

Level of adherence to lifestyle modifications and associated factors among hypertensive patients attending outpatient department at Bishoftu General Hospital, Oromia Region, Ethiopia, 2022

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Abstract

Background: Hypertension is a major public health problem affecting over one billion people worldwide. Many people live unhealthy lifestyles, which are regularly undetected and poorly controlled for hypertension. To address this issue, adherence to lifestyle modification approaches is regularly overlooked as the cornerstone of hypertension prevention and control.

Objective: To assess the level of adherence to lifestyle modifications and associated factors among hypertensive patients attending outpatient departments at Bishoftu General Hospital, in 2022.

Methods: A hospital-based cross-sectional study design was conducted among 301 hypertensive patients between January and March 2022. A systematic random sampling technique was used. The data were collected through face-to-face interviews with participants using a structured questionnaire by trained data collectors. Data were entered into Epi-info 7.2.1.0 and exported to SPSS version 26 software for further analysis. Data were analyzed by using descriptive statistics and identified predictors of the outcome using a bivariable and multivariable logistic regression model (adjusted odds ratios with p-value <0.05 and 95% CI).

Results: The study included 301 respondents with 100% response rate. 158 (52.5%) were females and median age was 57 (\pm 12.4 SD) years. The overall adherence in this study was only 26.9%. The study found that the patients age older than 55 years (AOR= 2.81; 95% CI: 1.35-5.84), formal education (AOR: 0.52; 95% CI: 0.28 - 0.96), the patients who had hypertension with 5 to 10 years diagnosis time (AOR = 2.33; 95% CI: 1.01–5.37), co-morbidity (AOR=2.06; 95% CI: 1.21,3.49) and good knowledge about healthy lifestyle (AOR:0.42; 95% CI: 0.24-0.74) are independently associated with adherence to lifestyle modifications.

Conclusions: The Level of adherence to recommended lifestyle modification among hypertensive patients was low in this study. Of the variables studied, age, educational level, duration of hypertension, having co-morbidities, and knowledge about healthy lifestyle were independent predictors of adherence to lifestyle modifications.

Keywords: Adherence, Lifestyle modification, Hypertension

Introduction

Hypertension is one of the major important risk factors for cardiovascular diseases. It is the largest cause of death worldwide, accounting for 10.8 million deaths per year [1,2]. Globally, 1.39 billion people had hypertension, and one-third of adults have the condition. These 349 million people live in high-income countries, while 1.04 billion live in low- and middle-income countries, indicating a considerable increase in morbidity and death. The prevalence of hypertension is rising globally owing to the aging of the population and increases in exposure to lifestyle risk factors including unhealthy diets [3]. Among all World Health Organization (WHO) regions, the prevalence of hypertension

is highest in the African region (46%) and lowest in the Americas region (35%) [4]. In terms of economic burden, poorly controlled hypertension is a fairly important public health concern among the elderly worldwide. Some studies have shown that most hypertensive patients do not have sufficient knowledge about lifestyle modification [5].

Approximately 74.7 million people in sub-Saharan Africa (SSA) suffer from hypertension, which is expected to reach 125.5 million and will hinder the target set to reduce by 25% the prevalence of hypertension globally by 2025 [6,7]. In 2016, WHO and the United States Centers for Disease Control and Prevention launched the Global Hearts Initiative to support governments in helping and treating cardiovascular disease. Ethiopia is one of the countries starting the Global Heart Initiative to address risk factors associated with non-communicable diseases (NCD) [8].

Most behavioral risk factors, such as tobacco use and drinking, were more common in men than in women. To reduce the risk of developing hypertension, it is highly recommended lifestyle modifications, such as avoiding drinking alcohol or smoking [9].

Hypertensive patients are expected to be able to modify their lifestyles. But little is known about the magnitude of healthy lifestyles since many of the studies were conducted on hypertension in Ethiopia. That means there are only a few studies done on adherence to lifestyle modification and associated factors of hypertension to show the gap and magnitude of the problem in this study area. So, this study was to assess adherence to lifestyle modifications and their associated factors among hypertensive patients in this study area.

Methods and Materials

Study area and period

The study was conducted at Bishoftu General Hospital in Bishoftu town, Oromia region, Ethiopia. The town is found 47-kilo meters away from Addis Ababa in the eastern direction. The area of the town is 182,878 hectares with a temperature range from 11.18°C to 26.5°C. The town population projection was 193,340 and out of the total, 101,108 (51%) were females. A general hospital acts as a referral hospital including some parts of the East Shoa zone rural districts. The hospital provides services for more than 1,000,000 people living in its catchment area. Data was collected from 30 January to 29 March 2022.

Study Design

A hospital-based cross-sectional study was conducted.

Source Population

All adult hypertensive patients were on follow-up at Bishoftu General Hospital.

Study Population

All selected adult hypertensive patients in the outpatient department who fulfilled the inclusion criteria and be available during the study period were the study population.

Eligibility criteria

Inclusion criteria: All hypertensive patients aged ≥ 18 years and old who were on medical treatment for at least six months period before the beginning of the study were included in the study.

Exclusion criteria: Patients with hypertension who were unwilling to perform a 24-hour recall at home and pregnant women were excluded from the study.

Sample size determination and sampling procedures

Sample size determination using adherence to lifestyle modifications: The sample size was calculated using a single population proportion formula by assuming 23.6% for the proportion of adherence to lifestyle modification with hypertensive patients from a study conducted at the Dessie Referral Hospital [10], with a 5% marginal error, and a 95% confidence level (CL). The sample size is $(n) = 273$.

Sample size determination using risk factors associated with adherence to life style modifications among hypertension patients: The sample size required by using double population proportions to identify risk factors associated with adherence to lifestyle modifications among hypertensive patients was detected at a confidence level of 95%, variables significantly associated with hypertension in previous studies, and the power was fixed at 80% of the study. From a previous Ethiopian study, we have addressed a few factors that are strongly associated with lifestyle modifications in hypertensive patients. In a study of selected hospitals in southern Ethiopia [11], adherence to healthy lifestyle was 25.9% for patients aged over 65 years and 5.4% for patients under 65 years, with an adjusted odds ratio (AOR) of 0.27, and an analysis of similar studies recommended lifestyle modifications showed 32.2% of patients without formal education and 20.7% with formal education, with an adjusted odds ratio (AOR) of 2.00. In the Northeastern Ethiopia study [10], adherence to recommend lifestyle modifications was 9.3% in adult hypertensive patients with comorbidities and 14.3% in those without comorbidities, with an adjusted odds ratio (AOR) of 2.37.

The sample sizes calculated accordingly were 205, 210, and 273. The sample size of the first objective was larger than the sample size of the second objective. Therefore, the final sample size was adjusted by adding a 10% non-response rate, and finite population adjustment, resulting in a total sample size of 273. Accordingly, the sample size calculated in this study was 301. Hence the sample size of 301 was the final sample size for the present study as it would suffice to address all objectives of the study.

Sampling technique and procedures: Patients found during the study period at Bishoftu General Hospital who met the inclusion criteria were included in the study and exclusively for lifestyle modification adherence. Participants in the study were selected using a systematic random sampling technique of patients with hypertension who visit the hospital at chronic follow-up departments known to be hypertensive patients based on monthly hospital reports. In 2021, a total of 3,111 hypertensive patients were divided by the sample size $(n=301)$ to obtain $k=10.3$. Finally, participants were selected for the study using a systematic sampling method, with every tenth client selected from the daily flow of interval clients based on their outpatient follow-up, and the first case being randomly selected from 1 to 10 clients.

Variables

Dependent variable: Level of adherence to lifestyle modifications.

The independent variables

Socio-demographic factors: Age, sex, marital status, religion, ethnicity, level of education, occupation, residence, monthly income, and family size.

Health profile of the patients: Presence of co-morbidity (such as diabetes mellitus and chronic kidney disease), duration of the disease, and family history of hypertension.

Individual factors: Knowledge of lifestyle modification.

Data collection instruments and procedure

Data were obtained using a structured, validated, and pretested interviewer-administered questionnaire modified from questions found in the literature and the WHO STEPS questionnaire survey [12]. There is no standard questionnaire available to assess adherence to lifestyle modifications. The questionnaire contains information about variables related to socio-demographic, personal, and knowledge of lifestyle modifications. These variables can be expressed in terms of adherence to a dietary approach to stop hypertension (DASH), regular exercise, limiting alcohol consumption, and quitting smoking.

Measurements: Dependent variables, which are adherence to lifestyle modifications, were evaluated by adapting tools from similar studies. In this study, the components of lifestyle changes were measured on the Likert scale (always, most of the time, some time, and never). For each element (regular exercise, diet, smoking cessation, drinking limitation), participants always had specific questions to answer from some time options, never, and never did so [13,14].

Data collection and data collectors

Data was collected through face-to-face interviews. Investigators are responsible for the overall management of the study. Data were selected by three Bachelor of Science (BSC) professional nurses based on their experience in outpatient clinics, and a Master of Public Health (MPH) professional was recruited for supervisory activities. The study protects patient privacy by allowing for anonymity and voluntary participation.

Data quality control

Both data collectors and supervisors were trained on the objectives, research methodology, and approach to data collection for one day. The purpose of the training was to ensure that all data collectors had the same information about the research tool and followed the same interview procedures. The training focused on the purpose of the study, confidentiality, how to approach and promote questions to clients. The questionnaire is primarily prepared in English and translated into Afaan Oromo and then translated into English by another person to verify consistency. Preliminary testing was carried out in 15 (5%) of samples in health facilities that were not included in the final study. Based on the finding, grammatical sequences of questions will be arranged on questionnaires. The Principal Investigator and Supervisor checked the completeness, accuracy, and clarity of the daily data collection with the data collectors, and any necessary corrections were made before the start of the next data collection day. Finally, the data was cleaned, coded, and cross-checked using the Epi-info software before data analysis.

Data processing and analysis

The data was cleaned, coded, edited, and entered into Epi-Info version 7.2.1.0, and then exported to SPSS version 26 for further analysis. To assess the level of adherence to lifestyle modifications and associated factors among hypertensive patients, bivariable and multivariable analysis was employed. The assumptions for binary logistic regression were checked to ensure that all potential confounders were controlled and values less than 0.25 in the bi-variable analysis were considered as candidate variables for multivariable logistic regression. The model goodness of fit was assessed using the Hosmer Lemeshow test. The association between the different independent variables and with dependent was measured using a bivariable and multivariable logistic regression model (adjusted odds ratios with p-value <0.05 and 95% CI).

Operational definitions and measurements

Lifestyle modification: The adoption of a healthy lifestyle which was recommended by JNC 7 as non-pharmacological management of hypertension measured using physical exercise, (DASH) diet, moderation of alcohol intake, and stopping smoking [10].

Adherence to lifestyle modifications: According to JNC 7 recommended healthy lifestyles, were measured based on respondents who adhere to (DASH) diet usually or always ate a diet rich in vegetables, grains, and fruits; rarely or never ate salt, rarely or never ate saturated fat; aerobic physical activity for >30 minutes per day at least five times per week; stop smoking, and never consumed alcohol or alcohol consumed limited to 2 standard drinks a day for men and 1 standard drink a day for women. In this study, the participants who adhered to all these four healthy lifestyles were considered adherent or otherwise non-adherent [15].

Diet-related adherence: Respondents who usually or always ate a diet rich in vegetables, grains, and fruits, rarely or never ate salt; rarely or never ate saturated fat at least 3 times per week were considered to be adherent [15].

Exercise-related adherence: Respondents who engage in aerobic physical activity (including brisk walking, jogging or running, riding a bicycle and swimming) for >30 minutes per day at least five times per week. The respondents were considered adherent to the physical activity recommendation if they answered yes to the exercise inquiry and otherwise [14].

Smoking-related healthy lifestyle: Participants who self-reported to have never smoked or quit smoking within the previous 12 months [16].

Alcohol consumption-related adherence: Participants who reported that they either never consumed alcohol or alcohol consumed limited to 2 standard drinks a day for men and 1 standard drink a day for women (1 standard drink is equivalent to 25 ml spirits (e.g. whisky, brandy, vodka) or 125 ml (one standard drink glass) wine or 340 ml beer) were taken as adherent to moderation of alcohol consumption [17].

Knowledge on healthy lifestyle: Respondents with a scores above the mean value on hypertension evaluation of lifestyle and management scale were taken as having good knowledge about a healthy lifestyle otherwise low [10].

Ethical considerations

Ethical clearance was obtained from the institutional review board (IRB) (Ref.No.PM23/345/2022) of St. Paul's Hospital Millennium Medical College and Oromia Regional Health Bureau. An official letter was sent to Bishoftu general hospital. After obtaining permission from the hospital to participate in the study, an informed, voluntary, written, and signed consent was obtained for the participation of both the hospital manager and the patients. The patient's privacy and confidentiality were ensured through an interview in a non-public place, and they will be aware that their participation in the study would not be an incentive or harm. Finally, the identity of the participants remained anonymous throughout the process of data collection and analysis.

Results

Socio-demographic characteristics of participants

Out of the total hypertensive patients who attended the

outpatient chronic follow-up department of Bishoftu General Hospital during the study period, 301 hypertensive patients were included in the study, giving a response rate of 100%. The majority of 212 (70.4%) study participants lived in an urban area. The median age of the participants was 57.00 years (± 12.4 SD), slightly higher than half of 162 (53.8%) of the participants were found to be above the age of 55 years. The majority of participants were married 211 (70.1%), females 158 (52.5%), and 242 (80.4%) of them attended formal education. Around 138 (45.8%) of the participants were Oromo by ethnicity and 212(70.4%) were Orthodox followers by religion (**Table 1**).

Health profile of the patients and individual related factors

Of the 301 study participants, 122 (40.5%) have a family history of hypertension and 130 (43.2%) were hypertensive for five or more years. Among the study participants, 129 (42.9%) participants had co-morbidities diseases (such as diabetes mellitus and chronic kidney disease) (**Table 2**).

Table 1. Socio-demographic characteristics of hypertensive patients attending the outpatient department at Bishoftu General Hospital, Oromia, Ethiopia, 2022 (n=301).

Variables	Category	Frequency	Percent (%)
Residency	Urban	212	70.4
	Rural	89	29.6
Sex	Male	143	47.5
	Female	158	52.5
Age in years	18-35	20	6.6
	36-45	36	12.0
	46-55	83	27.6
	>55	162	53.8
Marital status	Married	211	70.1
	Single	16	5.3
	Divorced	30	10.0
	Widowed	44	14.6
Ethnicity	Oromo	138	45.8
	Amhara	106	35.2
	Gurage	33	11.0
	Tigre	17	5.6
	Others*	7	2.3
Religion	Orthodox	212	70.4
	Protestant	43	14.3
	Muslim	38	12.6
	Others **	8	2.7
Educational status	No formal education	59	19.6
	Formal education	242	80.4

Occupation	Employed	88	29.2
	Unemployed	65	21.6
	Farmer	65	21.6
	Private business	73	24.3
	Others***	10	3.3
Average monthly income(in birr)	No regular income	59	19.6
	1000 ETB	23	7.6
	1000-1999ETB	49	16.3
	2000-2999ETB	111	36.9
	>3000ETB	59	19.6
Family Size(in number)	<5	163	54.2
	>5	138	45.8
Others (Sidama, Silte and Somale *, Wakefata and Catholic **, House wife and private workers or contract ***)			

Table 2. Patient health profile and individual factors of study participants at Bishoftu General Hospital, Oromia, Ethiopia, 2022 (n=301).

Variable	Category	Frequency	Percent (%)
Family history of hypertension	No	179	59.5
	Yes	122	40.5
Duration of hypertension (years)	<2	44	14.6
	2-5	78	25.9
	5-10	130	43.2
	>10	49	16.3
Presence of comorbidity	No	172	57.1
	Yes	129	42.9

Knowledge on a healthy lifestyle

The knowledge and information on a healthy lifestyle addressing hypertension patients was determined using ten (10) questions for hypertension evaluation on a healthy lifestyle. The average knowledge score was (2.01 ± 0.415) as the cut-off point, indicating that 134 (44.5%) of the 301 participants were good knowledge on a healthy lifestyle (Figure 1).

Level of adherence to recommended lifestyle modifications

Adherence to the recommended diet: The majority 174 (57.8%) of participants included fruits, vegetables, and grains in their diet after being diagnosed with hypertension. The average dietary score was found to be (3.246 ± 0.594). Among 167 (55.5%) respondents sometimes ate foods rich in saturated fats, and 85 (28.2%) participants rarely ate spicy foods after diagnosis. About 112 (37.2%) of participants never eat salt in food during their meals (Table 3).

Adherence to related-Exercise: About 152 (50.5%) of participants said they do physical activity, with 69 (22.6%) claiming they exercise at least 3 times a week, and about a similar number

66 (21.9%) confirming that they engage in an activity that takes greater than 30 minutes of practice. Aerobic exercise (including brisk walking, jogging or running, riding a bicycle and swimming) was the most common physical activity among those found to be consistent at 126(41.9%) (Table 4).

Alcohol consumption: All 273 (90.7%) hypertensive patients were adhering to moderation in alcohol consumption. About 105 (34.9%) of the participants consumed less than one drink per week and 25 (8.3%) of the participants consumed more than seven drinks per week. Approximately 128 (46.9) of these participants confirmed that a relative/health care professional was concerned about their alcohol use and advised them to reduce their alcohol consumption during the last year (Table 5).

Smoking cessation: Of the 301 participants, 274 (91.0%) had never smoked, while 27 (9.0%) of them are still smokers. Among the 27 participants who still smoked cigarettes, 18 (66.7%) had tried to quit smoking (Table 6).

Overall, the level of adherence to recommended lifestyle: Overall, the level of adherence to recommended lifestyle (including diet, exercise, moderation of alcohol consumption, and smoking

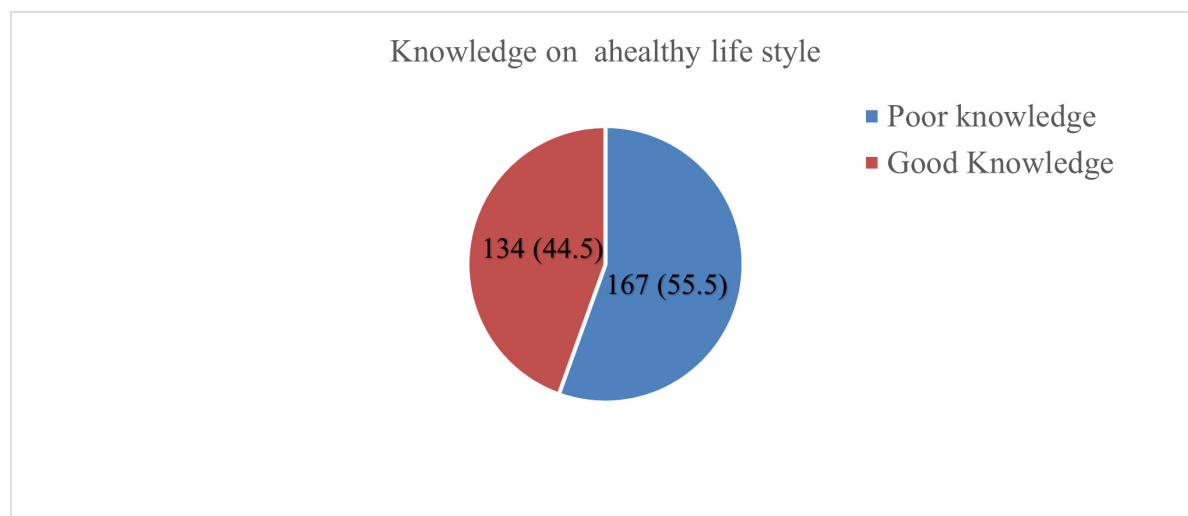


Figure 1. Knowledge on a healthy lifestyle among respondents attending outpatient department at Bishoftu General Hospital, 2022(n=301).

Table 3. Adherence to the recommended diet among hypertensive patients attending Bishoftu General Hospital outpatient department, Oromia, Ethiopia, 2022 (n=301).

Variables	Always	Often	Sometimes	Rarely	Never
Included fruits, vegetables, and grains in the diet	71 (23.6%)	33 (11%)	132 (43.9%)	39 (13%)	26 (8.6%)
Consuming foods that contain high saturated fat	24 (8%)	15 (5%)	167 (55.5%)	59 (19.6%)	36 (12%)
Consuming spicy foods	31 (10.3%)	40 (13.3%)	109 (36.2%)	85 (28.2%)	36 (12%)
Consuming salt in your food	7 (2.3%)	15 (5%)	104 (34.6%)	63 (20.9%)	112 (37.2%)

Table 4. Adherence to related-Exercise among hypertensive patients attending Bishoftu General Hospital outpatient department, Oromia, Ethiopia, 2022 (n = 301).

Variables	Category	Frequency	Percent (%)
Do you perform physical exercise?	No	149	49.5
	Yes	152	50.5
Frequency of exercise in a week	<Three times per week	44	14.6
	Three times per week	69	22.9
	>Three times per week	44	14.6
Duration of exercise per session	Less than 30 minutes	35	11.6
	From 30 minutes to 1 hour	66	21.9
	More than 1 hour	58	19.3
Type of exercise performed	Aerobics (walking, Jogging)	126	41.9
	Weight-bearing	15	5.0
	Driving	13	4.3
	Dancing	5	1.7

Table 5. Participant response to alcohol consumption among hypertensive patients attending outpatient follow-up at Bishoftu General Hospital, Oromia, 2022 (n=301).

Variables	Category	Frequency	Percent (%)
Alcohol consumption	Not moderated	28	9.3
	Moderated	273	90.7
How often do you usually drink alcohol	<1 drink a week	105	34.9
	1-3 drinks a week	96	31.9
	4-6 drinks a week	47	15.6
	≥ 7 drinks a week	25	8.3
	Never	28	9.3
Tried to quit Alcohol consumption	No	145	53.0
	Yes	128	46.9

Table 6. Participant response on Smoking cessation among hypertensive patients attending the outpatient department at Bishoftu General Hospital, Oromia, 2022 (n=301).

Variables	Category	Frequency	Percent (%)
Ever smoked cigarette	No	274	91.0
	Yes	27	9.0
Advice by a health worker to quitting smoking	No	3	11.1
	Yes	24	88.9
Tried to quit smoking	No	9	33.3
	Yes	18	66.7

cessation) in this study found that only 26.9% of participants adhere to all recommended lifestyle modifications. About 174 (57.8%) of participants adhere to recommendations related to the diet. Most 177 (58.8%) participants did not engage in regular exercise at least 3

days per week, with a minimum duration of 30 minutes. About 274 (91.0%) participants did not smoke, and 273 (90.7%) participants remained with moderate alcohol consumption (**Table 7**).

Table 7. Overall, the level of adherence to recommended lifestyle modifications for hypertensive patients attending outpatients at Bishoftu General Hospital, Ethiopia in 2022 (n=301).

Variables	Category	Frequency	Percent (%)
Diet-related adherence	Non-adherent	127	42.2
	Adherent	174	57.8
Exercise-related adherence	Non-adherent	177	58.8
	Adherent	124	41.2
Alcohol consumption	Not moderated	28	9.3
	Moderated	273	90.7
Smoking	Ceased	274	91.0
	Did not ceased	27	9.0
Overall adherence to recommended lifestyle	Non-adherent	220	73.1
	Adherent	81	26.9

Factors associated with adherence to lifestyle modifications:

Bivariable logistic regression analysis study showed that age, marital status, educational status, occupational status, family membership, duration of hypertension, having co-morbidities, and knowledge about lifestyles were significantly associated with adherence to recommended lifestyle modifications at a p-value ≤ 0.25 . The Hosmer and Lemeshow test showed the goodness of fit test gave a p-value = 0.212 suggestive of evidence of fitness of the model. After controlling for the influence of other factors (confounders) in a multivariable logistic regression, age, educational status, duration of hypertension, having co-morbidities, and knowledge about lifestyles were found to be significantly associated with adherence to recommended lifestyle modifications at a p-value ≤ 0.05 .

Respondents in the elderly group were found to be nearly three times more adherent than respondents in the young age group (AOR 2.81; 95% CI: 1.35, 5.84). Formal education respondents were 48% less likely to be adherent to lifestyle modification (AOR = 0.52; 95% CI: 0.28, 0.96) compared to respondents with no formal education. Patients who had hypertension for long-duration were almost twice as likely to adhere to patients as short as diagnosis (AOR = 2.33; 95% CI: 1.01–5.37). Adult hypertensive patients with co-morbidities were about two (AOR=2.06; 95% CI: 1.21-3.49) times more likely to adhere to recommended lifestyle modifications than patients without co-morbidities. Patients with good knowledge about lifestyles were 58% less likely to adhere to recommended lifestyle modifications than those with less knowledge about lifestyles (AOR = 0.42; 95% CI: 0.24-0.74) (**Table 8**).

Table 8. Bivariable and Multivariable Logistic regression output indicating factors associated with Adherence to recommended lifestyle modifications among patients with hypertension attending the outpatient department at Bishoftu General Hospital, Oromia, Ethiopia, 2022 (n=301).

Variables	Category	Lifestyle adherence		COR (95%CI)	AOR (95%CI)	P-value
		Adherent N (81)	Non-adherent N (220)			
Age in years	18-35	7	13	1.00	1.00	
	36-45	10	26	1.28 (0.39-4.22)	0.92 (0.29-2.85)	0.891
	46-55	11	72	0.97 (0.39-2.42)	1.07 (0.45-2.51)	0.869
	>55	53	109	0.90 (0.16-0.77)*	2.81 (1.35-5.84) **	0.006
Marital status	single	6	10	0.45 (0.13-1.58)*	0.56 (0.14-2.20)	0.408
	Married	47	164	0.47 (0.10-2.30)	1.70 (0.37-7.79)	0.491
	Divorced	6	24	1.47 (0.35-6.15)	1.81 (0.53-6.12)	0.340
	Widowed	22	22	1.00	1.00	
Educational status	No- formal education	22	37	1.00	1.00	
	Formal-education	59	183	0.48 (0.24-0.97)**	0.52 (0.28-0.96)**	0.037
Occupational status	Employed	19	69	1.00	1.00	
	Unemployed	19	46	3.53 (0.38-32.41)	0.35 (0.04-3.06)	0.349
	Farmer	25	40	3.61 (0.39-33.44)	0.26 (0.03-2.23)	0.220
	Private business	17	56	10.65 (0.94-120.62)*	0.17 (0.021-1.48)	0.109
	Other	1	9	3.18 (0.34-29.17)	0.32 (0.03-2.77)	0.304
Family size (numbers)	<5	47	116	1.00	1.00	
	>5	34	104	0.80 (0.37-1.19)*	0.76 (0.45-1.28)	0.304
Duration of hypertension (years)	<5	21	75	1.00	1.00	
	5-10	29	89	0.85 (0.35-2.09)*	2.33 (1.01-5.37)**	0.047
	10-15	15	36	0.20 (.07-.53)	1.96 (0.88-4.36)	0.099
	>15	16	20	0.79 (.36-1.69)	1.61 (0.64-4.00)	0.304

Co-morbidities	No	35	137	1.00	1.00	
	Yes	46	83	2.01 (1.19-3.73)*	2.06 (1.21-3.49)**	0.007
Knowledge level	Poor	58	109	1.00	1.00	
	Good	23	111	0.38 (0.24-.80) *	0.42 (0.24-0.74) **	0.003
Notes: *Variables having a ($p \leq 0.25$) in bivariable analysis, **statistically significant at ($p \leq 0.05$) in the multivariable analysis.						

Discussion

This study aimed to investigate the level of adherence to lifestyle modifications and associated factors among patients with hypertension attending the outpatient department at Bishoftu General Hospital, Oromia, Ethiopia. In this study, the level of good adherence to the recommended lifestyle modification among patients with hypertension was found to be 26.9%. Age, educational status, duration of hypertension, having co-morbidities, and knowledge about lifestyle were significantly associated with adherence to lifestyle modification. So, hypertension is the most important public health problem, if poorly managed and poor adherence to a healthy lifestyle this factor that can lead to disability and mortality. As a result, maintaining a healthy lifestyle is an effective strategy for reducing hypertension.

Overall, the level of adherence to recommended lifestyle modification in this study was only 26.9%. This is low compared to studies conducted in Ghana and eastern Ethiopia that reported adherence rates of (72%) and (28.7), respectively [18,19]. The discrepancy in adherence rates between our study and other studies may be due to the various study methods (like sample size) and inadequate health promotion given to the client regarding knowledge on a healthy lifestyle of hypertension prevention and control. This study found that although many people still don't adhere to a healthy lifestyle, this increases the burden of chronic diseases like hypertension.

In this study dietary adherence was described by including more fruits, vegetables, and grains in the diet, as well as eating low-sodium and low fat. The prevalence of dietary adherence in this study was 57.8%. In contrast, in Korea, this study shows that a majority (77.5%) of the study participants followed dietary modification and another study from Addis Ababa found that only (64.7%) of the respondents were found to be adherent [20,21]. Discrepancies in local studies may be due to differences in dietary habits and the place of residence of study participants. Hypertension was successfully reduced in those who followed a recommended diet.

In this finding, exercise-related adherence was 41.2%. Similar studies conducted in Bangladesh and Georgia found slightly higher adherence rates of (46%) and (46.6%), respectively [22,23]. This finding is comparable with the adherence level of participants to exercises at a public health hospital in Addis Ababa, in which (33.9%) adhere to exercise regularly [24]. Discrepancies in the study area could be the result of hard-working circumstances, a lack of awareness of promotions for those with low educational attainment, cultural differences, and a lack of organized living conditions. This indicates that a lack of exercise adherence is a leading cause of hypertension and cardiovascular disease.

The majority in this study 90.7% of respondents were found to moderate their alcohol consumption. In similar studies conducted

in Malaysia and Korea and almost (90%) and (80%) of the study, participants were limited to alcohol consumption [14,25]. Another study conducted in Addis Ababa, Ethiopia, when compare the results shows that (74.8%) of respondents moderated their alcohol consumption [26]. This disparity can be explained by social and cultural norms that support the consumption of alcoholic beverages. This means that consuming alcohol raises the risk of hypertension.

The majority in this study 91% had never smoked before twelve months, which is consistent with studies in Zimbabwe (97%) and Turkey (83%) where the majority of respondents were found to be adherent to smoking cessation [17,27]. In a similar study in selected hospitals, in southern Ethiopia, 91.2% were non-smokers [11]. One of the leading causes of hypertension is smoking. This similarity can be explained by social and cultural practices in society that discourage smoking.

In this study, age, education level, duration of hypertension, having co-morbidities, and knowledge about lifestyles were strongly associated with adherence to the recommended lifestyle modifications.

It was found that older respondents are more adherent to lifestyle modifications than younger age groups. In a similar study conducted in the Kingdom of Saudi Arabia and Addis Ababa, Ethiopia, it was found that individuals above the age of 60 years were more likely to recommend lifestyle modifications [26,28]. The reason for the older age differences may be further explained by increased awareness of the management and control of hypertension during visits to health care providers.

Those with formal education were 48% less likely to adhere to lifestyle modification than respondents with no formal education. This study is supported by Eritrea and Gondar, Ethiopia [29,30]. A possible explanation may be related to an increase in patients' awareness of the importance of recommended lifestyle modification to prevent hypertension with increasing formal education levels.

In this study respondents who reported that they have been diagnosed longer period since diagnosis with hypertension for a short period were found more likely to be adherent. This is comparable to a study from southern Ethiopia and Ghana, which found that Patients on treatment with a long history of hypertension were more likely to adhere to lifestyle modifications [11,18]. The results showed that those who have had hypertension for less than five years are less likely to see the condition as life-threatening, while those with hypertension for more than five years are more likely to adhere to lifestyle modification. The differences are due to the continuous counseling and health education provided by healthcare providers.

This study showed that adult hypertensive patients with co-morbidities were twice as likely to adhere to the recommended lifestyle modifications compared to those without co-morbidities. It is very difficult to control hypertension if it is accompanied by other

co-morbidities. This could make it harder for the patient to adhere to a healthy lifestyle, making their conditions worse. The study was conducted in Saudi Arabia and north-eastern Ethiopia [10,28]. A possible rationale could be that patients with comorbidities visit health care providers more frequently and pay more attention to their health status, as evidenced by better commitment to lifestyle changes.

This study indicated that knowledgeable patients were 58% less likely to adhere to lifestyle modifications than less knowledgeable patients. Hypertension knowledge is an important part of the chronic care model and knowing how to prevent and control the disease is an important part of managing it. This finding was consistent with findings of studies conducted in hospitals in Gondar, Ethiopia, and Eastern Ethiopia [30,31]. This may be because poor knowledgeable patients may not understand the disease and how to prevent and manage it. It is important to increase patient access to information on risk factors and lifestyle modification recommendations.

The main limitation of this study it was conducted only at a single public health hospital and did not include patients with hypertension who were seen in private clinics. In addition, research methodologies involving self-reported measures depend largely on individuals. This method is simple but less reliable among those patients who deny poor adherence and social desirability bias, especially among smokers, and recall bias may exist.

Conclusions

This study revealed the level of adherence to recommended lifestyle modifications was low among patients with hypertension. Of the variables studied, age, educational level, duration of hypertension, having co-morbidities, and knowledge about healthy lifestyle were independent predictors of adherence to lifestyle modifications.

Abbreviations and Acronyms

AOR: Adjusted Odd Ratio; BP: Blood Pressure; CVD: Cardiovascular Diseases; DASH: Dietary Approaches to Stop Hypertension; EDHS: Ethiopian Demography and Health survey; HTN: Hypertension; HC: Health Center; JNC7: Seventh Report of Joint National Committee; Mm Hg: Millimeters of Mercury; NCD: Non-Communicable Disease; SPHMMC: St. Paul's Hospital Millennium Medical College; WHO: World Health Organization

Declaration

Author's contributions

GM, SS and TG made a substantial contribution to the conception design, acquisition, and interpretation of data. GM drafted the manuscript and carried out rigorous editorial work. All authors revised the paper critically for the intellectual contents. All authors read and approved the final manuscript

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Conflict of interest

The authors declare that they have no conflicts of interest for this work.

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