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Factors Associated with Antihypertensive Medication Adherence among Diabetic Patients with Coexisting Hypertension in a Tertiary Care Centre from a Low Middle Income South Asian Country

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ABSTRACT

Introduction:
Poor medication adherence is a known preventable factor which can adversely affect desired achievable blood pressure (BP) target. Strict control of blood pressure is essential among patients who have diabetes and hypertension (HT) in order to prevent complications. This is the first study conducted among 371diabetic patients with co-existing HT to examine the antihypertensive medication adherence in Sri Lanka to date.

Materials and Methods:
This cross-sectional study was done in the general medical clinics of Jaffna Teaching Hospital from October 2019 to November 2019.

Results:
The majority (66.6%) of the patients were female. Mean age of the participants was 60.93 ± 9.77. The total mean score for modified MASES (Medication Adherence Self Efficacy Scale) was 48.1 ± 3.81. A negative correlation was noted between MASES scores and systolic (r= -0.033) and diastolic (r=- 0.083) blood pressure. Median score 49 was used to classify the patients into optimal or suboptimal adherence to antihypertensive medication. A significant percentage (43.4%CI: 38.4-48.5) of research participants were sub optimally adhered to antihypertensive medication. Among the associated factors explored, gender (P-0.007), low-income (P-0.002) and employed people (P-0.046) showed significant association with poor adherence. However, the number of co-morbidities (P-0.335), number of medications (P-0.454), duration of hypertension (P-0.440), and frequency of clinical visits (P-0.373) were not significantly associated with anti-hypertensive medication adherence.

Conclusion:
This finding has an implication in clinical practice to improve the quality of care. Professionals should give consideration to above socio-demographic factors (gender, income, and occupation) before prescribing appropriate medication and its dosing schedule for hypertension.

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Introduction

Hypertension is one of the chronic conditions considered as international public health concern (1). Even though it can be preventable and controllable, the prevalence has been significantly rising. The total number having hypertension spiked from 594 million to 1.13 billion since 1975 to 2015 among adults, this increment largely observed in developing (less or average income) countries[1]. Even though there are only few studies available to date in Sri Lankan context, prevalence (adjusted for age) noted in males, females and adults were 23.4% 23.8% and 23.7% respectively (2). It was noted that diabetic patients were more associated with HT but prevalence varied depend on various other factors (3,4). In diabetic patients with chronically elevated blood sugar levels contribute to the development of atherosclerosis independent of other risk factors (5). But hypertension impose a significant impact in incidence, progression of cardiovascular events and micro vascular complications. Hypertensive diabetic patients are at increased risk of developing diabetes-specific compli-cations such as retinopathy and nephropathy. Each 10-mmHg decrease in average systolic BP was associated with a reduction of "12% risk for any complication related to diabetes, 15% reduction of deaths due to diabetes, 11% reduction in the incidence of myocardial infarction and 13% reduction of micro vascular complications"(6).

Therefore, stringent blood pressure control in diabetic patients is a paramount importance. It is always worth investigating the reasons for poor BP control including non-adherence to antihypertensive medication, which is one of the factor influences on the control of blood pressure (BP). The world Health Organization defined medication adherence as "the degree to which the agreed person's behaviour matches with recommendations from a health provider"(7). Though the terms compliance and medication adherence are synonymously used, they are not interchangeable. Adherence differs from compliance because compliance is the extent to which a patient's behaviour corresponds to the prescriber's advice (8). Compliance indicates patients' obedience to the physician's authority (9, 10), whereas adherence is an alliance between the health professional and patient to improve the patient's health condition by integrating the physician's expert opinion with patient preferences according to their lifestyle and cultural values. Hypertension and diabetes are chronic illnesses as such patients understanding of medication adherence is essential to prevent both long and short-term complications. Self-efficacy means how an individual judges their confidence to implement a particular activity to produce an expected outcome. The stronger the person's self-efficacy of the recommended activity, the more likely that a person will start the desired behaviour and maintain as per recommendation (11).

Although non-adherence to medication is a leading factor for not achieving control of hypertension, only limited research explored the reasons throughout the world. In the Sri Lankan context, a study done at the same centre in 2017 by Pirasath et.al[12] showed majority of the patients reported poor drug compliance and the same study showed forgetfulness and interruption of daily routine were the most common reasons attributed to poor compliance (12). In this study, the authors used a different medication adherence scale[13] and they have not studied the ability of the patients control over the medication recommended. Further, there have been no study done in Sri Lanka on hypertensive medication adherence among diabetic patients even though this group of patients showed a higher risk of developing complications compared to non-diabetic hypertensive. This study was conducted to examine factors associated with

antihypertensive medication adherence among diabetic patients attending medical Clinics in Teaching Hospital Jaffna by using modified MASES questionnaire.

Materials and Methods

This cross-sectional descriptive study was conducted from October to November 2019. Diabetic patients with coexisting hypertension attending the general medical clinics of all four medical units of Teaching Hospital Jaffna in the Northern Sri Lanka were recruited for this study.

For the calculation of sample size, a single population proportion formula was used, assuming a proportion 10.5% from the previous study in the same setting and confidence interval (CI) of 95% and 3% margin of error was considered appropriate (13). We were able to recruit 371 patients out of 401 calculated sample sizes. Participants consented were included in the research, but patients who were pregnant, patients who were age below eighteen, and mentally incompetent were excluded from the study.

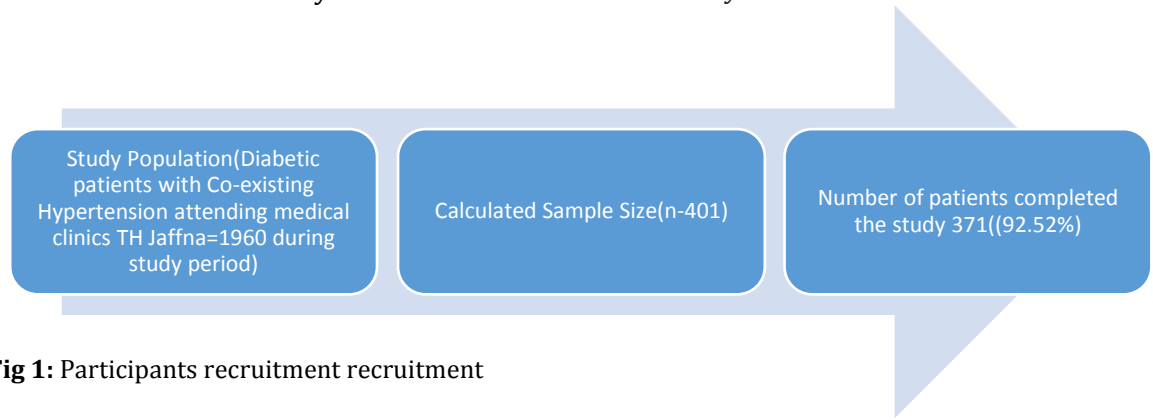

Fig 1: Participants recruitment recruitment

Questionnaire was prepared to collect patient details which included gender, age, educational level, occupation, income, marital status, smoking, and alcohol habits as number of co-morbidities, number and frequency of drugs, duration of illnesses, last HbA1c and diagnosis of chronic kidney disease (CKD). For the assessment of medication adherence widely used MASES questions were included with permission from author. Level of medication adherence determined with the help of modified MASES questionnaire. This 13 items scale is used to assess patients' confidence regarding taking their medications for hypertension in different situations. Some examples of the situations included "when busy at home," "while at work," "when they cause some side effects." Items were scored from score 1 (not at all sure) to score 4 (certain). Total score (13-52) on the measure is computed by across responses to all items. High score mean a higher level of self-efficacy. A mean score for the measure was also computed by averaging across responses for all items. This internationally used tool has high validity and reliability [14, 15, 16]. Initially MASES was developed by Ogedegbe et.al in 2003 to assess "medication adherence and compliance" (14). The short form has 13 questions with 4-point "Likert" format scale for each question and reliability determined as 0.94 (15), among Turkish population and 0.91 among African Nigerian population (16). After two independent translators made a forward translation from English to Tamil language, it was independently back translated to English to ensure the accuracy of the translation. Expert judgment (from general physicians, endocrinologist, and public health specialist) was obtained regarding consensual, face and content validity. Pilot test was carried out by the principal investigator in different period to test the feasibility of the study of the instrument. Thirty-three participants used for this pilot study were not included in the proper study. Patients' background details were collected or extracted from the clinic registry with the help of interviewer administered questionnaire by trained data collectors under the guidance of principal investigator. BMI (Body Mass Index) and blood pressure (BP) was measured at the time of interview. Control of blood pressure

was defined as "not control" if "systolic blood pressure (SBP) above 130 mmHg and/or diastolic blood pressure (DBP) above 80 mmHg". Standard procedure was adhered when measuring BP readings on the day of patient interview at the clinic. BP was measured by applying a calibrated sphygmomanometer with a recommended sized cuff to the right arm. Blood pressure measurements were conducted 3 times in a sitting position for each individual and the average of 3 readings was calculated.

SPSS version 26.0 software was used for analysis and descriptive statistics which were given in frequency and proportion. Variables such as (BP, Age) showed normal distribution and parametric tests such as t test were used in the analysis of those data. However, for the variables showed non normal distribution (Total score for MASES) non-parametric tests were used in the analysis.

From the descriptive statistics calculated for total MASES score, median value was used to categorized the anti-hypertensive medication adherence into two categories named as optimal adherence and suboptimal adherence (Above median – Optimal adherence, below median (Sub optimal adherence) as MASES score distribution showed non normal distribution. These categories were analyzed with different socio, demographic, and disease related categories by using Chi square test. The relationship between systolic and diastolic blood pressure and total MASES adherence score was examined with correlation analysis. $P<0.05$ was accepted as statistically significant was defined as $P<0.05$. Permission to use MASES from its developer also obtained. Informed written consent was obtained prior to collecting data from participants. Ethical clearance was obtained from Jaffna University, Faculty of Medicine ethical review committee (Reference No J/ERC/19/107/DR/0068).

Results

Out of the 371 participants of this study, 247 (66.6%) were female and 124 (33.4 %) were male ($\chi2 = 73.715$; $P <0.0001$). The majority (192, 50.9%) belong to the middle income group. The mean age of the participants was 60.93 ± 9.77 with the range 31–86 years. 76.3% of participants were married, 55.5% were secondary school graduate and 59.8% were either housewife or unemployed. The Background details of the patients are shown in Table 1.

Table 1: Background characteristics of Participants (n=371)

Variable		**Percentage (%)**
Gender	Male	124(33.4%)
	Female	247(66.6%)
Age	Mean 60.92+_9.76	Range 31-86
Income	<Rs16162	167(45.0%)
	Rs16163-57499	192(51.8%)
	>Rs57500	12(3.2%)
Education	Not attended school	7(1.9%)
	Primary	106(28.6%)
	Secondary	206(55.5%)
	Tertiary	52(14.0%)
Employment Status	Employed	149(40.2%)
	Housewife/Unemployed	222(59.8%)
Marital status	Single/Widowed/Separated	79(21.3%)
	Married	283(76.3%)
	Divorced	9(2.4%)
Smoking Status	Never	294(79.2%)
	Ex-Smoker	65(17.5%)
	Current smoker	12(3.2%)
Alcohol status	Never	280(75.5%)
	Ex-Alcoholic	48(12.9%)
	Current Safe level	35(9.4%)
	Current Unsafe level	8(2.2%)
BMI	<18.5 (underweight)	10(2.7%)
	Normal	180(48.5%)
	Overweight (25-30)	111(29.1%)
	Obese (>30)	42(11.3%)

Disease or health related characteristics of participants

The mean duration since diagnosis of hypertension of the patients was 8.72± 6.16 years. Two participants were diagnosed just under 1 year of duration. Majority of the patients reported (194; 52.3%) 3-4 co-morbidities and six of them (1.6%) reported more than 5 co-morbidities. Twelve (3.2%; CI:1.8-5.2) were identified as current smokers and 8 patients (2.2%; CI: 0.9-4.2%) reported unsafe level of alcohol consumption. Forty two patients (11.3%; CI: 8.4-14.9) were identified as obese (BMI>30). There were 33 patients (8.9%; CI: 6.3-12.1) had diagnosed CKD and 239 (64.4%; CI: 59.9%-692%) participants were showed poor diabetic control (HbA1C> 6.5%). Most of them (98.1%) were taking more than five medications at time of study period. Majority of them (322; 86.8%) reported they visit clinic once in every two months while 49 (13.2%) mentioned they visit clinic once in a month. The characteristics related to disease of patients are shown in Table 2. Also smoking status (P=0.0001), alcohol consumption (P<0.0001), diabetes control (P-0.041), presence of CKD (P-0.001) significantly differed between male and female participants.

Table 2: Clinical Characteristic of participants (n=371)

Variable		N(%) or Mean +_SD
Duration of Hypertension(in years)		**8.72+_6.16**
Co-Morbidities	2	171(46.1%)
	3-4	194(52.3%)
	5 or more	6(1.6%)
Number of medications	Less than 5	6(4%)
	>=5	119(96%)
Clinic Visit	Monthly	49(13.2%)
	Once in Two months	322(86.8%)
Diabetes Controlled	Uncontrolled (HbA1C>=6.5)	239(64.4%)
	Controlled (HbA1C>=6.5)	132(35.6%)
CKD(Chronic Kidney Disease)	Presence	33(8.9%)
SBP(Systolic Blood pressure)	Mean +_SD	134.69+/_14.35
DBP(Diastolic Blood pressure)	Mean +-SD	81.18+/_7.78
Blood Pressure Control	Not controlled	196(52.8%)
	Controlled	175(47.2%)
Medication Adherence (Mean Modified MASE score)	Mean 48.1+_3.81	Range 32-52
Medication Adherence	Optimal	210(56.6%)
	Suboptimal	161(43.4%)

Anti-hypertensive medication adherence among participants

The overall total mean score of modified MASES for patients (n=371) with hypertension was found to be 48.1 ± 3.81(min=32, max=52). The distribution of total mean score of modified MASES showed negative skewness (-1.38).

The overall total median score of modified MASES for patients (n=371) with hypertension was found to be 49 which used classify the participants to optimal level of adherence and sub optimal level of adherence.

Descriptive statistics of Modified Medication Adherence Self-Efficacy Scale (MASES) 13-items summarized in Table 3.

Each individual item was significantly correlated with mean score at 0.01 level.

The overall total median score of modified MASES for patients (n=371) with hypertension was found to be 49 which used classify the participants into optimal level of adherence and sub optimal level of adherence.

Out of 371 participants 161 (43.4%; CI: 38.4-48.5) were found to be suboptimal medication adherence.

Table 3: Descriptive statistics of Modified Medication Adherence Self-Efficacy Scale (MASES) 13-items (n=371)

Responses categories n (%)				
Scale item	**Not at all Sure**	**A little Sure**	**Fairly Sure**	**Very Sure**
When you are busy at home (MASESR-1)	2(0.5%)	21(5.7%)	117(31.5%)	231(62.3%)
When there is no one to remind you (MASESR-2)	2(0.5%)	16(4.3%)	98(26.4%)	255(68.4%)
When you worry about taking them for the rest of your life (MASESR-3)	4(1.1%)	24(6.5%)	58(15.6%)	285(76.8%)
When you do not have any symptoms (MASESR-4)	0	17(4.6%)	73(19.7%)	281(75.7%)
When you are with family members (MASESR-5)	1(0.3%)	10(2.7%)	65(17.5%)	295(79.5%)
When you are in a public place (MASESR-6)	1(0.3%)	9(2.4%)	73(14.7%)	288(77.6%)
When the time to take them is between your meals (MASESR-7)	0	7(1.9%)	46(12.4%)	318(85.4%)
When you are travelling (MASESR-8)	5(1.3%)	44(11.9%)	103(27.8%)	219(59%)
When you take them more than once a day (MASESR-9)	3(0.8%)	8(2.2%)	47(12.7%)	313(84.4%)
When you have other medications to take (MASESR-10)	2(0.5%)	7(1.9%)	53(14.3%)	309(83.3%)
When you feel well(MASESR-11)	0	15(4%)	59(15.9%)	297(80.1%)
If they make you want to urinate while away from home(MASESR-12)	1(0.3%)	8(2.2%)	50(13.5%)	312(84.1%)
Make taking your medications part of your routine (MASESR-13)	1(0.3%)	15(4%)	51(13.7%)	304(81.9%)

Factors associated with medication adherence

Socio demographic factors such as gender, age, income, education status, employment status and marital status were examined for association with medication adherence and results are summarized in Table 4. 53.3% of males showed suboptimal adherence while only 38.5% female showed suboptimal adherence (P-0.007).

Likewise among patients age less than 45 suboptimal adherence level was 37.5% meanwhile among age above 60 suboptimal adherence level was 44.9%. But this results was statistically not significant (P-0.741). Furthermore low income category (P-0.002) and employed people (P-0.046) showed association with suboptimal adherence. This study also examined the association between health-related factors and antihypertensive medication adherence and the results were summarized in Table 4. Number of co-morbidities (P-0.335), number of medications (P-0.454), duration of hypertension (P-0.440) and frequency of clinical visit (P-0.373) were not showed significant association. Furthermore patients' habits such as smoking status (0.089), alcohol consumption status (P-0.223), and diabetic control (P-779) and co-existing CKD (0.803) were not associated with poor medication adherence.

Antihypertensive medications

Most commonly prescribed anti-hypertensive medication among participants was ACEI (Angiotensin Converting Enzyme Inhibitors (/ARB (Angio-Tensin Receptor blockers) (287; 77.4%) followed by Calcium Channel Blockers (CCB) (43.4%), diuretics (22.4%), beta-blockers (17%) and alpha-blockers (6.2%). None of the prescribed anti-hypertensive medication class also significantly associated with medication adherence at P-0.05 level.

Blood pressure and Medication Adherence

The mean points of the overall total score medication treatment adherence scale (modified MASES) for patients with hypertension for were 48.1 ± 3.81 (32-52) .Clinical mean BP measurements were systolic 134.69± 14.4(100-180)and diastolic 80.4± 6.8 mm Hg(60-110).

Negative correlation was observed between treatment adherence scale scores and systolic BP at clinic (r=−0.033) and total score with clinical diastolic BP (r=-0.083).While the correlation with diastolic blood pressure showed statistically significant association (P-0.05) systolic BP showed statistically not significant association(P-0.415).

Backward linear regression analysis was conducted by initially entered variable age, duration of HT, number of medication, medication adherence with diastolic blood pressure showed which showed predictor variables for diastolic blood pressure were medication adherence (P-0.031), number of medications (P-0.061) and age (0.056).

Table 4: The association between socio demographic factors, health related factors and antihypertensive medication adherence

		Antihypertensive Medications Adherence		Statistics	
Variable		**Optimal Adherence**	**Suboptimal Adherence**	**χ2**	**P-value / OR [95% CI]**
Gender	Male	58(46.8%)	66(53.2%)	χ2-7.326	P-0.007* OR-1.23(CI:1.05-1.43)
	Female	152(61.5%)	95(38.5%)		
Income	<Rs16162	81(48.5%)	86(51.5%)	χ2-8.175	P-0.002*
	Rs16163-57499	121(63%)	71(37%)		
	>Rs57500	8(66.7%)	4(33.3%)		
Employment Status	Employed	75(50.3%)	74(49.7%)	χ2-3.983	P-0.046*/OR-1.27(CI:1.007-1.595
	Housewife/Unemployed	135(60.8%)	161(39.2%)		
Age	<45	15(62.5%)	9(37.5%)	χ2-0.598	P-0.741
	46-60	82(57.7%)	60(42.3%)		
	61 and above	113(55.1%)	92(44.9%)		
Education	Not attended school	3(42.9%)	4(57.1%)	χ2-3.307	P-0.347
	Primary	67(63.2%)	39(36.8%)		
	Secondary	110(53.4%)	96(46.6%)		
	Tertiary	30(57.7%)	22(42.3%)		
Marital status	Married	158(58.8%)	125(44.2%)	χ2-0.291	P-0.590
	Single/Widowed/Separated	52(59.1%)	36(40.9%)		
Co-Morbidities	2	93(54.4%)	78(45.6%)	χ2-2.188	P-0.335
	3-4	112(57.7%)	82(42.2%)		
	5 or more	5(83.3%)	1(16.7%)		
Number of medications	Less than 5	3(42.9%)	4(57.2%)	χ2-0.549	P-0.454
	>=5	207(56.9%)	157(43.1%)		
Duration of HT	<1year	9(52.9%)	8(47.1%)	χ2-2.701	P-0.440
	2-5Years	74(67.2%)	45(37.8%)		
	6-10 years	68(56.2%)	53(43.8%)		
	11 and above years	59(51.8%)	55(48.2%)		
Smoking	Ex-Smoker	30(46.2%)	35(53.8%)	χ2-4.834	P-0.089
	Current smoker	9(75%)	3(25%)		
Alcohol status	Ex-Alcoholic	22(45.8%)	26(54.2%)	χ2-4.381	P-0.223
	Current Safe level	17(48.6%)	18(51.4%)		
	Current Unsafe level	4(50%)	4(50%)		
Clinic Visit	Monthly	31(63.3%)	18(36.7%)	χ2-1.02	P-0.313
	Once in Two months	179(55.6%)	143(44.4%)		
Diabetes Control	HbA1C>=6.5	134(56.1%)	105(43.9%)	χ2-0.79	P-0.779
	HbA1C <6.5	76(57.6%)	56(42.4%)		
CKD	Presence	18(54.5%)	15(14.5%)	χ2-0062	P-0.803

*Statistics -χ2 -chi - square test. U- Mann-Whitney *P<0.05 considered significant

Discussion

Despite of availability of effective treatment for hypertension (HT), many patients drop out from treatment within one year of diagnosis (17). Inspite of careful follow up from physicians, not all patients take the prescribed medication according to the recommendation. Estimation of adherence to pharmacotherapy of HT varies from 50 to 70% (17).

Our analysis of antihypertensive medications adherence among the 371 patients who were recruited for this study indicates only 56.6% (CI-51.5%-61.6%) of them were optimal adherents and remaining 44.4% (CI-39.5%-49.6%) were suboptimal adherents to their antihypertensive medications.

According to World Health Organization the anti-hypertensive medication adherent rate in many parts of the world varied 50% to 70% (17). Our findings is almost similar to that of antihypertensive medications adherence rate estimated by WHO. However, in a study conducted in 2018 revealed the overall mean score of MASES was found to be 70.29 ± 8.52, which implies that medication adherence is good among patients with HT (18).

However, according to a local study in Northern Sri Lanka showed that the majority of patients (84.5%) reported poor drug compliance (12). Globally, few studies were done to investigate hypertension medication compliance in diabetics, in which Natarajan et al found that more than 75% of patients with DM (type 2) with co-existing hypertension from family clinics in the community of Maritime Canada showed good adherence to their antihypertensive medications (19).

In both studies researchers used different validated scales to assess the medication adherence.

The variation on the prevalence in adherence rates reported in different studies might be due to many reasons which not only includes the methods diversity (tools) used to assess medication adherence, and duration and follow up of the studies but also includes socio demographic factors of the patients. Similarly, a study from Southern India

conducted by Rao et.al revealed compliance to hypertension treatment was 82.2%, but the same study showed blood pressure control was suboptimal which indicates assessing self-efficacy could give more insight in regards to adherence. Adherence was better among females as compared with males (20).

Current study also showed female participants were better in adherence than males (P-0.007) which indicate gender is a big influential factor on anti-hypertensive medication adherence. However, a study in Nigeria revealed gender, level of education attainment level, age, marital status, and cost of the medication were not associated with non-adherence while employment significantly influenced on medication adherence (21).

The current study also showed age (P-0.741), educational level (0.347) and marital status (P-0.590) were not significantly influenced on medication adherence but occupation influenced negatively on anti-hypertensive medication adherence (P-0.046). Being employed could reflect a busy lifestyle and due to the tight daily schedule, medication regimen may not have fit or they would have find it difficult to get time off from work to get prescriptions or, stigma of taking medication in front of the colleagues or side effects from medication could have prevented them from taking medication at work which might lead to the poor adherence to medications. In a previous study in the same setting showed, 11.5% of participants revealed that the reason for non-adherence was being busy or late for work (12).

This has a significant implication in clinical practice, physicians should take employment status (nature of work) into consideration before prescribing medication and frequency. Several studies found that total family income was a significant predictor for medication adherence (22-24).

Our study also showed that low income significantly associated with sub optimal medication adherence (P-0.002).

This study also examined association between health-related factors such as number of co-morbidities (P-0.335), number of medications (P-0.454), duration of hypertension (P-0.440) and frequency of clinical visit (P-0.373) with medication adherence which were failed to show significant association. However, many previous studies showed recently diagnosed hypertensive patients often showed poor adherence levels when compared to patients diagnosed a long time ago (25).

Further, number of comorbidities did not show significant association with antihypertensive medications adherence in the current study. This finding is similar to the findings of a study conducted previously (P>0.05) (26).

This may be due to the fact that patients who had multiple comorbidities carefully adhere to prescribed hypertensive medications in order to controlling complications/ symptoms effectively and probably they were also be followed up more frequently by health professionals. It is reasonable to assume that someone to expect the number of medications taking might affect medication adherence, however the current study failed to show an association (P-0.454).

Moreover, it may be due to the high number of patients (98.1%) reported that they were on more than 5 medications at the time of the study period. However, a previous study in the same setting showed that 10.5% of patients reported “Too many medications to take” as one of the reasons for non-compliance (12).

Similarly, smoking habit (P-0.089) and consumption of alcohol (P-0.223) were not significant predictors for adherence. Although the role of smoking cessation and alcohol counselling in the clinics has not been investigated in this study, patient education to support the patients with hypertension to reduce alcohol , smoking cessation and to reduce salt intake is a part of management.

The current study also showed control diabetes was poor (HbA1C>6.5) among the participants (64.4%; CI: 59.9%-692%) but important to note that individual targets of HbA1C with multiple morbidities should be individualized rather than a common target. Furthermore, poor anti-hypertensive medication adherence showed no association with poor control of diabetes (P-0.779). Similarly, 33 patients (8.9%; CI: 6.3-12.1) had had a diagnosis of CKD (Chronic Kidney Disease) but again which is not associated with poor adherence (P-0.809) of hypertensive medication.

Medication adherence and blood pressure control

A study previously showed around 75% of patients not achieved desired control of blood pressure because of poor adherence to medications (17). Our study also showed negative correlation with medication adherence (MASES) scores and clinic systolic BP (r=−0.033, P-0.415) and diastolic BP(r=-0.083,P-0.05).

This indicates blood pressure control can be achieved by improving the antihypertensive medication adherence among patients. Similarly, a research done in Turkey showed that medication adherence scale scores negatively correlated with systolic BP (r= −0.171; P = 0.006) (27).

Limitation

A previous study showed that patient's knowledge regarding treatment received positively influenced on medication adherence (28). Similarly, a study showed that 43.7% of patients believe that anti-hypertensive medications can be reduced or stopped once BP control is achieved. This indicates lack of knowledge of need for lifelong treatment also contributory factor for low medication adherence (28-30). Current research did not explore the role patient knowledge and beliefs on medication adherence. However, some authors involved in the current study already explored the role of patient's knowledge of treatment and medication adherence previously in the same setting (12). Association between physical activity and duration of the morbidity with medication adherence was not explored in our study and which may a potential limitation. Further we included the questions from MASSES questionnaire (internationally validated) and we have translated the questions into local language (Tamil) and assessed by local physicians and pretested but we have not done validity study.

Conclusion

The current study showed that the antihypertensive medication adherence among the participants was sub-optimal. Among the variables examined, gender, total family income, and employment (occupation) were significantly associated with the differences in the medication adherence levels (Optimal, sub-optimal) assessed by the modified MASES scale. Furthermore, the current study also indicates by improving the medication adherence, control of blood pressure can be improved, which in turn reduces the complications among diabetic patients. But in contrast to our prediction associated co- morbidities, number of medication taking, number of clinic follow up, type of anti-hypertensive medication were not significantly influencing on medication adherence. Therefore it is essential prescribers to consider patients socio demographic factors such as gender, income, and occupation when choosing the appropriate pharmaceutical agents to control hypertension. By giving proper attention to above socio demographic factors quality of care in regards to hypertension control will improve and which is essential to ensure the patient safety.

Abbreviations

BP- Blood Pressure
MASES- Medication Adherence Self Efficacy Scale
SPSS- Statistical Package for the Social Sciences
SD-Standard Deviation
CI-Confidence Interval
WHO-World Health Organisation
BMI-Body Mass Index
SBP-Systolic Blood Pressure
DBP-Diastolic Blood Pressure
CKD- Chronic Kidney Disease

Declarations

Approval for the study was obtained from the Faculty of Medicine Ethical Review Committee of the University of Jaffna. From each participants, written consent was obtained after explaining the purpose and the nature of the study (Reference No J/ERC/19/107/DR/0068).

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