Original Research Article

SAGE Open Medicine

SAGE Open Medicine
Volume 10: 1–12

DOI: 10.1177/20503121221104442
journals.sagepub.com/home/smo

Uncontrolled hypertension and associated factors among adult hypertensive patients on follow-up at public hospitals, Eastern Ethiopia: A multicenter study

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Abstract

Objective: The aim of this study was to assess the magnitude of uncontrolled hypertension and associated factors among adult hypertensive patients on follow-up at public hospitals in Eastern Ethiopia.

Methods: A hospital-based cross-sectional study was conducted among 415 hypertensive patients in Eastern Ethiopia from June 15 to July 15, 2021. A systematic random sampling technique was used to select the study participants. Data were collected through face-to-face interviews and reviewing patients' charts. Bivariable and multivariable logistic regression analyses were performed to identify factors associated with uncontrolled hypertension.

Results: This study revealed that magnitude of uncontrolled hypertension was 48% (95% confidence interval = 43.1%−52.8%). Being male (adjusted odds ratio = 2.05, 95% confidence interval = 1.29–3.26), age $\geqslant$55 years (adjusted odds ratio = 3.16, 95% confidence interval = 1.96–5.08), non-adherence to medication (adjusted odds ratio = 1.83, 95% confidence interval = 1.14–2.94), low diet quality (adjusted odds ratio = 4.04, 95% confidence interval = 2.44–8.44), physically inactive (adjusted odds ratio = 3.20, 95% confidence interval = 1.84–5.56), and having comorbidity (adjusted odds ratio = 3.04, 95% confidence interval = 1.90–4.85) were significantly associated with uncontrolled hypertension.

Conclusions: In our sample of hypertensive patients on follow-up at public hospitals in Eastern Ethiopia, half had uncontrolled hypertension. Older age, male sex, non-adherence to antihypertensive medication, low diet quality, physically inactive, and having comorbidity were found to be predictors of uncontrolled hypertension. Therefore, sustained health education on self-care practices with special emphasis on older, males, and patients with comorbid conditions.

Keywords

Uncontrolled hypertension, Blood pressure, Associated Factors, Eastern Ethiopia

Date received: 19 December 2021; accepted: 11 May 2022

Introduction

Despite the availability of therapeutic options, most of the hypertensive patients were living with uncontrolled hypertension.[1,2] More than 1 billion people live with hypertension. Out of these, 82% of them lived in low-income and middle-income countries.[3] Uncontrolled hypertension is higher in Sub-Saharan Africa (SSA) than in Western countries over the past few decades,[4] while more than three-fourths of hypertensive patients are living with uncontrolled hypertension.[5] According to the result of the meta-analysis report, the pooled prevalence of uncontrolled hypertension in Ethiopia was 48%.[6]

Despite the increasing availability of low-cost drugs and increasing treatment options,[7] hypertension is associated

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with high rates of morbidity, disability, and premature death.[8] The increase of systolic blood pressure (SBP) by 20 mm Hg and diastolic blood pressure (DBP) by 10 mm Hg above normal ranges could double the risk of cardiovascular diseases (CVDs), strokes, and kidney diseases.[9,10] In the Ethiopian context, the annual death-related non-communicable diseases (NCDs) including hypertension are still high despite all efforts.[11] To manage and control high blood pressure (BP), identifying factors that affect BP control status is important.[12]

There were several factors associated with uncontrolled hypertension in previous studies were being males, advanced age, rural residence, low educational level, family history of hypertension, smoking, khat chewing, alcohol consumption, excessive salt consumption, lack of physical activity, poor weight control, and diabetes.[13–15] Most of these studies were conducted in a single hospital. Multiple comorbid conditions such as anxiety, depression, and the role of social support in uncontrolled hypertension were not properly explored.[16–18] In addition, those identified factors were inconstantly reported across all studies. Therefore, this study aimed to determine uncontrolled hypertension and associated factors among adult hypertensive patients on follow-up at public hospitals, in Eastern Ethiopia.

Materials and methods

Study setting and design

A hospital-based cross-sectional study was conducted from 15 June to 15 July 2021, in four public hospitals: namely, Hiwot Fana Compressive Specialized University Hospital and Jugal Hospitals were found in Harar, whereas Dilchora Referral Hospital and Sabian General Hospital were selected from the Dire Dawa Administration. Harar is the capital city of the Harari region which is found at a 526 km distance to the southeast of Addis Ababa. Based on the 2007 Central Statistical Agency population census, the total population of the town was projected to be 259,260, of those 130,097 are females in 2021. Dire Dawa Administration is found in the Eastern part of Ethiopia at a distance of 515 km away from Addis Ababa. According to the 2007 Central Statistical Agency population census, the total population of Dire Dawa Administration was projected to be 599,651, of those 301,496 are females in 2021. Harar and Dire Dawa Administration are 48 km apart and share similar socio-demographic and cultural characteristics.

Population and sampling procedure

All adult hypertensive patients who had been taking anti-hypertensive medications ⩾6 months and were willing to participate in the study were included. Those patients who missed at least two previous visits' BP measurements and patients who had a cognitive impairment were excluded. A single population formula was used to calculate the sample size. The assumptions considered during the calculation of the sample size were 95% confidence level, 5% margin of error, and 52.5% of prevalence of uncontrolled hypertension from the study carried out in Mekelle, Ethiopia.[15]

$$n = \frac{\left(Z_{\alpha/2}\right)^2 P\left(1-P\right)}{d^2}$$

$$\mathbf{n} = \frac{(1.96)^2\, 0.525\left(1-0.475\right)}{0.05^2} = 383$$

By adding a 10% non-response rate, the final sample size became 421. There were a total of 2934 hypertensive patients on follow-up in all hospitals: Dilchora hospital (353), Hiwot Fana Compressive Specialized University Hospital (672), Sabian General Hospital (618), and Jugal hospital (585). After reviewing the monthly patient flow of each hospital from the registration books, the average number of patients who came for follow-up per month was calculated, and then 421 were allocated to each respective hospital. Finally, 152, 96, 89, and 84 hypertensive patients were selected from Dilchora Referral Hospital, Hiwot Fana Compressive Specialized University Hospital, Sabian General Hospital, and Jugal Hospitals, respectively. A systematic random sampling technique was used to select the study participants and the first cases were selected by lottery method, and the rest were enrolled every two patients.

Data collection and measurements

A pretested questionnaire was used for data collection. The questionnaire contains socio-demographic information (age, sex, educational level, residence, occupation, monthly income, and family history of hypertension). The level of self-care activity was assessed using Hypertension Self-Care Activity Level Effects (H-SCALE).[19] The Cronbach's alpha of medication adherence, low salt, physical activity adherence, weight management, and alcohol use was 0.94, 0.74, 0.81, 0.93, and 0.92, respectively. Hypertension knowledge was assessed by Hypertension Knowledge-Level Scale (HK-LS).[20] The Cronbach's alpha is 0.81, indicating an acceptable level of internal consistency. The clinical characteristics include duration diagnosis, comorbidity, body mass index (BMI), BP check-up, frequency of follow-up, source medication, number of medications, and comorbidity. The internal consistency of the Generalized Anxiety Disorder 7-item (GAD-7) scale was 0.90,[21] whereas the internal consistency of the Patient Health Questionnaire-9 (PHQ-9) was 0.95[22] and social support was assessed by Oslo Social Support Scale (OSSS-3),[23] and its internal consistency was 0.86. The patient charts were also reviewed for medical information and physical measurement.

Hypertension control status

The last two consecutive measurements of BP recordings were taken to determine the level of hypertension from the patients' records. Based on the mean of BP measurements, the level of hypertension was further dichotomized into controlled and uncontrolled BP as per the Eighth Joint National Committee (JNC-8) recommendations. Patients were classified as having uncontrolled hypertension if BP $\geqslant$150/90 mm Hg in hypertensive patients age 60 years or $\geqslant$140/90 mm Hg for patients aged less than 60 years and all hypertensive patients with diabetes mellitus (DM) or chronic kidney disease (CKD) based on the average of three measurements unless considered as controlled hypertension.[14,24,25]

Operational Definitions

The H-SCALE scale contains six domains (subscales) of self-care practice activities (medication adherence, weight management, physical activity, smoking, alcohol intake, and low-salt diet). Medication adherence was measured by three items containing the number of days in the last 7 days. Responses were summed (range from 0–21). Patients who scored 21 out of 21 were considered as adherent to medication.[19]

Dietary Approaches to Stop Hypertension (DASH-Q) was assessed by 11 items. These items assess the intake of healthy foods associated with the nutritional composition of the DASH diet. Item seven ("Eat pickles, olives, or other vegetables in brine?") were reverse coded. Responses for all items are then summed and range from 0–77. Scores of 32 and below are considered as low diet quality; scores between 33 and 51 are medium diet quality, and scores of 52 or greater should be considered adherent.[19] Weight management was measured by 10 items rated from 1 (strongly disagree) to 5 (strongly agree). The responses summed (10–50). Patients' score $\geqslant$40 was considered as adherent to weight management.[19] Past 7 days of physical activity of patients were assessed by two items. Responses were scored (range = 0–14). The patients who scored $\geqslant$8 were considered as adherent to physical activity.[19] Patients who had not smoked in the last 7 days were considered non-smokers.[19] Alcohol intake was assessed by three items participants who reported not drinking any alcohol in the last 7 days, or who indicated that they usually did not drink at all, were considered adherent.[19]

Hypertension knowledge was measured by HK-LS which contains 22 item questions. Nine of these items on the questionnaire were negatively phrased. Before the analysis, these were reverse coded. The total sum of the scores of the knowledge items gives a score ranging from 0 to 22. The mean value was calculated. Respondents who scored equal to the mean and above on the HK-LS were considered as good knowledge and respondents who scored below the mean were considered as poor knowledge about hypertension.

Anxiety was assessed by the GAD-7 scale, which are scored from 0 (not at all) to 3 (nearly every day), which gives a score ranging from 0 to 21. In this study, patients with a score $\geqslant$10 had anxiety.[26]

Depression was screened using the PHQ-9, which are scored from 0 (not at all) to 3 (nearly every day), with a score ranging from 0 to 27. In this study, patients who scored $\geqslant$10 were had depression.[21]

Social support was measured using Oslo Social Support Scale (OSSS-3) which contains three items. The first item is rated on a 4-point Likert-type scale ranging from 1 to 4. The second and the third items are rated on a 5-point Likert-type scale ranging from 1 to 5. The sum score ranges from 3 to 14. The ranges from 12 to 14 in OSSS-3 were considered as strong social support, 9 to 11 were considered as moderate social support, and 3 to 8 were poor social support.[27]

Data quality control

A pretest was conducted among 21 (5%) of the sample size at Haramaya General Hospital which is outside of the study area. Data collectors and supervisors were trained for 2 days on the data collection approach of the study. Data were collected using the local language (Amharic, Afaan Oromo, and Af Somali), according to patients' preferences. Continuous follow-up and supervision were done.

Statistical analysis

The data were entered into EpiData version 3.1 and then exported to SPSS version 20 for analysis. Simple frequency, percentage, mean values, median, standard deviations, and interquartile range were generated as descriptive statistical analyses. Variables with a P-value of less than 0.25 in the bivariate binary logistic regression analysis were considered for the multivariable regression model. The multi co-linearity test was carried out to see the correlation between independent variables using variance inflation factor (VIF) and tolerance test; no variables were observed with tolerance test <0.1 and VIF of >10. The model fitness was checked using Hosmer–Lemeshow (p = 0.33). Crude and adjusted odds ratios with a 95% confidence interval (CI) were estimated, and variables with P-value less than 0.05 in the multivariable regression analysis were taken as significant predictors of uncontrolled hypertension.

Results

Socio-demographic characteristics

In this study, 415 hypertensive patients participated giving a response rate of 98.6%. The mean age (±SD) of the patients was 50 (±19) years and 220 (53%) were males. Two hundred fifty-seven (61.9%) of the participants were married and regarding the religion of respondents, 174 (41.9%) were Muslim religion followers, and almost half, 200 (48.2%), of

Table 1. Socio-demographic characteristics of adult hypertensive patients on follow-up at public hospitals, Eastern Ethiopia, 2021 (n = 415).

Variable	Frequency (n = 415)	Percent (%)
Sex		
Male	220	53
Female	195	47
Age (years)		
<50	204	49.2
⩾50	211	50.8
Marital status		
Single	28	6.7
Married	257	61.9
Divorced	47	11.3
Widowed	83	20.0
Religion		
Muslim	174	41.9
Orthodox	156	37.6
Protestant	60	14.5
Others*	25	6
Educational status		
No formal education	51	12.3
Primary education	73	17.6
Secondary education	91	21.9
College and above	200	48.2
Occupation		
Farmer	51	12.3
Civil servant	161	38.8
Merchant	115	27.7
Housewife	70	16.9
Other**	18	4.3
Place of residence		
Urban	284	68.4
Rural	131	31.6
Family history of hypertension		
Yes	150	36.1
No	265	63.9
Monthly income (ETB)		
⩽500	50	12.0
501–2000	99	23.9
<2000	266	64.1

*Others: Catholic, Waqefata.
**Daily labor, retired, student, and self-employed.

the respondents, attended college and above. Two hundred sixty-five (36.1%) of the participants had a family history of hypertension (Table 1).

Hypertension knowledge and hypertension self-care practice

The mean knowledge score of the respondents was 13.02 ± 3.72. More than half, 241 (58.1%), scored above the mean value that indicated good knowledge about hypertension. Almost half, 204 (49.2%), were adherent to medication. One hundred thirty-four (32.3%) of study participants were adherent to a DASH-Q and only near to one-fourth, 118 (28.4%), practiced physical activity. The majority, 355 (85.5%), of the participants were non-smokers and 301 (72.5%) of them were alcohol abstainers. Almost half, 205 (49.4%), of them, were engaged to weight management protocol (Table 2).

Clinical-related characteristics

Almost half, 215 (51.8%), of the patients had a disease duration of less than 5 years. The majority of the participants, 255 (61.4%), had normal BMI (18.5–24.9), and nearly half,

Table 2. Knowledge of hypertension and hypertension of adult hypertensive patients on follow-up at public hospitals, Eastern Ethiopia, 2021 (n=415).

Variable	Frequency (n=415)	Percent (%)
Hypertension knowledge		
Good knowledge	241	58.1
Poor knowledge	174	41.9
Medication adherence		
Adherent	204	49.2
Non-adherent	211	50.8
Low-salt diet		
Adherent diet quality	134	32.3
Medium diet quality	97	23.4
Low diet quality	184	44.3
Physical activity		
Adherent	118	28.4
Non-adherent	297	71.6
Non-smoking		
Adherent	355	85.5
Non-adherent	60	14.5
Alcohol abstinence		
Adherent	301	72.5
Non-adherent	114	27.5
Weight management		
Adherent	205	49.4
Non-adherent	210	50.5

181 (43.6%), had BP measurement more than two times per month at home, health institution, or elsewhere. Almost half, 208 (50.1%), had ever missed follow-ups. About 182 (43.9%) of the patients had comorbidity, and 111 (61%) of them had DM comorbidity (Table 3).

Psychosocial-related characteristics

Among the respondents, 92 (22.2%) had anxiety and 80 (19.28%) had depression. One hundred sixty (38.6%) of the patients had strong social support, while 117 (28.2%) of respondents had moderate social support and 138 (33.3%) of them had poor social support.

The magnitude of uncontrolled hypertension

Based on the average of three consecutive blood pressure (Bps) measurements, the magnitude of uncontrolled hypertension was 48% (95% CI=43.1%–52.8%). The mean of SBPs was 145.01 ± 15.13 mm Hg and the mean DBPs was 88.25 ± 9.53 mm Hg.

Bivariate analysis for factors associated with uncontrolled hypertension

The following variables were analyzed to see the association with outcome variables: sex, age, educational level, residence, family income, family history of hypertension, medication adherence, diet, smoking, physical activity, alcohol intake, weight management, BMI, duration of diagnosis, frequency of appointment, BP check-up, source medication coverage, number medication used, follow-up miss, comorbidity, anxiety, depression, and level of social support. However, only sex, age, medication adherence, low-salt diet, smoking, physical inactive, alcohol intake, weight management, follow-up miss, comorbidity, and depression were significantly associated with uncontrolled hypertension. In multivariable logistic regression analysis, sex, age, medication adherence, low-salt diet, physical exercise, and comorbidity were significantly associated with uncontrolled hypertension at P-value < 0.25 (Table 4).

Factors associated with uncontrolled hypertension

In multivariable logistic regression analysis, sex, age, medication adherence, low-salt diet, physical exercise, and comorbidity were significantly associated with uncontrolled hypertension. Male patients were two times greater odds of uncontrolled hypertension as compared to female patients (adjusted odds ratio (AOR)=2.05, 95% CI=1.29–3.26). Patients aged ⩾50 years was three times greater odds of uncontrolled hypertension than patients aged <50 years (AOR=3.16, 95% CI=1.96–5.08). Patients poor adhered to medication was 1.87 times greater odds of uncontrolled hypertension than their counterparts (AOR=1.83, 95% CI=1.14–2.94). The odds of having uncontrolled hypertension were four times higher among patients with low diet quality than those adherent to a quality diet (AOR=4.01,

Table 3. Clinical characteristics of adult hypertensive patients on follow-up at public hospitals, Eastern Ethiopia, 2021 (n = 415).

Variable	Frequency (n = 415)	Percent (%)
Body mass index (kg/m^2)		
18.5–24.9	255	61.4
25–29.9	73	17.6
⩾30	24	5.8
<18.5	63	15.2
Duration of hypertension (years)		
<5	215	51.8
5–10	128	30.8
>10	72	17.3
Frequency of appointment (months)		
1 month	125	30.2
2 months	74	17.8
3 months	216	52
Blood pressure check-up (months)		
⩾2 times	181	43.6
⩽2 times	234	56.4
Source medication coverage		
Health insurance	243	58.5
Self-sponsored	136	32.8
Free charge	36	8.7
Number medication used		
Monotherapy	162	39
Dual therapy	220	53
⩾Triple therapy	33	8
Follow-up missed		
Yes	208	50.1
No	207	40.9
Comorbidity		
Yes	182	43.9
No	233	56.1
Types of comorbidities (n = 182)		
Diabetes mellitus	111	61
Chronic kidney disease	23	12.6
Myocardial infarction	33	18.1
Stroke	26	14.3
Others*	29	15.9

*Others: heart failure, hyperlipidemia, and ischemic heart disease.

95% CI = 2.44–8.44). Physically inactive was found to have 2.86 times greater odds of uncontrolled hypertension than that physically active (AOR = 3.20, 95% CI = 1.84–5.56). The odds of having uncontrolled hypertension were 3.04 higher among patients who had confirmed comorbidity than their counterparts (AOR = 3.04, 95% CI = 1.90–4.85) (Table 5).

Discussion

The results of this study revealed that 48% of the patients on follow-up had uncontrolled hypertension. The findings of this study indicated that almost half of the patients on follow-up had uncontrolled hypertension. This finding was in line with studies conducted in Jimma Southwest Ethiopia (52.7%),[13] Mekelle Northern Ethiopia (48.6%),[28] and Congo (52.7%);[29] however, the results of this study are higher than the studies conducted in Nekemte West Ethiopia (36.4%),[14] Gondar Northern Ethiopia (37%),[30] Sudan (36%),[31] and Chile (36.9%).[32] This inconsistency might be due to the proportion of non-adherence to medication, delivery services, proportion of comorbidity, and socio-demographic characteristics.

But, this finding is lower than other studies done in Addis Ababa central Ethiopia (69.9%),[33] Debre Tabor Northern Ethiopia (57.1%),[34] Kenya (64.7%),[35] and Nigeria (60.8%).[36] This discrepancy might be differences in the way of outcome variable categorized, study population, lifestyle

Table 4. Bivariate analysis for factors associated with uncontrolled hypertension among adult hypertensive patients in Eastern Ethiopia, 2021 (n = 415).

Variable	Hypertension		COR (95% CI)	P-value
	Uncontrolled (%)	Controlled (%)		
Sex				
Male	127 (57.7)	93 (42.3)	2.33 (1.57–3.46)	0.00**
Female	72 (36.9)	123 (63.1)	1	
Age (years)				
⩾50	128 (60.7)	83 (39.3)	2.88 (1.93–4.30)	0.00**
<50	71 (34.8)	133 (65.2)	1	
Educational level				
No formal education	26	25	1.15 (0.64–2.06)	0.645
Formal education	173	191	1	
Residence				
Rural	63	68	1.00 (1.67–1.53)	0.974
Urban	136	148	1	
Family income				
⩽500	25	25	1.11 (0.6–2.03)	0.733
500–2000	48	51	1.04 (0.66–1.66)	0.852
>2000	126	140	1	
Family history of hypertension				
Yes	75	75	1.14	0.530
No	124	141	1	
Medication adherence				
No-adherent	118 (55.9)	93 (44.1)	1.92 (1.3–2.84)	0.001*
Adherent	81 (39.7)	123 (60.3)	1	
Diet				
Low diet quality	98	36	6.22 (2.4–12.09)	0.005*
Medium diet quality	45	52	1.98 (1.13–4.21)	
Adherent diet quality	56	128	1	
Non-smoking				
No-adherent	79 (58.5)	56 (41.5)	1.88 (1.24–2.85)	0.003*
Adherent	120 (42.9)	160 (57.1)	1	
Physical activity				
Physically inactive	166 (55.9)	131 (44.1)	3.26 (2.05–5.18)	0.00**
Physically active	33 (28.0)	85 (72.0)	1	
Alcohol abstinence				
No-adherent	64 (56.1)	50 (43.9)	1.57 (1.02–2.42)	0.041*
Adherent	135 (44.9)	166 (55.1)	1	
Weight management				
No-adherent	113 (53.8)	97 (46.2)	1.61 (1.09–2.37)	0.016*
Adherent	86 (42.0)	119 (58.0)	1	
Body mass index (kg/m^2)				
18.5–24.9	106	149	1	
25–29.9	40	33	1.7 (0.76–2.33)	0.261
⩾30	14	10	1.97 (0.98–2.45)	0.451
<18.5	29	34	1.2 (0.64–1.97)	0.672
Duration of diagnosis (years)				
<5	93	122	1	
5–10	68	60	0.67 (0.22–1.23)	0.885
>10	38	35	0.70 (0.45–1.12)	0.918
Frequency of appointment (months)				
1 month	125	30.2	1.6 (1.03–2.5)	0.37
2 months	74	17.8	0.72 (0.42–1.24)	0.43
3 months	216	52	1	

(Continued)

Table 4. (Continued)

Variable	Hypertension		COR (95% CI)	P-value
	Uncontrolled (%)	Controlled (%)		
Blood pressure check-up (months)				
⩽2 times	138	96	1.77 (0.98–2.89)	0.340
⩾2 times	81	100	1	
Source medication coverage				
Health insurance	108	135	1	
Self-sponsored	71	65	1.37 (0.89–2.08)	0.32
Free charge	20	16	1.56 (0.77–3.16)	0.411
Number medication used				
Monotherapy	88	74	1.61 (0.78–2.25)	0.345
Dual therapy	115	105	1.48 (0.64–2.54)	0.561
⩾Triple therapy	14	19	1	
Follow-up miss				
Yes	112 (53.8)	96 (46.2)	1.60 (1.09–2.37)	0.016*
No	87 (42.0)	120 (58.0)	1	
Comorbidity				
Yes	117 (64.3)	65 (35.7)	3.31 (2.21–4.97)	0.000**
No	82 (35.2)	151 (64.8)	1	
Anxiety				
Yes	52	40	1.21 (0.46–3.45)	0.761
No	167	156	1	
Depression				
Yes	40 (58.0)	29 (42.0)	1.62 (0.96–2.73)	0.07
No	159 (46.0)	187 (54.0)	1	
Level of social support				
Poor social support	72	66	1.37 (0.87–2.16)	0.179
Moderate social support	56	61	1.15 (0.71–1.86)	0.565
Strong social support	71	89	1	

CI: confidence interval; COR: crude odds ratio.
*$P < 0.05$; **$P < 0.001$.

behaviors, and environmental factors. For instance, one BP value was used in a study done in Kenya, but in this study, an average of three BP results was used and this might increase the proportion of uncontrolled hypertension.

In this study, uncontrolled hypertension was higher among male than female patients. The possible justification might be due to females are more adherent to most components of the hypertension lifestyle modifications.[37] Another possible justification might be men are burdened by outdoor activities which make them busy and make them forget their medications. Alcohol consumption, a common practice by males, could also be a barrier to their treatment adherence.[38] This is in line with other studies conducted in Nekemte West Ethiopia, Morocco, Congo, Iran, and Vietnam.[14,29,39–41]

In this study, the odds of having uncontrolled hypertension are also higher among patients aged ⩾50 years. This is consistent with studies done in Jimma Southwest Ethiopia, Mekelle Northern Ethiopia, Uganda, Angola, India, and Lebanon.[13,28,42–45] This could be due to the biological effect of increased SBP with age, mainly due to the reduction in elasticity (increased stiffness) of large duct arteries which in turn leads to arterial stiffening, peripheral vascular resistance which leads to raised BP.[46] Another possible reason might be older age is unfavorable with most hypertension self-care practices whereas hypertension self-care practices are important for control of BP.[47]

Non-adherence to antihypertensive medication was also positively associated with uncontrolled hypertension. This finding is consistent with other studies conducted in Mekelle, Gondar Northern Ethiopia, Sudan, Cameroon, and Congo.[28,30,48–50] This might be due to antihypertensive medications controlling high BP by vasodilatation, increasing urination to remove excess salt and fluid from the body which leads to decreasing of BP.[51,52] In addition, one-third of the patients' monthly income was very lower than two thousand Ethiopian Birr, which indicates they cannot afford the price of the medicines this might affect medication adherence.

This study revealed that hypertensive patients with low diet quality were more likely associated with uncontrolled hypertension than those who adhered to a quality diet. This is supported by studies conducted in Mekelle, Debre Tabor,

Table 5. Factors associated with uncontrolled hypertension adult hypertensive patients on follow-up at public hospitals, Eastern Ethiopia, 2021 (n = 415).

Variable	Hypertension		COR (95% CI)	AOR (95% CI)
	Uncontrolled (%)	Controlled (%)		
Sex				
Male	127 (57.7)	93 (42.3)	2.33 (1.57–3.46)**	2.05 (1.29–3.26)*
Female	72 (36.9)	123 (63.1)	1	1
Age (years)				
⩾50	128 (60.7)	83 (39.3)	2.88 (1.93–4.30)**	3.16 (1.96–5.08)**
<50	71 (34.8)	133 (65.2)	1	1
Medication adherence				
No-adherent	118 (55.9)	93 (44.1)	1.92 (1.3–2.84)*	1.83 (1.14–2.94)*
Adherent	81 (39.7)	123 (60.3)	1	1
Diet				
Low diet quality	98	36	6.22 (2.4–12.09)**	4.01 (2.44–8.44)*
Medium diet quality	45	52	1.98 (1.13–4.21)	1.32 (0.6–3.45)
Adherent diet quality	56	128	1	1
Non-smoking				
No-adherent	79 (58.5)	56 (41.5)	1.88 (1.24–2.85)*	1.54 (0.88–2.69)
Adherent	120 (42.9)	160 (57.1)	1	1
Physical activity				
Physically inactive	166 (55.9)	131 (44.1)	3.26 (2.05–5.18)**	3.20 (1.84–5.56)**
Physically active	33 (28.0)	85 (72.0)	1	1
Alcohol abstinence				
No-adherent	64 (56.1)	50 (43.9)	1.57 (1.02–2.42)*	1.55 (0.90–2.68)
Adherent	135 (44.9)	166 (55.1)	1	1
Weight management				
No-adherent	113 (53.8)	97 (46.2)	1.61 (1.09–2.37)*	1.53 (0.92–2.54)
Adherent	86 (42.0)	119 (58.0)	1	1
Follow-up miss				
Yes	112 (53.8)	96 (46.2)	1.60 (1.09–2.37)*	1.27 (0.79–2.03)
No	87 (42.0)	120 (58.0)	1	1
Comorbidity				
Yes	117 (64.3)	65 (35.7)	3.31 (2.21–4.97)**	3.04 (1.90–4.85)**
No	82 (35.2)	151 (64.8)	1	1
Depression				
Yes	40 (58.0)	29 (42.0)	1.62 (0.96–2.73)	1.86 (0.98–3.53)
No	159 (46.0)	187 (54.0)	1	1

CI: confidence interval; COR: crude odd ratio; AOR: adjusted odd ratio.
*$P < 0.05$; **$P < 0.001$.

and Gondar Northern Ethiopia, China, and French.[25,28,34,53,54] This is due to the effect of high-salt diets on the activation of the renin–angiotensin–aldosterone system (RAAS) disrupts the natural sodium balance in the body and causes fluid retention that increases the pressure exerted by the blood against blood vessel walls.[55] Another possible justification is that one-third of the study participants had poor social support since the existence of the family or relative support increased adherence to medication, a low-salt diet, and reminding follow-up time. The World Health Organization (WHO)[56] self-care practices (SCP) guideline supports the presence of good social support for coping with chronic diseases like hypertension.

This study shows that physically inactive patients were more likely associated with uncontrolled hypertension than their counterparts. This is similar to studies done in Mekelle and Debre Tabor Northern Ethiopia, South Africa, China, and the United States.[28,34,57–59] The reason could be physical activity controls high BP through enhancement of heart function, renal function, and preventing weight gain.[60,61] Another possible reason is that physical activity also increases endothelial function and decreases psychosocial stress.[61]

Patients with other medically confirmed comorbidities were more likely to have uncontrolled hypertension than those patients without other comorbidities. This is in line with studies conducted in Gondar and AyderNorthern

Ethiopia, South Asia, Thailand, and Malaysia.[15,30,62–64] This might be due to many chronic diseases affecting endothelial cells which disturb the dilation of blood vessels or might be due to insulin resistance.[65]

Strength and limitations of the study

This study was a multicenter study that would have a better representation of the study participants and the generalizability of the result. This study would not be free from the limitations. Since it was a cross-sectional study, it did not show a temporal relationship. In addition, the tools (questionnaires) were validated in different contexts and some items may not have been relevant in the study context. Finally, in this study, factors associated with dropping out of care or not attending a clinic visit were not assessed.

Conclusions

The magnitude of uncontrolled hypertension was higher in this study. Male sex, age ⩾50 years, non-adherence to antihypertensive medication, low diet quality, being physically inactive, and having comorbidity were significantly associated with uncontrolled hypertension. So, healthcare professionals and other stakeholders need to design interventions that enhance lifestyle modifications including healthy dietary practice, physical activity, and medication-taking behaviors.

Acknowledgements

The authors would like to thank Haramaya University, College of Health and Medical Sciences, for giving the opportunity to conduct this study. Also, the authors would like to thank all hospital management and staff.

Author contributions

L.A., S.L., N.A., and S.G. participated in the conception of the idea, development, amendment of the proposal, data collection, analysis, and write-up of the results. M.L., E.Y., T.B., A.H., and Y.G. have participated in data collection, analysis, and manuscript write-up.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

Ethical clearance was obtained from the Institutional Health Research Ethics Review Committee (IHRERC) of Haramaya University, College of Health and Medical Sciences on 10 June with reference number N0.IHRERC/079/2021. A formal letter of permission and support was provided to all hospitals in which the study was conducted from Haramaya University.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Informed consent

Written informed consent was obtained from all subjects who were ⩾18 years old before the study after explanations about the aims, objectives, benefits, and harms of the study was provided. During data collection, the COVID-19 prevention protocol was kept.

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Data availability

Data can be made available on request to the corresponding authors.

Supplemental material

Supplemental material for this article is available online.

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