RESEARCH ARTICLE

Non-Adherence Related Factors to Antihypertensive Medications Among Hypertensive Patients on Follow up at Nedjo General Hospital in West Ethiopia

Habtamu Dame Berisa[2] and Mohammed Gebre Dedefo[1,*]

[1]*Department of Pharmacy, Wollega University, Oromia, Ethiopia*
[2]*Arjo Hospital, Oromia, Ethiopia*

Abstract:

Background:

Hypertension is an overwhelming global challenge. Increasing awareness and diagnosis of hypertension, and improving control of blood pressure with appropriate treatment are considered critical public health initiatives to reduce cardiovascular morbidity and mortality.

Objective:

To assess non-adherence-related factors to antihypertensive medications among hypertensive patients on follow up at Nedjo General Hospital.

Methods:

A cross-sectional study was conducted among hypertensive patients on follow up at Nedjo General Hospital from March 15 to May 5, 2015. A total of 172 hypertensive patients who were available during study period were included in the study. To identify the independent non-adherence-related factors, backward logistic regression analysis was used.

Results:

Only 54 (31.4%) of the study participants were adherent to their treatment. On multivariable logistic analysis non-adherence was more likely to occur among those with age of ≥55 years (Adjusted odds ratio (AOR) = 0.10, 95% CI = 0.01-0.85, p=0.035), illiteracy (AOR = 6.76, 95% CI = 1.01-45.08, p=0.049), income status of <500 Ethiopian birr (AOR = 18.51, 95% CI = 1.95-176.06, p=0.011), duration of treatments of ≥5 years (AOR = 5.41, 95% CI = 1.08-27.22, p=0.041), physical inactivity (AOR = 34.51, 95% CI = 4.66-255.89, p=0.001) and knowledge deficit about hypertension and its treatment (AOR = 7.67, 95% CI = 2.48-23.73, p<0.001).

Conclusion:

A finding of this study revealed that an adherence status of study participants was low. Thus, greater effort is needed to improve patient adherence to antihypertensive medications.

Keywords: Hypertension, Non-adherence, Hypertensive patients Antihypertensive, West Ethiopia, Blood pressure.

1. INTRODUCTION

Hypertension (HTN) is an overwhelming global challenge [1, 2]. Hypertension is defined as persistently elevated arterial Blood Pressure (BP) and it is identified as one of the most significant risk factors for Cardiovascular (CV)

* Address correspondence to this author at the Department of Pharmacy, Wollega University, Mohammed Gebre Dedefo, Oromia, Ethiopia;
Tel: +251912021296; E-mails: mohamedg@wollegauniversity.edu.et, gebremohammed@yahoo.com

disease. Increasing awareness and diagnosis of hypertension, and improving control of BP with appropriate treatment are considered critical public health initiatives to reduce CV morbidity and mortality [3].

A study done on global burden of blood-pressure-related disease revealed that Worldwide, 7·6 million premature deaths (about 13·5% of the global total) and 92 million Disability-Adjusted Life Years (DALYs) (6·0% of the global total) were attributed to high blood pressure [2]. Even though there are medications that are used to treat hypertension, because of large proportion of patients not taking these medicines as prescribed the benefits of these drugs are not being realized and this indirectly raises the issue of therapeutic adherence among hypertensive persons [4].

The most frequently used definition of adherence is "the extent to which a person's behavior – taking medication, following a diet, executing lifestyle changes – follows medical advice" [5]. Adherence has also been defined as "the extent to which patient behavior corresponds with recommendations from a health care provider" [5]. A review from the 2095 articles identified that therapeutic non-adherence occurs when an individual's health-seeking behavior lacks similarity with the recommendations as prescribed [6].

Non adherence to treatment medication and lifestyle modification is a complicated issue affecting patients' health, health expenditure, and resources' utilization while adherence to Antihypertensive Treatment (AHT) has been associated with improved blood pressure (BP), decreased hospitalizations rates, and lower medical care costs [7 - 9]. Survey conducted 2003-2004 showed only 37% of hypertensive patients have their blood pressure controlled [10]. Uncontrolled high blood pressure indirectly raises the issue of therapeutic adherence among hypertensive persons [11]. According to the WHO, poor adherence to treatment is the most important cause of uncontrolled blood pressure and only 20 to 80% of patients receiving treatment for hypertension in real life situations are considered to be "good compliers" [5].

Different studies had identified factors determining the levels of antihypertensive drug adherence such as; the complexity of the treatment, the drugs' side effects, the balance between established medical guidelines and their own convictions, communication between patient and doctor, patient's satisfaction with the healthcare system, socio-economic factors, socio-demographic factors, the cost of treatment and lack of medical insurance [3, 6, 7, 12 - 25].

This study aimed to examine adherence to antihypertensive medication and to assess factors associated with non-adherence to medications at Nedjo General Hospital. Identification of non-adherence related factors will help the healthcare professionals and patients to work on those factors to improve non-adherence. The findings of the study will also suggest strategies for improving non-adherence. As there was no study done in West Ethiopia, this study will help as a base to perform further studies.

2. METHODS AND PARTICIPANTS

2.1. Study Setting and Period

The study was conducted in Nedjo General Hospital (NGH), Nedjo town, Western Wollega zone, Oromia region, western Ethiopia which is found 496 km from Addis Ababa, a capital city of Ethiopia. The study was conducted from March 15 to May 5, 2015.

2.2. Study Design

The study was conducted using hospital based descriptive cross–sectional study design which involves quantitative methods.

2.3. Study Population

All adult hypertensive patients attending the facility on out-patient basis during the study period and attended the chronic care department for hypertension care at least for one year and volunteered to take part in the study were used for the study. A total of 172 hypertensive patients were included in the study. Patients who are critically ill, psychotic and/or unable to communicate with data collector due to other underlying medical disorder were excluded.

2.4. Data Collection Process and Quality Assurance

Data were collected using a questionnaire consisting of the 8- item morisky medication adherence scale [26] which was adapted to our set up and self-reported medication adherence questions relating to medication use and major reasons for non-adherence which were designed-based on an extensive literature review of similar studies [12, 21, 24,

27]. The questionnaire was presented to each patient with proper explanation and face to face interviews were conducted when patients came for follow up checkup. Patient medication charts were also reviewed carefully for assessing the characteristics of hypertension and antihypertensive treatment. Data collection was conducted with appropriate training of the data collectors and continuous advices to keep the quality of the data. Close supervision was made by the investigators and the collected data were checked for completeness every day.

For completeness and consistency, standardized questionnaire of English version was translated to local language Afaan Oromoo. Then, it was again translated to English and checked.

Medication adherence: Adherence to antihypertensive medications was measured using the 8-item Morisky medication adherence scale. Individual item scores were summed and those with a score of 8 were considered adherent to medication. Medium adherence corresponded to a score of 6–8, while a score of <6 was considered low adherence [26]. Medication non-adherence referred to a score of <8 (i.e., medium or low adherence).

Extra salt intake was defined as "Patients who report the addition of salt in food on table".

2.5. Data Analysis and Interpretation

After data collection, data were entered into the Statistical Package for the Social Sciences (SPSS) version 20 for analysis. Odds ratio with 95% confidence interval, along with binary and multiple logistic regression was used to assess the significance and strength of association. All factors with a p-value <0.25 in the bivariable logistic regression analysis were further entered into the multivariable model to control confounding effects. A significance level of alpha = 5% was used to identify statistically significant association.

Table 1. Socio demographic characteristic of the study participants at Nedjo General Hospital, West Ethiopia, from March 15 to May 5, 2015 (n = 172).

Variables	Categories	n (%)
Sex	Male	76 (44.2)
	Female	96 (55.8)
Age	18-34	19 (11.0)
	35-54	85 (49.4)
	55	68 (39.5)
Marital status	Single	17 (9.9)
	Married	119 (69.2)
	Divorced	21 (12.2)
	Widowed	15 (8.7)
Occupation	Employed	36 (20.9)
	Unemployed	26 (15.1)
	Student	12 (7.0)
	Farmer	84 (48.8)
	Business man or Woman	14 (8.1%)
Place of residence	Urban	78 (45.3)
	Rural	94 (54.7)
Level of education	Illiterate	75 (43.6)
	Elementary	42 (24.4)
	Secondary	22 (12.8)
	College/University	33 (19.2)
Income status (Monthly income in Birr)	<500	70 (40.7)
	500-1000	49 (28.5)
	1000-2000	21 (12.2)
	>2000	32 (18.6)

3. RESULTS

A total of 172 hypertensive patients out of the 184 cases were included in the study. Twelve of the respondents were excluded by the exclusion criteria. Of this 5 were not volunteer to participate while 7 patients, even though they are volunteer they did not fulfill the inclusion criteria because they were newly diagnosed for hypertension and medication initiation was less than one year. So the response rate was 93.5%. Majority of the respondents were females (55.8%). The mean age of the respondents was 51.5 ± 12.1 years. Out of the study participants 49.4% were in the age range of 35-54 years. More than half of the study participants 119 (69.2%) were married and 84 (48.8%) were farmers (Table **1**).

Most of the respondents, 109 (63.4%) were taking a single antihypertensive medication and 48 (27.9%) respondents were taking two antihypertensive medication. Among 172 study participants, 72 (41.9%) respondents were treated for less than two years and 51 (29.7%) were treated for ≥ 5 years. Regarding knowledge of the study participants about hypertension and its treatment, more than half of the study participants 112 (65.1%) had inadequate knowledge about hypertension and its treatment (Table **2**).

Table 2. Drug, disease and food related factors of the study participants at Nedjo General Hospital, West Ethiopia, from March 15 to May 5, 2015 (n = 172).

Variables	Categories	n (%)
Number of antihypertensive medication	1	109 (63.4)
	2	48 (27.9)
	3	15 (8.7)
Duration of treatments	<2 Years	72 (41.9)
	2-4 Years	49 (28.5)
	≥5 Years	51 (29.7)
Physical activity	Inactive	63 (36.6)
	Minimally active	76 (44.2)
	Vigorously active	33 (19.2)
Extra salt intake	Yes	59 (34.3)
	No	113 (65.7)
Cigarette smoking status	Yes	24 (14.0)
	No	148 (86.0)
Knowledge about hypertension and treatment	Yes	60 (34.9)
	No	112 (65.1)
Adherence Status	Adherent	54 (31.4)
	Non-adherent	118 (68.6)

Most of the study participants 118 (68.6%) were non-adherent to antihypertensive medications, whereas 54 (31.4%) were adherent (Table **2**). For non-adherent respondents 118 (68.6%), the major reasons for non-adherence were forgetfulness 81 (47.1%), followed by inability to buy medications 29 (16.9%) (Table **3**).
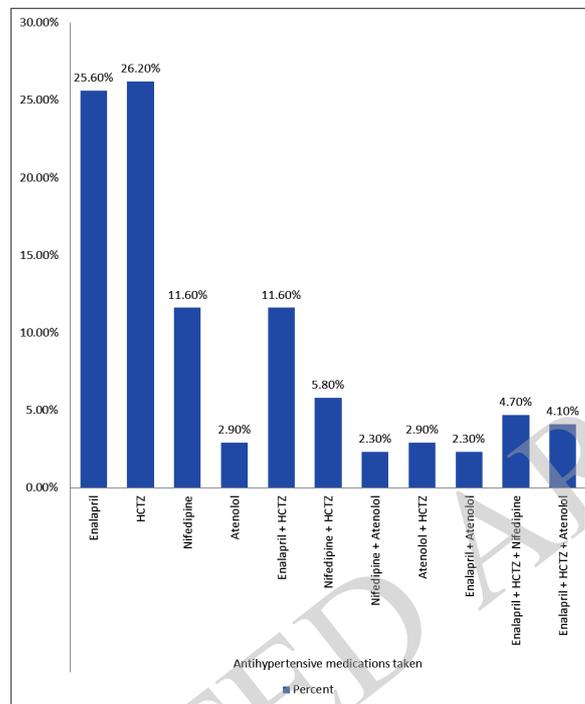
Table 3. Reason for non-adherence of the study participants at Nedjo General Hospital, West Ethiopia, from March 15 to May 5, 2015 (n = 172).

Variables	n (%)
Forget to take medications	81 (47.1)
Cannot afford to buy the medications always	29 (16.9)
Don't believe in the medication	5 (2.9)
Patient cannot swallow medication(s)	2 (1.2)

(Table 3) contd.....

Variables	n (%)
The schedule of patients work makes it impossible	1 (0.6)
Adherent	54 (31.4)

In our study regarding antihypertensive medications Hydrochlorothiazide, 45 (26.2%) and Enalapril, 44 (25.6%) were the commonly prescribed antihypertensive medications followed by Nifedipine 20 (11.6%) and a combination of Enalapril plus Hydrochlorothiazide 20 (11.6%) Fig. (**1**).

Fig. (1). Antihypertensive regimen among study participants at Nedjo General Hospital, West Ethiopia, from March 15 to May 5, 2015 (n = 172).

The bivariable analysis showed that non-adherence was associated with marital status, occupation, place of residence, level of education, income status, number of antihypertensive medication, physical activity, extra salt intake and knowledge of hypertension. However, other factors did not show statistically significant association with non-adherence (Table **4**). Majority of patients with age ≥ 55 years, patients who live in rural, patients who are illiterate and their level of education was elementary and patients with low level of Knowledge about hypertension and treatment were non-adherent to their antihypertensive medication (Table **4**).

Table 4. Bivariable analysis of factors associated with Non-adherence among hypertensive patients in Nedjo General Hospital, West Ethiopia, from March 15 to May 5, 2015.

Variables	Categories	Adherence status		P-value	COR (95% CI) for Non-adherence status
		Adherent	Non-adherent		
Sex	Male	28	48		1.00
	Female	26	70	0.172	1.57(0.82-3.00)
Age	18-34	9	10	0.231	1.00
	35-54	27	58	0.201	1.93(0.70-5.31)
	≥55	18	50	0.087	2.50(0.88-7.14)
Marital status	Single	10	7	0.096	1.00
	Married	34	85	0.017	3.57(1.26-10.15)
	Divorced	5	16	0.033	4.57(1.14-18.41)
	Widowed	5	10	0.154	2.86(0.67-12.11)

(Table 4) contd.....

Variables	Categories	Adherence status		P-value	COR (95% CI) for Non-adherence status
		Adherent	Non-adherent		
Occupation	Employed	26	10	0.000	1.00
	Unemployed	6	20	0.000	8.67(2.69-27.89)
	Student	8	4	0.714	1.30(0.32-5.29)
	Farmer	11	73	0.000	17.26(6.57-45.35)
	Business person	3	11	0.003	9.53(2.19-41.47)
Place of residence	Urban	40	38		1.00
	Rural	14	80	0.000	6.02(2.93-12.37)
Level of education	Illiterate	11	64	0.000	26.18(8.79-78.00)
	Elementary	4	38	0.000	42.75(10.99-166.22)
	Secondary	12	10	0.034	3.75(1.11-12.69)
	College/University	27	6	0.000	1.00
Income status (Monthly income in Birr)	<500	11	59	0.000	13.71(5.02-37.41)
	500-1000	11	38	0.000	8.83(3.18-24.53)
	1000-2000	9	12	0.038	3.41(1.07-10.85)
	>2000	23	9	0.000	1.00
Number of antihypertensive medication	1	27	82	0.001	1.00
	2	25	23	0.001	0.30(0.15-0.62)
	3	2	13	0.336	2.14(0.45-10.09)
Duration of treatments	<2 Years	27	45	0.174	1.00
	2-4 Years	16	33	0.585	1.238(0.576-2.66)
	≥5 Years	11	40	0.062	2.18(0.96-4.96)
Physical activity	Inactive	12	51	0.000	7.44(2.88-19.19)
	Minimally active	21	55	0.001	4.58(1.92-10.93)
	Vigorously active	21	12	0.000	1.00
Extra salt intake	Yes	8	51	0.001	4.38(1.90-10.08)
	No	46	67		1.00
Knowledge about hypertension and treatment	Yes	41	19		1.00
	No	13	99	0.000	16.43(7.43-36.35)
Cigarette smoking status	Yes	6	18	0.469	1.44(0.54-3.86)
	No	48	100		1.00

COR: Crude Odds Ratio.

Multivariable logistic regression have shown that variables such as age, level of education, monthly income status, duration of treatment, physical activity status and knowledge about hypertension and treatment were associated with non-adherence to antihypertensive medications. Factors like marital status, occupation, place of residence, number of antihypertensive medication and extra salt intake have shown significant association in bivariable analysis but the effect was absent after controlling for confounding factors (Table **5**).

Table 5. Multivariable analysis of factors associated with Non-adherence among hypertensive patients in Nedjo General Hospital, West Ethiopia, March 15 to May 5, 2015.

Variables	Categories	P-value	AOR (95% CI) for Non-adherence status
Age	18-34	0.075	1.00
	35-54	0.255	0.34(0.05-2.21)
	> 55	0.035	0.10(0.01-0.85)
Level of education	Illiterate	0.049	6.76(1.01-45.08)
	Elementary	0.002	21.62(3.17-147.38)
	Secondary	0.971	0.97(0.17-5.62)
	College/University	0.007	1.00
Income status (Monthly income in Birr)	<500	0.011	18.51(1.95-176.06)
	500-1000	0.071	7.19(0.85-61.12)
	1000-2000	0.401	2.52(0.29-21.71)
	>2000	0.031	1.00

(Table 5) contd.....

Variables	Categories	P-value	AOR (95% CI) for Non-adherence status
Duration of treatments	<2 Years	0.119	1.00
	2-4 Years	0.825	1.15(0.33-4.08)
	≥5 Years	0.041	5.41(1.08-27.22)
Physical activity	Inactive	0.001	34.51(4.66-255.89)
	Minimally active	0.005	8.49(1.91-37.84)
	Vigorously active	0.002	1.00
Knowledge about hypertension and treatment	Yes	0.000	1.00
	No		7.67(2.48-23.73)

AOR = Adjusted Odds Ratio.

4. DISCUSSION

Despite the availability of effective treatments, studies have shown that in many countries less than 25% of patients treated for hypertension achieve optimum blood pressure. Poor adherence has been identified as the main cause of failure to control hypertension [5]. In this study, only 31.4% of the study participants were adherent to their medication. This is comparable to studies reported from hospitals in Ghana and Nigeria 33.3%, Kenya 31.8%, Palestine 36.2%, Nepal 35.4% [17, 28 - 30]. When we compare the current finding to other studies done in Ethiopia, adherence to antihypertensive treatment was lower than studies done in University of Gondar Referral Hospital 64.6%, Black Lion Hospital 69.2%, Northern Ethiopia 52.9%, Adama Referral Hospital 59.5% [13 - 16]. Similarly the adherence to antihypertensive treatment found in current study was lower than studies done in Ghana 68.7%, Nigeria 44.7%, Zambia 83%, Malaysia 48.7%, Brazil 52.9%, Italy 48.6%, USA 57.6%, Pakistan 77%, United Arab Emirates 54.4% [12, 18 - 25]. The reason for the difference might be due to better access and skilled health care professionals for the patients in these regions and countries. It could also be due to participants' better knowledge toward hypertension and its management than the current study area. The results of this study suggest that greater effort is needed to improve patient adherence to antihypertensive medications at Nedjo General Hospital. To improve adherence the following intervention should be done: education on the use of medicines, management of disease and treatment in conjunction with patients, adherence education, multidisciplinary care, training in monitoring adherence, more intensive intervention by increasing the number and duration of contacts [5]. In addition involving the patient's family members and friends in providing education on the importance of adherence to antihypertensive medications and telling them the consequences if the patient is not adherent to his medication should also be targeted/ adopted.

The results obtained from multivariable logistic regression analysis of the present study revealed that younger age, being illiterate, income status of <500 Ethiopian birr, duration of treatments of ≥5 years, physical inactivity and knowledge deficit about hypertension were associated with non-adherence.

In this study, age was significantly associated (p=0.035) with non-adherence observed in younger age. The present finding is consistent with that reported by other studies from Adama Referral Hospital [16], in hospitals of Ghana and Nigeria [17], Nigeria [18] and Pakistan [24]. A probable reason for better adherence in elderly might be because of a better care given by the family members for patients in this age group. The other reason could be patients with younger age could be reluctant for their medication. Older people might have more concern about their health than younger patients, so that older patients' non-compliance is non-intentional in most cases. As a result, if they can get the necessary help from healthcare providers or family members, they may be more likely to be compliant with therapies [6].

Present study revealed that participants who were illiterate (p=0.049) and participants whom educational status was elementary (p=0.002) were significantly associated with non-adherence. Similar results were reported from studies in hospitals of Ghana and Nigeria [17], Zambia [19], Pakistan [24] and Nepal [30]. This could be due to lack of awareness about hypertension, its management and medications for this condition in this study area. It may be expected that patients with higher educational level should have better knowledge about the disease and therapy and therefore be more compliant [6]. To improve adherence in illiterate patients and patients with low level of education, interventions to optimize adherence must go beyond the provision of advice and prescriptions; supplementing oral teaching with written materials are required to improve adherence [5]. Using simple, everyday language, when explaining about the disease and giving instructions will also improve their adherence.

Different studies have identified inability to afford the cost of medications as an important barrier to medication adherence [14, 17, 24, 29]; however these studies did not show association of medication adherence with level of income. Unlike thus studies, this study showed an association between level of income and non-adherence (p=0.011)

with non-adherence 18.51 times more likely to occur in patients with low income than higher income. The reason could be because of patients with low income cannot able to afford the cost of medication.

In this study, duration of treatment was significantly associated (p=0.041) with non-adherence and patients on hypertension treatment for more than or equal to five years were 5.41 times more likely to be non-adherent than those with duration of treatments of less than two years. Similar finding was reported from study done in Black Lion Hospital [14]. This could be because long use of drugs would burden the patient and lead to forget their medication and discontinue medication too soon. Beside once the patient blood pressure had got stabilized they might felt to be in better condition.

A study done in Nigeria [27] revealed that exercise is a facilitator for adherence to antihypertensive medication. The result of present study showed that, physical inactivity was significantly associated (p=0.001) with non-adherence. Physicians should help patients find an activity that they enjoy, because enjoyment will increase their adherence [31].

In this study, lack of knowledge about hypertension and its treatment was significantly associated with non-adherence. The present finding is consistent with that reported by other studies from University of Gondar Referral Hospital [13], Adama Referral Hospital [16], in hospitals of Ghana and Nigeria [17], Pakistan [24], United Arab Emirates [25] and Congo [32]. Right knowledge about HTN and its treatment creates a clear understanding and avoids confusion about the treatment and the disease condition [5].

The present study revealed that the major reasons for non-adherence were forgetfulness followed by inability to buy medications. To improve non adherence related to forgetfulness we recommend the patients to use medication boxes with dates/times written on them ("Pill organizers") or setting an alarm clock. For patients with lack of finance, we recommend the government to find a means in which patients with lack of finance that cannot afford the cost of medication can get the medications; for example providing medications for free for patients that cannot afford the cost of medication, creating drug discount cards that can be helpful to patients who can afford to pay part of their prescription costs.

Strengths of our study were that adherence to antihypertensive medications was measured by using the 8-item Morisky medication adherence scale and data were collected from patients' card and by face to face interview with patients; this helped us to have more complete information. Limitations of our study were that, this study was conducted only in government District Hospitals in Nedjo Town and did not include patients who attended private Hospitals. Therefore results cannot be generalized to all hypertension patients in Nedjo woreda. However, the results have important insights for same hospitals within the same characteristics. Self-reporting was used for measuring adherence. This method has the disadvantages of recall bias and eliciting only socially acceptable responses and hence, may, lead to overestimation of some of the results, because they are self- reports by the patients which can be misleading.

CONCLUSION

In general, a finding of this study revealed that an adherence status of study participants was low. Thus greater effort is needed to improve patient adherence to antihypertensive medications. The major reasons for non-adherence among the study participants were forgetfulness, followed by inability to buy medications. Factors such as age, educational level, income status, duration of treatments, physical activity and knowledge deficit about hypertension and its treatment were significantly associated with non-adherence. We recommend that practitioners should always look for poor adherence and enhance adherence by emphasizing the value of a patient's regimen, making the regimen simple, and customizing the regimen to the patient's lifestyle. Health care professionals should assist hypertensive patients develop systems that will remind them to take their medications. There should be total collaboration between all the health professionals in the institution to promote patient education and medication counseling.

ETHICS APPROVAL AND CONSENT TO PARTCIPATE

Ethical clearance was obtained from the Ethical Review Committee of Wollega University, College of Medical and Health Sciences. This committee wrote a formal letter of permission to Nedjo General Hospital to seek its cooperation and access to the data. Permission was obtained from the medical director's office of the hospital.

HUMAN AND ANIMAL RIGHTS

No Animals were used in this research. All human research procedures followed were approved by the Ethical Review Committee of Wollega University.

CONSENT FOR PUBLICATION

After obtaining the required permission from the hospital, patient's written informed consent was obtained after explaining about the purpose and procedures of the study. Patients were expected to be fully voluntary to participate in the study. In addition all the responses were kept confidential.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

REFERENCES

[1]   Perkovic V, Huxley R, Wu Y, Prabhakaran D, MacMahon S. The burden of blood pressure-related disease: a neglected priority for global health. Hypertension 2007; 50(6): 991-7.
[http://dx.doi.org/10.1161/HYPERTENSIONAHA.107.095497] [PMID: 17954719]

[2]   Lawes CM, Vander Hoorn S, Rodgers A. Global burden of blood-pressure-related disease, 2001. Lancet 2008; 371(9623): 1513-8.
[http://dx.doi.org/10.1016/S0140-6736(08)60655-8] [PMID: 18456100]

[3]   Dipiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM. Pharmacotherapy, a pathophysiologic approach. 9th ed. McGraw-Hill Education 2014.

[4]   Starr B, Sacks R. Improving outcomes for patients with chronic disease: The Medication Adherence Project. New York City: MAP 2010.

[5]   Burkhart PV, Sabaté E. Adherence to long-term therapies: evidence for action. J Nurs Scholarsh 2003; 35(3): 207.
[PMID: 14562485]

[6]   Jin J, Sklar GE, Min Sen Oh V, Chuen Li S. Factors affecting therapeutic compliance: A review from the patient's perspective. Ther Clin Risk Manag 2008; 4(1): 269-86.
[PMID: 18728716]

[7]   Sarradon-Eck A, Egrot M, Blance MA, Faure M. Anthropological approach of adherence factors for antihypertensive drugs. Healthcare Policy 2010; 5(4): e157-75.
[PMID: 21532764]

[8]   Pimenta E, Gaddam KK, Oparil S, *et al.* Effects of dietary sodium reduction on blood pressure in subjects with resistant hypertension: results from a randomized trial. Hypertension 2009; 54(3): 475-81.
[http://dx.doi.org/10.1161/HYPERTENSIONAHA.109.131235] [PMID: 19620517]

[9]   Degli Esposti L, Saragoni S, Benemei S, *et al.* Adherence to antihypertensive medications and health outcomes among newly treated hypertensive patients. Clinicoecon Outcomes Res 2011; 3: 47-54.
[http://dx.doi.org/10.2147/CEOR.S15619] [PMID: 21935332]

[10]   Ong KL, Cheung BM, Man YB, Lau CP, Lam KS. Prevalence, awareness, treatment, and control of hypertension among United States adults 1999-2004. Hypertension 2007; 49(1): 69-75.
[http://dx.doi.org/10.1161/01.HYP.0000252676.46043.18] [PMID: 17159087]

[11]   Brown MT, Bussell JK. Medication adherence: WHO cares? Mayo Clin Proc 2011; 86(4): 304-14.
[http://dx.doi.org/10.4065/mcp.2010.0575] [PMID: 21389250]

[12]   Jambedu Ha. Adherence to anti-hypertensive medication regimens among patients attending the G.P.H.A. hospital in takoradi – Ghana 2006.

[13]   Ambaw AD, Alemie GA. W/Yohannes SM, Mengesha ZB. Adherence to antihypertensive treatment and associated factors among patients on follow up at University of Gondar Hospital, Northwest Ethiopia. BMC Public Health 2012; 12: 282.
[http://dx.doi.org/10.1186/1471-2458-12-282] [PMID: 22490130]

[14]   Hareri HA, Abebe M, Asefaw T. Assessments of adherence to hypertension managements and its influencing factors among hypertensive patients attending black lion hospital chronic follow up unit, Addis Ababa, Ethiopia-a cross-sectional study. IJPSR 2013; 4(3): 1086-95.

[15]   Ali MA, Bekele ML, Teklay G. Antihypertensive medication non-adherence and its determinants among patients on follow up in public hospitals in Northern Ethiopia. Inter J Clinic Trials 2014; 1(3): 95-104.
[http://dx.doi.org/10.5455/2349-3259.ijct20141103]

[16]   Hareri HA, Gedefaw M, Simeng B. Assessment of prevalence and associated factors of adherence to antihypertensive agents among adults on follow up in adama referal hospital, east shoa, ethiopia-cross sectional study. Int J Curr Microbiol Appl Sci 2014; 3(1): 760-70.

[17]   Boima V, Ademola AD, Odusola AO, *et al.* Factors associated with medication nonadherence among hypertensives in ghana and nigeria. Inter J Hypertens 2015.

[18]   Ajayi EA, Adeoti AO, Ajayi IA, Ajayi AO, Adeyeye VO. Adherence to antihypertensive medications and some of its clinical implications in patients seen at a tertiary hospital in nigeria. IOSR J Dental Med Sci 2013; 8(4): 36-40.
[http://dx.doi.org/10.9790/0853-0843640]

[19]   Mweene MD, Banda J, Andrews B. M-Mweene M, SLakhi. Factors associated with poor medication adherence in hypertensive patients in lusaka, zambia. Med J Zambia 2010; 37(3): 252-61.

[20]   Suleiman A, Sulaiman S, Albarq A. Hospital admission and poor adherence to antihypertensive therapy: Is there any relationship? Int J Pharm Pharm Sci 2009; 2(1): 38-46.

[21]   Oliveira-Filho AD, Barreto-Filho JA, Neves SJ, Lyra Junior DP. Association between the 8-item morisky medication adherence scale (MMAS-8) and blood pressure control. Arq Bras Cardiol 2012; 99(1): 649-58.
[http://dx.doi.org/10.1590/S0066-782X2012005000053] [PMID: 22688844]

[22]   Mazzaglia G, Ambrosioni E, Alacqua M, *et al.* Adherence to antihypertensive medications and cardiovascular morbidity among newly diagnosed hypertensive patients. Circulation 2009; 120(16): 1598-605.
[http://dx.doi.org/10.1161/CIRCULATIONAHA.108.830299] [PMID: 19805653]

[23]   Daugherty SL, Powers JD, Magid DJ, *et al.* The association between medication adherence and treatment intensification with blood pressure control in resistant hypertension. Hypertension 2012; 60(2): 303-9.
[http://dx.doi.org/10.1161/HYPERTENSIONAHA.112.192096] [PMID: 22733464]

[24]   Hashmi SK, Afridi MB, Abbas K, *et al.* Factors associated with adherence to anti-hypertensive treatment in Pakistan. PLoS One 2007; 2(3): e280.
[http://dx.doi.org/10.1371/journal.pone.0000280] [PMID: 17356691]

[25]   Bader RJ, Koprulu F, Hassan NA, Ali AA, Elnour AA. Predictors of adherence to antihypertensive medication in northern United Arab Emirates. East Mediterr Health J 2015; 21(5): 309-18.
[http://dx.doi.org/10.26719/2015.21.5.309] [PMID: 26343119]

[26]   Morisky DE, Ang A, Krousel-Wood M, Ward HJ. Predictive validity of a medication adherence measure in an outpatient setting. J Clin Hypertens (Greenwich) 2008; 10(5): 348-54.
[http://dx.doi.org/10.1111/j.1751-7176.2008.07572.x] [PMID: 18453793]

[27]   Odusola AO, Hendriks M, Schultsz C, *et al.* Perceptions of inhibitors and facilitators for adhering to hypertension treatment among insured patients in rural Nigeria: a qualitative study. BMC Health Serv Res 2014; 14: 624.
[http://dx.doi.org/10.1186/s12913-014-0624-z] [PMID: 25491509]

[28]   Achieng' L, Joshi MD, Ogola EN, Karari E. Adequacy of blood pressure control and level of adherence with antihypertensive therapy. East Afr Med J 2009; 86(11): 499-506.

[29]   Zyoud SH, Al-Jabi SW, Sweileh WM, Morisky DE. Relationship of treatment satisfaction to medication adherence: findings from a cross-sectional survey among hypertensive patients in Palestine. Health Qual Life Outcomes 2013; 11: 191.
[http://dx.doi.org/10.1186/1477-7525-11-191] [PMID: 24195638]

[30]   Khan GM, Thapa RK, Khakurel A, Shrestha G, Katila N, Bhurtel S. Medication adherence and blood pressure control among hypertensive patients of pokhara valley. JHAS 2013; 3(1): 64-7.

[31]   Wexler R, Aukerman G. Nonpharmacologic strategies for managing hypertension. Am Fam Physician 2006; 73(11): 1953-6.
[PMID: 16770925]

[32]   Lulebo AM, Mutombo PB, Mapatano MA, *et al.* Predictors of non-adherence to antihypertensive medication in Kinshasa, Democratic Republic of Congo: a cross-sectional study. BMC Res Notes 2015; 8: 526.
[http://dx.doi.org/10.1186/s13104-015-1519-8] [PMID: 26427798]