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Socio-demographic profile, lifestyle changes and co-morbid ailments as predictors of medication adherence among hypertensive patients attending federal teaching hospital, ido-ekiti, southwestern, Nigeria

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Abstract

Background: Non-adherence to anti-hypertensive medications is a modifiable risk factor for uncontrolled hypertension. Despite the availability of tolerable anti-hypertensive drugs, majority of patients are still not adherent to their medications.

Aim: To investigate Socio-demographic profile, lifestyle changes and comorbid ailments as predictors of medication Adherence among hypertensive patients attending Federal Teaching Hospital, Ido-Ekiti, Southwestern, Nigeria.

Methods: Hospital-based cross-sectional study was conducted on 356 hypertensive patients on follow up. Systematic random sampling technique was adopted to recruit the 356 respondents. Semi-structured interviewer administered questionnaire was employed to seek information on respondents' socio-demographic characteristics, lifestyle changes, comorbid ailments, and number of antihypertensive medications. Adherence level was determined using the Morisky's Medication Adherence Scale. Data was analyzed using SPSS 20. Multivariate logistic regression analysis was used to identify the predictors of medication adherence.

Results: The prevalence of medication adherence was 60.4%. In multivariate analysis; male gender (OR, 15.85, 95% CI: 4.33 – 58.11) level of education (OR, 16.94, 95% CI: 1.13 – 253.06) habits of salt usage (OR, 284, 95% CI: 29.35 – 2748.37) and two anti-hypertensive drugs (OR, 15.13, 95% CI: 4.78 – 47.867) were the predictors of good medication adherence. On the other hand, trading (OR, 0.13, 95% CI: 0.02 – 0.78) was associated with poor medication adherence.

Conclusion: The prevalence of medication adherence was low. Trading was the predictor of poor medication adherence. Therefore, clinicians and other stakeholders should target this set of occupation and provide qualitative health education to improve their medication adherence level.

Abbreviations: FTH: Federal Teaching Hospital; BMI: Body Mass Index; BP: Blood Pressure; AOR: Adjusted Odds Ratio; OR Odds Ratio; CI: Conference Interval.

Introduction

Hypertension is a global public health importance and a major contributory factor for cardiovascular disease with significant morbidity and mortality [1]. Hypertension accounted for annual death of 9.4 million globally and by year 2025, an estimated 2 billion people will suffer from hypertension [2]. Despite the increasing awareness of the burden of hypertension among the people worldwide, and the improvement in diagnostic and therapeutic interventions with evidence-based reduction of cardiovascular risk, majority of the people blood pressure still remain uncontrolled [3,4]. Reasons for the poorly controlled blood pressure are multi-factorials with poor medication adherence identified as a major modifiable risk factor [4,5]. Adherence to antihypertensive treatment is the degree by which a patient follows the agreed recommended regimen with their physician either by taking medication, following a diet and or executing lifestyle changes [5]. Globally, recent study conducted by Abegaz et al., revealed that 45.3% of patients with hypertension were non-adherent to their anti-hypertensive medication, with 62.5% reported among African patients

[6]. Consequences of non-adherence ranges from untold financial burden (due to frequent hospitalization and unnecessary change of medication) to reduce quality of life of the patient and treatment withdrawal [5,7].

Adherence to medication is affected by complex interplay of several factors which may include patient-centered factors like socio-demographic characteristics and lifestyle changes [8,9]. Study by Odusola et al., has established rate of tobacco and alcohol use as factors contributing to poor medication adherence [10]. Other factors affecting medication adherence are therapy-related factors like dosing, types and side effects of the anti-hypertensive medication and the disease related factors including co-morbid ailments [8-10]. Studies have established a link between poor medication adherence, uncontrolled blood pressure and increased risk of cardiovascular morbidity and mortality [11,12].

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Currently, there are paucity of data on adherence to anti-hypertensive medications in Ido-Ekiti, Southwestern Nigeria. Identifying the predictors of medication adherence in this study area would provide answers on how best to achieve effective treatment adherence among the study population. The objectives of this study therefore are:

1. To determine the prevalence of medication adherence among the study respondents,

2. To investigate the socio-demographic profile, lifestyle changes and comorbid ailments as predictors of medication Adherence among hypertensive patients on follow up at Federal Teaching Hospital (FTH), Ido-Ekiti, Southwestern Nigeria.

The research questions: The research answered the following questions:

1. What is the prevalence of medication adherence among the study respondents?

2. What is the association between socio-demographic profile and medication Adherence among the respondents?

3. What is the association between lifestyle changes and medication Adherence among the respondents?

4. What is the association between co-morbid ailments and medication Adherence among the respondents?

5. What is the association between number of antihypertensive medications taken by the respondents and medication adherence?

The following null hypothesis were tested at 0.05 level of significance:

Null hypothesis 1: There was no statistically significant relationship between socio-demographic profile and medication adherence among the respondents.

Null hypothesis 2: There was no statistically significant relationship between lifestyle changes and medication adherence among the respondents.

Null hypothesis 3: There was no statistically significant relationship between comorbid ailments and medication adherence among the respondents.

Null hypothesis 4: There was no statistically significant relationship between number of antihypertensive medications taken by the respondents and medication adherence.

Materials and methods

Study area: This study was conducted at the Family Medicine Department of FTH Ido-Ekiti, Southwestern Nigeria. Ido-Ekiti is the Headquarter of Ido-Osi Local Government which is about 15 km from Ado-Ekiti, the State capital. The hospital serves as a referral centre for patients from private and government-owned hospitals. The hospital is 180 bedded and serves as accredited centre for residency training by both the National Postgraduate Medical College and West Africa College of Physicians.

Study design: This was a hospital-based cross-sectional analytical survey.

Study population: The study population was all hypertensive patients on follow-up at FTH, Ido- Ekiti, Southwestern Nigeria.

Inclusion criteria: Patients aged 18 years and above, known hypertensive and consented to the study and who were on anti-hypertensive medication for at least 3 months were included.

Exclusion criteria: Newly diagnosed and critically ill hypertensive patients were excluded.

Sample size determination: Representative sample size for the study was determined using a prevalence of medication non-adherence of 49.5% in Nigeria, at 5% margin of error and 95% confidence level [13]. Based on these assumptions a minimum sample size of 318 was calculated using the sample size formula

$n=Z^2 (P–P1)/d2$ [14]. However, in order to allow for unexpected data losses, an attrition rate of 10% was added and sample size of 356 was calculated and used for this study.

Sampling technique and recruitment procedure: A systematic random sampling technique was used to select the 356 respondents who fulfilled the inclusion criteria. The medical record of hypertensive patients on follow up at Family Medicine Clinic of FTH Ido-Ekiti showed that in the year 2019, an average of 20 patients on follow-up were seen daily. This translated to 100 patients per week (Monday to Friday) and 1300 (sample frame) patients over a period of 13 weeks that the study was conducted. Using the formula k=N/n, where k represented sampling interval, N represented the sample frame (1300), and n represented the minimum sample size of 356. The sampling interval k=4. The first respondent was selected by simple random sampling and thereafter, every 4th respondent was selected by systematic random sampling until the sample size 356 was attained. A sticker was placed on each of the selected folder to avoid re-sampling at the subsequent clinics.

Data quality assurance: Eligibility of the respondents for the study was determined using inclusion criteria. The method and objectives of the study were carefully explained to the respondent individually after which the written informed consent was obtained by appending signature or thumb print for consent to participate in the study. The data was collected using a pre-tested semi structured interviewer administered questionnaires. The adopted part of the questionnaires was validated by subjecting to face and content validity. The reliability of the instrument was determined using cronbach alpha and a reliability coefficient of 0.83 was obtained which was within acceptable limits. To ensure construct validity, the pretesting of the questionnaires was carried out on 20 hypertensive patients on follow up who were selected haphazardly at the Family Medicine Clinic of the Ekiti State University Teaching Hospital (EKSUTH) and lasted for four days. The pretesting was to see to the applicability of the instrument and recruitment procedure. Feedback from the pretest and validity assessment led to some modifications in the questionnaire. The questionnaires were translated from English to Yoruba language for those who did not understand English with the assistance of the interpreter while back translated to English language was subsequently done to maintain response consistency. The questionnaires took between 20 to 25 minutes to complete.

Data collection instruments: The main instrument for data collection were the pretested semi-structured interviewer administered questionnaires and data collection forms. The questionnaire was grouped into five sections. The first four sections (A-D) were the independent variables while section E was the dependent variable. Section A assessed the social demographic characteristics of the respondents including the duration of the hypertension. Session B assessed the lifestyle changes with respect to alcohol and tobacco use and usage of salt. These were all self-reported. Section C assessed the co-morbid ailment as retrieved

from the folder of each respondent. Section D assessed the number of antihypertensive medication that the patient was currently taking as retrieved from the folder. Section E assessed the patient medication adherence using the Morisky's medication adherence scale (MMAS-8). The scale consists of eight (8) items adherence measure designed to evaluate medication adherence in respondent with hypertensive and has been validated and found to be reliable in a number of medication adherence studies [15,16]. Answers consistent with adherence were scored as 1. Scores are added and graded into High adherence (0-2), Medium adherence (3-5) and Low adherence (6-8). For the purpose of this study, the score was dichotomized into "adherent" and "non-adherent". Adherent means high adherence while non inherent means medium and low adherence.

Clinical parameters of the respondents

Blood Pressure (BP): A good accosson brand of mercury sphygmomanometer with the appropriate cuff size was used to measure the B.P of the respondents. The systolic Blood Pressure (SBP) was taken at the first phase of Korotkoff sound while the diastolic blood pressure (DBP) was taken at the disappearance of the Korotkoff sound. The process was repeated after about 5 minutes and the average measurement of the SBP and DBP was recorded as mean SBP and DBP for each respondent. The reading of B.P was done by a senior resident doctor.

Body Mass Index (BMI): Body weight was measured to the nearest 0.1kg while height was measured to the nearest 0.1cm in the standing position using a portable height board. BMI was calculated as weight in kilogram divided by the square of the height (in Metre Square). The BMI $\leq 18 kg/m^2$ was described as underweight; 18- $24.9 kg/m^2$ as normal; 25- $29.9 kg/m^2$ as overweight, and $\geq 30 kg/m^2$ as Obese.

Data entry and analysis

Data was checked, cleaned and entered into EPI info version 7 and then it was exported to SPSS version 20.0 for analysis. Computations tabulation of proportions, percentages and another summary statistic were done. Chi-square analysis was used to determine the significance of association. Mean value was compared with student-t-test. Chi-square (X^2) and Fisher's exact test were used to compare proportion of categorical variables. A P–value <0.05 was considered significant. Binary logistic regression was done to identify the predictors of medication adherence. Variables which were found to have an association with the outcome variable in the bi-variate regression analysis were entered to the multivariate logistic regression model. The magnitude of the association between independent and dependent variables was measured using odds ratios and 95% Confidence Interval (CI) with significant level (p-value < 0.05).

Results

A total of 356 respondents were studied. Their mean age was 63.4±11.5 years with female 59.6% to male 40.4%. Majority, 260 (73.0%) were married. Respondents who were traders were 161 (45.2%). Over one-third 141 (39.6%) had at least tertiary level of education. Majority, 295 (82.9%) were monogamous in family setting and 347 (97.5%) were Yorubas. Most of them, 245 (68.5%) lived above the poverty level. Over one-third, 138 (38.8%) had family history of hypertension, with 52 (37.7%) reported hypertension to be present in both of their parents. More than one-third, 148 (41.6%) have been diagnosed of hypertension for over a year with 139 (39.0%) over five years. There was statistically significant association between medication adherence and age (p<0.001), sex (p<0.001), marital status (p<0.001), occupation

(p<0.001), education (p<0.001), income (0.001), family history of hypertension, (p<0.001), and duration of hypertension (p<0.001) (Table 1).

Majority, 300 (84.3%) did not consume alcohol and nearly all, 353 (99.2%) did not smoke tobacco. Majority, (238 66.9%) cooked their food with salt. One-third, 124 (34.8%) were overweight and only 95 (15.4%) were obese. There was statistically significant association between medication adherence and alcoholic intake (p<0.001), tobacco-use (p<0.002), salty food (p<0.001) and BMI (p<0.002) (Table 2).

Diabetes, 130 (31.5%), dyslipidemia 53 (14.9%), obesity, 49 (13.8%) osteoarthritis, 111 (31.2%) and Peptic Ulcer Disease PUD, 51 (14.3%) were the common co-morbid ailments harbor by the respondents. There was statistically significant association between medication adherence and dyslipidemia (p<0.031), obesity (p<0.010) and osteoarthritis (p<0.001) (Table 3).

More than 221 (62.1%) respondents took at least two antihypertensive medications. There was statistically significant association between medication adherence and numbers of antihypertensive medication (p<0.001) (Table 4).

In all, 215 (60.4%) of the respondents were adherents and 14 (39.6%) were non adherents to their medications. Therefore, the prevalence of medication adherence was 60.4% (Table 5).

Using multivariate logistic regression analysis for factors that were predictors of medication adherence; Male sex (OR, 15.85, 95% CI: 4.33 - 58.11), Secondary Education (OR, 16.94, 95CI: 1.13 - 253.06), Tertiary education (OR, 11.67, 96% CI: 1.50 – 90.28), Eating non salty food, (OR, 284.0, 95%CI: 29.35 - 2748.37), cooked food with salt (OR, 46.43, 95% CI: 11.89 - 181.31), add salt on cooked food (OR, 17.50, 95% CI: 2.53 - 121.09), and taking two antihypertensive medications (OR, 15.13, 95% CI: 4.78 – 47.86), were the predictors of good medication adherence. On the other hand, being a trader (OR, 0.13, 95% CI: 0.02- 0.78) was associated with predictor of poor medication adherence (Table 6).

Discussion

The mean age of 63.4 + 11.5 years found in this study was close to 60.67 + 13.85 obtained by Gabriel et al. [17] at the same study area and 62.8 + 10.9 years recorded in a study from Turkey [18]. This finding was not surprising because most of the chronic medical conditions develop during the middle age period.

In this study, the prevalence of medication adherence was 60.4%. This is fairly good given the fact that adherence to chronic medications is estimated to be around 30 to 50% [8]. The finding in this study is also higher than 40.2% reported in Zimbabwe [19] and 53.0% in Kano, North-central Nigeria [20]. The differences with our findings may be explained by our study area with majority of the respondents being educated to a tertiary level and who are likely to be enlightened about the need to have proper health seeking behavior irrespective of their genders [21]. Previous studies have linked high level of education to increase patient awareness of health and disease, increase self-care practices and increase medication adherence [21,22].

The adherence rate of 60.4% in this study is close to but slightly higher than 57.2% reported in Oshogbo also in Southwestern Nigeria [23]. The similarity with our finding could be due to related study design, socio-demographic characteristics and study population. Both studies are hospital-based within the same geographical region of Southwestern Nigeria which is known for region with increased health literacy [23,24]. Studies have linked the high health literacy

Table 1. Relationship between socio-demographic characteristics and medication. *One-way ANOVA followed with Tamhane T2 post-hoc tests, mean difference is sig. at $p < 0.05$ between low vs high and medium vs high

Adherence Variables	Medication Adherence n (%)			Total	χ^2	p- value
	Low	Medium	High			
Age group (yrs)						
< 40	0 (0.0)	0 (0.0)	10 (100.0)	10 (100.0)	58.328	< 0.001
40 – 49	0 (0.0)	0 (0.0)	37 (100.0)	37 (100.0)		
50 – 59	9 (13.0)	11 (15.9)	49 (71.0)	69 (100.0)		
60 – 69	36 (27.7)	20 (15.4)	74 (56.9)	130 (100.0)		
≥ 70	29 (26.4)	36 (32.7)	45 (40.9)	110 (100.0)		
Mean ± SD	68.6 ± 7.8	68.5 ± 9.6	60.0 ± 11.9	63.4 ± 11.5	27.387	< 0.001*
Sex						
Male	13 (9.0)	29 (20.1)	102 (70.8)	144 (100.0)	20.672	< 0.001
Female	61 (28.8)	38 (17.9)	113 (53.3)	212 (100.0)		
Marital status						
Single	0 (0.0)	0 (0.0)	2 (100.0)	2 (100.0)	42.291	< 0.001
Married	38 (14.6)	40 (15.4)	182 (70.0)	260 (100.0)		
Separated	2 (33.3)	2 (33.3)	2 (33.3)	6 (100.0)		
Widow	34 (38.6)	25 (28.4)	29 (33.0)	88 (100.0)		
Occupation						
Civil servants	8 (8.2)	0 (0.0)	90 (91.8)	98 (100.0)	87.933	< 0.001
Traders	53 (32.9)	36 (22.4)	72 (44.7)	161 (100.0)		
Farmers	4 (12.9)	6 (19.4)	21 (67.7)	31 (100.0)		
Retirees	3 (6.5)	15 (32.6)	28 (60.9)	46 (100.0)		
Unemployed	6 (30.0)	10 (50.0)	4 (20.0)	20 (100.0)		
Education						
None	29 (39.2)	18 (24.3)	27 (36.5)	74 (100.0)	67.51	< 0.001
Primary	27 (27.6)	23 (23.5)	48 (49.0)	98 (100.0)		
Secondary	8 (18.6)	14 (32.6)	21 (48.8)	43 (100.0)		
Tertiary	8 (6.3)	9 (7.1)	109 (86.5)	126 (100.0)		
Postgraduate	2 (13.3)	3 (20.0)	10 (66.7)	15 (100.0)		
Family type						
Monogamous	53 (18.0)	59 (20.0)	183 (62.0)	295 (100.0)	8.629	0.013
Polygamous	21 (34.4)	8 (13.1)	32 (52.5)	61 (100.0)	12	
Ethnicity						
Yoruba	74 (21.3)	65 (18.7)	208 (59.9)	347 (100.0)	2.438	0.296
Ibo	0 (0.0)		2 (22.2)	7 (77.8)	9 (100.0)	
Income						
< NGN 500 / day	40 (36.0)	32 (28.8)	39 (35.1)	111 (100.0)	43.667	< 0.001
≥ NGN 500 / day	34 (13.9)	35 (14.3)	176 (71.8)	245 (100.0)		
Family history of hypertension						
Yes	35 (25.4)	13 (9.4)	90 (65.2)	138 (100.0)	29.169	< 0.001
No	24 (13.8)	39 (22.4)	111 (63.8)	174 (100.0)		
Don't know	15 (34.1)	15 (34.1)	14 (31.8)	44 (100.0)		
History of hypertension						
(n = 138)						
In both parents	15 (28.8)	1 (1.9)	36 (69.2)	52 (100.0)	7.35	0.119
Father only	9 (31.0)	3 (10.3)	17 (58.6)	29 (100.0)		
Mother only	11 (19.3)	9 (15.8)	37 (64.9)	57 (100.0)		
Duration of hypertension						
< 6 months	3 (11.1)	0 (0.0)	24 (88.9)	27 (100.0)	25.682	< 0.001
6 - 12 months	6 (14.3)	9 (21.4)	27 (64.3)	42 (100.0)		
1 - 5 years	23 (15.5)	26 (17.6)	99 (66.9)	148 (100.0)		
> 5 years	42 (30.2)	32 (23.0)	65 (46.8)	139 (100.0)		

Table 2. Relationship between medication adherence and lifestyle changes. * One-way ANOVA followed with Tamhane T2 post-hoc tests, ** Mean difference is sig. at P<0.05.

Variables	Medication Adherence n (%)			Total	χ²	p- value
	Low	Medium	High			
Frequency of Alcohol consumption						
None	66 (22.0)	52 (17.3)	182 (60.7)	300 (100.0)	35.946	< 0.001
Once a month	0 (0.0)		6 (35.3)	11 (64.7)	17 (100.0)	
Once weekly	8 (61.5)	0 (0.0)		5 (38.5)	13 (100.0)	
Thrice a week	0 (0.0)		9 (45.0)	11 (55.0)	20 (100.0)	
Everyday	0 (0.0)		0 (0.0)		6 (100.0)	6 (100.0)
Smoking						
No	74 (21.0)	64 (18.1)	215 (60.9)	353 (100.0)	13.05	0.001
Yes (passive)	0 (0.0)		3 (100.0)	0 (0.0)		3 (100.0)
Salty food						
None	4 (10.0)	11 (27.5)	25 (62.5)	40 (100.0)	58.66	< 0.001
Food cooked with salt	31 (13.0)	48 (20.2)	159 (66.8)	238 (100.0)		
Add salt on cooked food	6 (31.6)	2 (10.5)	11 (57.9)	19 (100.0)		
Both (Cooked/ Added)	33 (55.9)	6 (10.2)	20 (33.9)	59 (100.0)		
BMI						
Underweight	3 (60.0)	0 (0.0)	2 (40.0)	5 (100.0)	19.051	0.004
Normal	39 (22.7)	37 (21.5)	96 (55.8)	172 (100.0)		
Overweight	14 (11.3)	23 (18.5)	87 (70.2)	124 (100.0)		
Obesity	18 (32.7)	7 (12.7)	30 (54.5)	55 (100.0)		
BMI (Kg/m2)	25.91 ± 5.65	24.83 ± 3.41	26.41 ± 4.63	26.01 ± 4.69	2.957	0.053*
Weight (kg)	65.3 ± 15.0	63.6 ± 8.2**	68.2 ± 11.9**	66.8 ± 12.2	4.367	0.013*
Height (m)	1.6 ± 0.1	1.6 ± 0.0	1.6 ± 0.1	1.6 ± 0.1	3.75	0.024*

Table 3. Relationship between medication adherence and co-morbid ailments.

Variables	Medication Adherence n (%)			Total	χ²	p- value
	Low	Medium	High			
Diabetes						
Yes	33 (25.4)	23 (17.7)	74 (56.9)	130 (100.0)	2.63	0.269
No	41 (18.1)	44 (19.5)	141 (62.4)	226 (100.0)		
Chronic renal disease						
Yes	0 (0.0)	0 (0.0)	2 (100.0)	2 (100.0)	1.319	0.517
No	74 (20.9)	67 (18.9)	213 (60.2)	354 (100.0)		
Dyslipidaemia						
Yes	19 (35.8)	7 (13.2)	27 (50.9)	53 (100.0)	8.76	0.013
No	55 (18.2)	60 (19.8)	188 (62.0)	303 (100.0)		
Obesity						
Yes	19 (38.8)	4 (8.2)	26 (53.1)	49 (100.0)	12.78	0.002
No	55 (17.9)	63 (20.5)	189 (61.6)	307 (100.0)		
Osteoarthritis						
Yes	37 (33.3)	30 (27.0)	44 (39.6)	111 (100.0)	29.49	< 0.001
No	37 (15.1)	37 (15.1)	171 (69.8)	245 (100.0)		
PUD						
Yes	11 (21.6)	9 (17.6)	31 (60.8)	51 (100.0)	0.063	0.969
No	63 (20.7)	58 (19.0)	184 (60.3)	305 (100.0)		
Other comorbidity						
Yes	8 (17.0)	12 (25.5)	27 (57.4)	47 (100.0)	1.743	0.418
No	66 (21.4)	55 (17.8)	188 (60.8)	309 (100.0)	18	

Table 4. Relationship between medication adherence and number of Anti-hypertensive medications

Number of anti-hypertensive	Medication Adherence n (%)			Total	χ²	p- value
	Low	Medium	High			
One	2 (25.0)	0 (0.0)	6 (75.0)	8 (100.0)	38.372	< 0.001
Two	24 (10.9)	51 (23.1)	146 (66.1)	221 (100.0)		
Three	48 (37.8)	16 (12.6)	63 (49.6)	127 (100.0)		
Total	74 (20.8)	67 (18.8)	215 (60.4)	356 (100.0)		

Table 5. Adherence to Anti-hypertensive medications

Grades of Adherence	Sex n (%)		Total
	Male	Female	
Medication Adherence			
Non-Adherent	42 (29.1)	99(46.7)	141 (39.6)
Adherent	102 (70.8)	113 (53.3)	215 (60.4)
Total	144 (100.0)	212 (100.0)	356 (100.0)

Table 6. Logistic regression analysis for predictors of medication adherence. * Variable entered as a continuum.

Variables	B	S.E.	OR (95% CI)	p- value
Age*	-0.031	0.032	0.97 (0.91 - 1.03)	0.334
Sex				
Male	2.763	0.663	15.85 (4.33 - 58.11)	< 0.001
Female			1	
Occupation				
Civil servants	-1.126	1.317	0.32 (0.02 - 4.28)	0.392
Traders	-2.042	0.913	0.13 (0.02 - 0.78)	0.025
Farmers	-0.273	1.070	0.76 (0.09 - 6.20)	0.799
Retirees	-1.952	1.397	0.14 (0.01 - 2.19)	0.162
Unemployed			1	
Education				
None	0.379	1.317	1.46 (0.11 - 19.32)	0.774
Primary	1.5	1.253	4.48 (0.38 - 52.26)	0.231
Secondary	2.83	1.38	16.94 (1.13 - 253.06)	0.04
Tertiary	2.453	1.046	11.62 (1.50 - 90.28)	0.019
Postgraduate			1	
Family type				
Monogamous	0.646	0.707	1.91 (0.48 - 7.63)	0.361
Polygamous			1	
Income				
< NGN 500 / day	-0.855	0.598	0.43 (0.13 - 1.37)	0.153
≥ NGN 500 / day			1	
Salty food				
None	5.649	1.158	284.00 (29.35 - 2748.37)	< 0.001
Food cooked with salt	3.838	0.695	46.43 (11.89 - 181.31)	< 0.001
Add salt on cooked food	2.862	0.987	17.50 (2.53 - 121.09)	0.004
Both (Cooked and Added)			1	
BMI				
Underweight	1.115	2.432	3.05 (0.03 - 358.74)	0.647
Normal	0.542	0.815	1.72 (0.35 - 8.49)	0.506
Overweight	1.108	0.887	3.03 (0.53 - 17.24)	0.211
Obesity			1	
Dyslipidaemia				
Yes	0.686	0.828	1.98 (0.39 - 10.07)	0.408
No			1	
Obesity				
Yes	1.073	0.828	2.92 (0.58 - 14.82)	0.195
No			1	
Osteoarthritis				
Yes	0.038	0.56	1.04 (0.35 - 3.11)	0.946
No			1	
Number of anti-hypertensive				
One	1.353	1.318	3.87 (0.29 - 51.27)	0.305
Two	2.717	0.588	15.13 (4.78 - 47.86)	< 0.001
Three			1	

among patients to high understanding of treatment regimen and higher knowledge of the diseases leading to increase in treatment outcome.

Nevertheless, our finding is still less than 80.0% recommended adherence rate needed for optimal therapeutic efficacy [25]. It is also less than 74.0% reported adherence rate in Turkey [18] and 65.1% in China [26]. This may partly be linked to high adherence cut-off compared to adherence definitions in previous studies [25,27]. It could also be due to multiple co-morbid ailments reported among the respondents in this study. Previous studies have established that hypertensive patients who harbour other co-morbid ailments require multiple drugs for treatment. This could create additional burden both in terms of medication adherence and cost of the drugs, where majority of the respondents in this study paid their service fee out-of-pockets.

Identified factors that are associated with good adherence to antihypertensive medication in this study were male gender, secondary and tertiary level of education, eating of low salty food and taking two antihypertensive drug regimen. Reports on the impact of social demographic variables on adherence have been inconsistent [28-30]. Both positive and negative relationship have been reported in literatures [29,30].

In this study, gender was a predictor of good medication adherence with male reporting better adherence than females. This finding was consistent with some previous studies [7,31] but opposite to several other studies [32,33]. A study by Osamor et al., found no relationship between gender and adherence [8]. The high adherence rate in male in this study could be due to less demand of household chores in male as compared to female thereby enable male to dedicate more time to their health [31].

Higher education at the secondary and tertiary level is associated with good medication adherence in this study. Study has shown that patients with higher education should have better understanding about their medical problems and the drug management and therefore be more adherent [9]. From a policy standpoint, identifying key aspects of secondary and tertiary education attainment that are strongly associated with health, provides a crucial point for intervention. Therefore, clinicians should use the opportunity of every encounter with hypertensive patients to provide effective health education and screening for adherence as a way to reducing cardiovascular risk associated with uncontrolled hypertension.

In this study, little or no salt diet is associated with good medication adherence with respondents without salt intake more likely to have good adherence compared to those who added little salt to their diet. This is consistent with the previous studies who found that higher adherence is observed in those who care for salt restriction [30,34]. In an observational study conducted in India by Venkatachalom et al, high salt intake and unrestricted dietary habits were associated with poor adherence [34]. This finding suggests the need to strengthen interventions aimed at improving DASH diet that can reinforce good adherence to antihypertensive medication.

Similarly, respondents on two antihypertensive medication showed good adherence as compared to those on monotherapy This is consistent with previous studies which found a positive association between adherence and number of medications [35,36]. This could probably be explained that patients who are on multiple medications may likely be motivated to take their medication due to the belief of the severity of the disease.[36]

On the contrary to the above findings, trading has been found in this study to be associated with poor medication adherence. This could probably be explained because traders are usually busier, may be far away from home and may experience heavy pressure from business which may hinder them spending more time attending to their health [37]. This finding reinforced the need for close attention and adequate screening for medication adherence among this set of occupation.

Conclusion

The proportion of hypertensive patients with good medication adherence in this study is still very low, though, higher than those reported by some other researchers in Nigeria. Good adherence to antihypertensive medication is related to respondent gender status, level of education, habit of salt intake and the use of two antihypertensive medications. On the other hand, trading was found to be associated with poor risk of medication adherence. Therefore, we suggest that this set of occupation should be targeted with focus care and provision of qualitative health education to improve their drug adherence level.

Limitation of the Study

Firstly, there may be recall bias, since a self-report was used to assess the behavioral practice of the study respondent and performance of these behaviors was not observed. For instance, the habit of salt usage was assessed using a questionnaire rather than a precise qualification of salt intake. Secondly, adverse side effects of the prescribed medications taken by the respondents were not taken into consideration while assessing the adherence level to medication as these side effects can significantly affect the level of medication adherence.

Benefits of the study

Interventions were put in place for respondents identified with poor medication adherence in order to optimize their medication adherence. These interventions include:

1. Regular follow-ups visit and detailed education about salt restrictions.

2. Those with good medication adherence were counselled on ways to keep and improve their medication adherence level.

Recommendations

1. Further research is needed to identify other factors negating good medication adherence and suggest possible interventions to achieve better adherence.

2. Larger community-based studies are required to clarify fully the relationship between sodium intake and medication adherence.

Acknowledgements

Availability of data and materials

The datasets for this study would be made available from the correspondence author on a reasonable request.

Consent for publication

All the authors consented for publication of this study.

Authors' contribution

AOI-Conceptualization of the study, designed the study protocol, data acquisition and analysis and drafted the initial manuscript; TAA–Literature review, data analysis and review of manuscript for intellectual content; OA–Critically revised the protocol for methodological and intellectual content; TK-Literature review, review of manuscript for intellectual content; AMF-Literature review, review of manuscript for intellectual content; TMO-Data collection and acquisition and review of manuscript for intellectual content; All the authors read and approved the final version of the manuscript prior to submission.

Ethical consideration and Consent

Ethical approval for the study was obtained from the Ethics and Research Committee (ERC) of FTH, Ido-Ekiti. Informed consent was obtained, and participation was fully based on the willingness of the respondents. They were free to refuse or discontinue participation at any time without losing any benefits of care or favor to those that participated. Information was recorded anonymously; confidentiality and privacy were ensured throughout the study. The study involved no extra cost to the respondents.

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