Tian A, Liu J, Ge J, Peng Y, Su X, et al. Home Blood Pressure Monitoring and Its Association With Blood Pressure Control Among Hypertensive Patients With High Cardiovascular Risk in China. Cardiol Discov. 2024 Mar;4(1):15-22. doi: 10.1097/CD9.0000000000000118.
21. Akl C, Akik C, Ghattas H, Obermeyer CM. The cascade of care in managing hypertension in the Arab world: a systematic assessment of the evidence on awareness, treatment and control. BMC Public Health. 2020 Jun 3;20(1):835. doi: 10.1186/s12889-020-08678-6.
22. Elkheshebi A, Alakhder F, Zarti S. The effects of non-pharmacological intervention in the management of essential blood pressure. Alq J Med App Sci. 2021 Jul 6;4(2):143-51.
23. World Health Organization. Guideline for the pharmacological treatment of hypertension in adults. Geneva: World Health Organization; 2021.
24. National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report. Circulation. 2002 Dec 17;106(25):3143-421. doi: 10.1161/circ.106.25.3143.
25. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser. 2000;894:i-xii, 1-253.
26. World Health Organization. Guideline for the pharmacological treatment of hypertension in adults. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.
27. Alefan Q, Huwari D, Alshogran OY, Jarrah MI. Factors affecting hypertensive patients' compliance with healthy lifestyle. Patient Prefer Adherence. 2019 Apr 23;13:577-585. doi: 10.2147/PPA.S198446.
28. Zinat Motlagh SF, Chaman R, Sadeghi E, Eslami AA. Self-care behaviors and related factors in hypertensive patients. Iran Red Crescent Med J. 2016 May 10;18(6):e35805. doi: 10.5812/ircmj.35805.
29. Alhaddad IA, Hamoui O, Hammoudeh A, Mallat S. Treatment adherence and quality of life in patients on antihypertensive medications in a Middle Eastern population: adherence. Vasc Health Risk Manag. 2016 Oct 27;12:407-413. doi: 10.2147/VHRM.S105921.
30. Alawneh IS, Yasin A, Musmar S. The Prevalence of Uncontrolled Hypertension among Patients Taking Antihypertensive Medications and the Associated Risk Factors in North Palestine: A Cross-Sectional Study. Adv Med. 2022 Aug 25;2022:5319756. doi: 10.1155/2022/5319756.
31. Farhadi F, Aliyari R, Ebrahimi H, Pashaei A, Masoudi A, Asgari S, et al. Prevalence of uncontrolled hypertension and its associated factors in 50-74 years old Iranian adults: a population-based study. BMC Cardiovasc Disord. 2023 Jun 6;23(1):318. doi: 10.1186/s12872-023-03357-x.

Received*: 29-06-2025 -* ***Accepted****: 25-08-2025 -* ***Published****: 02-09-2025*

32. Najem RN, Halawi A, Tanios B, Ambriss R, Bikai RE, Partington G, et al. May Measurement Month 2019: an analysis of blood pressure screening results from Lebanon. Eur Heart J Suppl. 2021 May 20;23(Suppl B):B92-B94. doi: 10.1093/eurheartj/suab037.
33. Abebe RB, Kebede SA, Birarra MK. The association of lipid-lowering therapy and blood pressure control among outpatients with hypertension at the Felege Hiwot Comprehensive Specialized Hospital, Northwest Ethiopia. Front Cardiovasc Med. 2023 Mar 1;10:1071338. doi: 10.3389/fcvm.2023.1071338.
34. Abegaz TM, Shehab A, Gebreyohannes EA, Bhagavathula AS, Elnour AA. Nonadherence to antihypertensive drugs: A systematic review and meta-analysis. Medicine (Baltimore). 2017 Jan;96(4):e5641. doi: 10.1097/MD.0000000000005641.
35. Derbi H, Aghilla M, Algledy F, Elsaeh H, Abdelhamid MHM. Estimation of salt intake based on 24-hour urinary sodium excretion among a Libyan adult population: cross-sectional study. Sci Progr. 2025 Aug [cited 2025 Aug 28]; [Epub ahead of print]. Available from: https://www.researchgate.net/publication/394807996_Estimation_of_salt_intake_based_on_24-hour_urinary_sodium_excretion_among_a_Libyan_adult_population_cross-sectional_study

Received*: 29-06-2025 -* ***Accepted****: 25-08-2025 -* ***Published****: 02-09-2025*