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MAGNITUDE OF ADHERENCE OF DIABETIC PATIENTS TOWARD THEIR ANTI- DIABETIC MEDICATION AND ASSOCIATED FACTORS IN HALIBET NATIONAL REFERRAL HOSPITAL

Daniel Tikue Asrat[*1], Robiel Ankeste[1], Amanuel Tesfit[1], Naod Fsseha[1], Zenawi Zeramariam Araia[1], Luwam Russom[1], Ghirmay Yohannes[1], Frezghi Hidray[1], Hager Tesfaselassie[1]

[1*]Department of Nursing and Public Health, Asmara College of Health Sciences, Asmara, Eritrea, North East Africa.

ABSTRACT

Background: Diabetes mellitus is a growing global health problem that affects individuals of all ages. Anti-diabetic medications are integral for glycemic control in diabetes. Lack of adherence to drugs can alter blood glucose levels and can lead to treatment failure, accelerated development of complications and increased morbidity, mortality and disability. In Eritrea, adherence to anti-diabetic medication is not well studied so far. **Objective:** To assess the magnitude of adherence of diabetic patients toward their anti- diabetes medication and associated factors in diabetic clinic of Halibet National Referral Hospital. **Method:** A Descriptive cross-sectional study was conducted in Asmara Halibet National Referral Hospital diabetic clinic from February 01 to May 31, 2019. Subjects of the study were all diabetic patients 16 years and above and had been on diabetic treatment for not less than a six month. The sample size of this study was 205 determined using Crecy and Morgan formula and convenience non probability sampling was used to select study participants. Data was collected through interview questionnaire assessed using self-report which then, cleaned, coded and entered to excel and exported to SPSS for Windows version 20.0. Descriptive and inferential statistics were done to determine adherence to anti-diabetic medication and the associated factors. **Result:** A total of 205 study participants were interviewed with response rate of 100%. The level of adherence was found to be 86.3%. Factors found to be significantly associated with anti-diabetes medication were duration of diabetes (P-value =0.001), Health education about DM and its medications (P-value=0.004), taking multiple medication (P-Value= 0.018), forgetfulness (P-value= 0.000), and monitoring of blood glucose level (p-value= 0.06). **Conclusions:** Majority of respondents 86.3% in this study were found to be adherent to their anti-diabetic medications. Strategies that further improves anti-diabetic drug availability, provide health education, reduce the intervals of visit for follow-ups on diabetic care and giving explicit information and persistent close family support for those taking multiple medication may help in improving adherence levels among patients with diabetes.

KEYWORDS

Diabetes mellitus, Adherence and Patients.

Author for Correspondence:

Daniel Tikue Asrat,

Department of Nursing,

Asmara College of Health Sciences,

Asmara, Eritrea, North East Africa.

Email: danitkku21@gmail.com

INTRODUCTON

Background

Diabetes mellitus is unquestionably one of the fastest growing public health problems worldwide. According to the International Diabetes Federation (IDF), there were 463 million people living with diabetes, 4.2 million deaths due to diabetes caused

and 79% of adults with diabetes were living in low- and middle-income countries, moreover diabetes caused at least USD 760 billion dollars in health expenditure in 2019 - 10% of total spending on adults in 2019, with a expected 700 million by 2045[1].

According to t HIMS diabetes control program of Eritrea, diabetes mellitus is one of the leading causes of morbidity and mortality mainly in adults; a total of 98167 new cases and 1194 deaths of DM were reported from hospitals and health centers in the years 1998 - 2017[2]. Moreover, 695 amputations due to DM were also reported between 2006 - 2012 indicating that it is not only leading cause of morbidity but also a cause of disability. Diabetes mellitus was accountable to 0.4% of morbidity and 2.7% of total reported deaths in 2012[3].

One of the key measurements of healthcare quality in diabetes management is adherence to prescribed medications. According WHO medication adherence or compliance is the extent to which an individual is taking their medication as instructed by a health care professional[4]. Drugs or medications constitute a vital component in the management of diabetes, but it is a fact that a lot of diabetic patients find it difficult to adhere to their drugs regimen. The trouble of Non-adherence to prescribed medicinal treatment remains a challenge for medical professionals and community; consequently, numerous patients did not get effective benefits from medical treatment. This leads to poor health outcomes, lower quality of life, and increased health care costs. Despite the improvement in adherence research, non-adherence rates have remained nearly unchanged in the last decades[5,6].

Effectual management of diabetes is declining morbidity, mortality, and health care utilization, primarily decreasing the charges and burden to government and the society. People with diabetes who did not adhere to treatment have significantly worse clinical outcomes compared to patients who adhered to treatment[7]. Even though a lot of emphasis was made on patients regarding the significance of proper medication use, many patients poorly adhere to drugs mainly for chronic diseases and fall short of achievable health goals[8].

Non-adherence is association factors that are patient-centered, therapy-related, or healthcare system related[7,9]. The patient-centre factors can be demographic (age, gender, educational level, and marital status) and psychological (patients' beliefs and motivation towards the therapy, negative attitude, patient-prescriber relationship, understanding of health issues, and patients' knowledge[10,11]. The therapy-related factors include route of administration, duration of treatment, complexity of treatment, type of medication and the side effects of the medicines. The factors linked to the healthcare system include availability and accessibility of health care, and the health provider-patient interactions[12].

Non-adherence, poverty, lack of knowledge and poor follow ups are the main factors observed in poor glycemic control. Non-adherence to prescribed medication schedule has been and continuous to be a major problem in the world. In chronic disease it has been described as taking less than 80% of the prescribed treatment. Previous studies have found adherence to diabetes treatment generally to be sub optimal ranging (23%-77%)[13].

During our clinical posting time we have witnessed many diabetic patients with severe complications and further admission to the hospital. So we came up with an idea that whether these complications were of patients' non-adherence to their anti-diabetic medication or any other possible factors?

There is a need of continuous appraisal for patients with DM, as it is exhausting in taking the drug for continual time and paying a large amount of money, resulting to non adherence among patients. This is observed mainly in low income developing countries; the major cause include such as economic insecurity and inadequate access to health care facilities that led to an increase in incidence of non-adherence to anti-diabetic medication. In resource limited countries like Eritrea, the prevalence of economic instability, low literacy level, scanty evidence-based research that evaluate medication adherence and restricted access to health care facilities might have led to the increase incidence of medication non-adherence. Identification of the factors leading to non adherence to a prescribed

treatment can help in planning interventions to overcome these barriers.

The purpose of this study was to assess the adherence and associated factors in determining the magnitude at Halibet Regional Referral Hospital, Diabetic clinic from February to May. Therefore, this evidence-based research provides baseline information regarding the magnitude of adherence, since there is no study in Eritrea about adherence and to determine various non-adherence associated factors among patients that are using anti-diabetic medication. This information will help for health planners at the MOH and specifically Halibet Regional Referral Hospital health management staff, for the continuity of medications and prevention of morbidity, disability and deaths due to DM.

MATERIAL AND METHODS

Study design and Area

This was a cross sectional study conducted at the diabetes clinic of Halibet National Referral Hospital from February 1 to May 30, 2019. This hospital is located in the Northeast part of Asmara, the capital city of Eritrea. It is a tertiary level hospital acting as referral hospital and teaching center. Outpatient and inpatients care services are given on a daily except Sunday. Patients receive free medical care including medicines and laboratory investigations and attend the clinics at scheduled time for continuous monitoring and consultation regarding their illness.

Participant of the Study

A total 205 diabetic patients who were registered and have been taking anti-diabetes medication for more than six months were included in this study. Subjects were above the age of 16 years who were attending the diabetic clinics and gave informed consent to participate in the study.

Sampling method and Sampling size

There were about 7000 registered clients in the diabetic clinic of Halibet National Referral Hospital who were taking anti-diabetes medication regularly as outpatient follow-up. The study sample size was found to be 190, adding up 10% non-response rate the final sample size was 205. The samples were selected by convenience non probability sampling method.

Data collection

The research team conducted the study by approaching patients on their regular visit to diabetic clinic of Halibet National Referral Hospital. Data was collected using interview guided questionnaire. The questionnaire included socio demographic data, medication adherence level and diabetic profile, and factors related to non-adherence. Questions were adopted, modified and translated in to local language (Tigrigna). Data were cleared and checked at the end of each interview for completeness, before data entry to excel.

The tool of scoring system for the adherence level was based on self-reports of how patients had been taking medication one week prior to the interview period. The number of times doses were missed was calculated based on the patients' medication regimen which was obtained from their interview. Patients, whom scored 0-79% of the prescribed dose from the last seven days, were poor adhered and those who scored 80-100% were good adhered[14].

Data Analysis Methods

The study used quantitative data according to the variables that the research questions need to answer. Data were entered using an excel and exported to Statistical Package for Social Sciences (SPSS) for Windows version 20.0 for cleaning and analysis. Chi-square analysis method was used to find out the strength of the associations of each independent variable with the dependent variables in which crude odds ratio with their corresponding 95% confidence intervals were used to describe these associations. A p-value less than 0.05 were considered as statistically significant.

Ethical Considerations

The ethical issue was dealt first by obtaining a permission letter from the School of Nursing, ACHS, and then taken to the Halibet medical officer. The participants were adequately informed about the purpose, method and expected outcome of the study by the researchers. Verbal consent was obtained and secrecy was maintained highly confidential. The responders' right to refuse or

withdraw from the study was also respected fully. And all patients who were willing to participate in the study were kindly requested to put their signatures.

RESULTS

A total of 205 respondents were interviewed with 100% response rate. The age of respondents ranged from 20-88 years with SD 14 years. More than half (52.7%) of the respondents were Males. Majority of the respondents were from urban areas 181(88.3%) and Christian religion 187(91.2%). Almost (37.1%) had educational background secondary school followed by college levels (22.9%) education. Around three fourth (72.2%) of the respondents reported that they were married. (29.9%) were students followed by civil employee (25.9%).

More than three fourth (77.1%) of the subjects were known T2DM. Regarding the age of onset of DM, majority of the respondents (83.3%) were ≥30 years old when first diagnosed with DM. Most of the respondents (74.6%) had duration of five years and above with the disease. Majority of the respondents (69.3%) reported that they had no family history of diabetes. Almost equal number of patients, 51.2% and 49.3%, told that they take injection and oral only respectively. Out of all the respondents, 41.5% had co morbidity. Details of the respondents are summarized in above Table No.2.

Out of 205 participants 86.3% had good adherence whereas the remaining 13.7% had poor adherence.

Numerous factors, comprising socio demographic characteristic (age, sex, address, religion, ethnicity, educational level, marital status, occupation, monthly income) and medication and clinical characteristics (type of DM, type of DM drugs and frequency taken per day, family history, co morbid disease, duration of DM and age of disease onset) were analyzed to determine any association with adherence to anti-diabetic medications. Only duration of DM and co-morbid diseases had statistically significant association with adherence to ant-diabetic medication at *P*-Value 0.001 and 0.026 respectively. Details are summarized in above Table No.4.

At crude odds ratio analysis, factors associated with adherence to medication were: monitor blood glucose level regularly (OR = 2.078, 95% CI = 0.604-7.142), having ever attending health education (OR = 1.621, 95% CI = 0.179-14.639), availability of anti-diabetic medication (OR = 76.174, 95% CI = 17.520-331.184), forgetfulness (OR = 0.141 95% CI = 0.037-0.531), taking Multiple medication (OR = 0.550 95% CI = 0.164-1.841) and Financial problem (OR = 0.883, 95% CI = 0.221-3.533). Details are summarized in Table No.5 below.

DISCUSSION

This study revealed that the adherence rate of the respondents to their medication was 86.3% with almost similar rates in both males and female which is 87% and 85.6% respectively. About five in every six respondents adhered in a satisfactory way to their diabetic medication based on self-reports at an adherence index of 80%. Similar adherence rates had been reported previously from studies conducted in UAE in which male's adherence was 84% and females' adherence was 87%[15], Uganda (83.3%)[14] and Gondar Ethiopia (85.1%)[16]. However, it is higher than the medication adherence rate reported in Botswana (58.2%)[17], Tanzania (71.2%)[18], New York (75%)[19], Ghana (68.5%)[20], Nigeria (72.5)[21] and Adama Ethiopia (72.2%)[22]. The disparity in adherence levels may be attributed to differences in metrics to assess adherence, and/or differences in health care settings, time gape of study, financial cost and socio economic status. With reference this study patients receive free anti-diabetic drugs while in low income countries patients were might be pay for drugs and clinic consultations. Therefore associated financial costs may discourage or becomes late patients from re-filling prescribed medication and this becomes hinder on their adherence and the high costs of the prescribed medications.

Higher adherence rates were shown among patients with an educational level of junior (89.1%), secondary (85.5%), collage and above (91.5%) and were found to be the most compliant to the prescribed treatment whereas lower adherence rates

were found among illiterates (62.5%) and primary (78.9%) level of education. Despite the difference in rates of adherence with educational levels there is no statistical significant association (P-value =0.186). Similar study conducted in UAE reported higher adherence rates among patients with graduate level (bachelor's degree) (85.8%) and post-graduate degree (master's degree) (84.6%)[15]. Another study conducted in Adama Ethiopia revealed higher adherence rates among graduate patients (diploma) (80.7%) and secondary school (80%). This finding could be explained as the educational level of individual's increase their knowledge could also be lifted which leads to better understanding. In the case of diabetes those who have higher educational level could easily grasp the information provided to them

In this study, 20% of those who had co-morbid disease were not adhered to the prescribed drug therapy and this is statistical significant at p value of (0.026). Likewise, the same results were noted in Adama Ethiopia 25%[22] and Zimbabwe 23%[23]. As a result of taking multiple medications patient could be confused with the drug regimen and may feel bored to take multiple drug. This implies that having a co-morbid disease additionally could have affected the rate of adherence to the prescribed drugs.

Another significant association found in this study was the duration of diabetes with the adherence status of the participants at p value (0.001). Patients with five years and above since medically diagnosed as having diabetes were observed to be more likely adherent than those with less than five years of duration with an adherence level of 90.8% and 73% respectively. This outcome is similar to results of the study done in Gonder Ethiopia in which patients with five years and above duration of diabetes had an adherence level of 85.0% and patients with diabetes duration of less than five years had 78.0% adherence level[16]. Another study from Uganda reported an adherence level of 88.6% and 77.6% among patients with five and above years of diabetic duration as compared to patients with less than five years of diabetes duration respectively[14]. This could be related to the experience of the patients and their bond with the health workers or care givers. The longer the time a patient follows a treatment the better could be the understanding about the regularity, schedules and perceived benefits. In addition, with the length of time a patient and care provider relations could be strengthened leading to close communication and encouraging care provider to convey every piece of information and advice. Meanwhile motivating patients to follow the given instruction and advices with trust ship and altogether improving adherence.

According to the respondents of this study, the common reasons for non-adherence to anti-diabetes medications were modifiable factors such as forgetfulness and non-monitoring blood glucose level. Forgetfulness accounts for 34.1% and was statistically significant (OR = 0.141, 95% CI =0.037- 0.531). This finding was in line with a study from Ghana and Adama Ethiopia where 45.5%[20] and 53.9%[22] subjects reported forgetfulness respectively. In contrast, a study from Tanzania stated financial factor as the main reason for non-adherence to anti-diabetic medications with a value of 35.1%[18].

Financial factor could not be such influencer in Eritrea as patients receive free medical care including medicines and laboratory investigations. Forget fullness as a barrier could be solved by supporting patients in organizing their medications with dosing alarms or specific remainder techniques. Moreover, a family member or close friend support could have a role in avoiding forgetfulness. Regular monitoring of blood glucose levels was found to be significantly associated to anti-diabetes medication adherence (OR = 2.078, 95% CI = 0.604-7.142). More than half of the respondents (53.2%) in this study reported that they monitor their blood glucose levels regularly and from those 90.8% were adhering to their medication. Similarly, a study conducted in UAE found that more than 95% of the respondents were monitoring their blood glucose levels regularly[15]. While a study from Nigeria had the opposite results in which majority of the participants (80%) did not monitor their blood glucose levels on a regular basis[21]. The practice of self-monitoring of blood

glucose levels by patients could be a signal of their commitment to management diabetes and could possibly be rooted behind the reasons for the good adherence rate.

This study also found a significant association between health education about diabetes mellitus and the adherence level of patients with 88.1% of those patients who attended the health education sessions were adherent to their anti-diabetes mediation (OR = 1.621, 95% CI = 0.179 - 14.639). This finding is similar to studies done in Gondar Ethiopia (86%) (16) and Uganda (84%)[14]. Where patients attending health education had a higher adherence rate and were significantly associated. Providing health education to patients about diabetes mellitus, its diagnosis, management and other self-care advices related to diabetes could be effective in improving recruitment of patients into treatment programs, improving patients' health condition and improving drug adherence. Education on diabetes self-management has possibility to improve diabetes care. Having a 20 minutes discussion with a diabetes educator in every three months before an office visit may help to achieve many goals. Therefore, it is very important to staff the diabetic clinics with adequate numbers of well-trained health workers who are willing to spend reasonable time with patients and provide up to date diabetic management guidelines[24].

Another significant association observed in this study was the association between the availability of anti-diabetes medication and adherence level to the medication (OR = 76.174, 95% CI = 17.520-331.184). Almost all (94.5%) of those who reported the availability of drug is continuous (always) were adherent to their medications. Study conducted in Uganda indicated that 33.8%[14] of the respondents had missed getting at least one of the drugs in their regimen. If drugs stock out- patients will go without drugs till next scheduled visit or are forced to purchase their medications from private providers. Failure to afford medications could be a potential factor for poor adherence.

Table No.1: Distribution socio demographic characteristic

S.No	Variables	Frequency	Percentage (%)
Age			
1	16-45	40	19.5
2	46-60	81	39.5
3	61-75	71	34.6
4	76 and above	13	6.4
Sex			
5	Male	108	52.7
6	Female	97	47.3
7	Address		
8	Urban	181	88.3
9	Rural	24	11.7
10	religion		
11	Christian	87	91.2
12	Muslim	18	8.8
Educational			
13	Illiterate	8	3.9
14	Primary	19	9.3
15	Junior	55	26.8
16	Secondary	76	37.1
17	Collage and above	47	22.9
Marital status			
18	Single	23	11.2
19	Married	148	72.2
20	Widowed	20	9.8
21	Divorce	9	4.4
22	Separate	5	2.4
Occupation			
23	Farmer	5	2.4
24	House wife	45	22
25	Civil employ	53	25.9
26	Military employ	23	11.2
27	Trader	12	5.9
28	Student	61	29.8
29	Unemployed	6	2.9

Table No.2: Distribution of medication and clinical characteristic of the study participants

S.No	Variables		Frequency	Percentage
1	Type of DM	T1D	47	22.9
		T2D	158	77.1
2	Age of onset of DM	<30 year old	28	13.7
		≥30 year old	177	86.3
3	Duration of DM	<5 years	52	25.4
		≥5 years	153	74.6
4	Family history	Yes	63	30.7
		No	142	69.3
5	Type of DM drugs	Oral only	101	49.3
		Injection only	103	50.2
		Both oral and injection	1	0.5
6	Co-morbid disease	yes	85	41.5
		No	120	58.5
7	Co morbid disease	hypertension	65	76.4
		Kidney disease	6	7.1
		Respiratory disease	2	2.4
		Others, HIV, liver disease	12	14.1

Table No.3: Distribution of adherence to anti-diabetic medication (N=205)

S.No	Adherence level	Frequency	Percentage
1	Good adherence	177	86.3%
2	Poor adherence	28	13.7%

Table No.4: Associations of selected socio-demographic, clinical and medication characteristic with adherence anti-diabetic medication

S.No	Variables		Level of adherence				p- value
			Adhered		Non adhered		
			frequency	Percent age	Percentage	Frequency	
1	Sex	Male	94	87	14	13	0.760
		Female	83	85.6	14	14.4	
2	Age	20-45	35	87.5	5	12.5	0.851
		46-60	67	82.7	14	17.3	
		61-75	65	91.5	6	8.5	
		76 and above	10	76.9	3	23.1	
3	Address	Asmara	156	86.2	25	13.8	.860
		Outside Asmara	21	87.5	3	12.5	
4	Religion	Christian	159	85	28	15	.077
		Muslim	18	100	0	0	
5	Education	Illiterate	5	62.5	3	37.5	.186
		Primary	15	78.9	4	21.1	
		Junior	49	89.1	6	10.95	
		Secondary	65	85.5	11	14.5	
		Collage and above	43	91.5	4	8.5	

S.No							
6	Marital status	Single	28	91.3	2	8.7	.740
		Married	129	87.2	19	12.8	
		Widowed	16	80	4	20	
		Divorced	7	77.8	2	22.2	
		Separated	4	80	1	20	
7	Occupation	Farmer	4	80	1	20	.312
		House wife	34	75.6	11	24.4	
		Civil employee	46	86.8	7	13.2	
		Military employee	21	91.3	2	8.7	
		Merchant	11	91.7	1	8.3	
		Student	55	90.2	6	9.8	
		Unemployed	6	100	0	0	
8	Type of DM	T1D	42	89.4	5	10.6	.492
		T2D	135	85.4	23	14.6	
9	DM drug	Oral only	88	87.1	13	12.9	.868
		Injection only	88	85.4	15	14.6	
		Both oral and injection	1	100	0	0	
10	Co morbid disease	Yes	68	80	17	20	.026
		No	109	90.8	11	9.2	
11	Duration of dm	<5yrs		73.1		26.90	0.001
		>5yrs		90.8		9.20	

Table No.5: Association between factors and the level of adherence

S.No	Variables		Adherence level				Odds Ratio	P-value
			Adherence		Non adherence			
1	Monitor blood glucose regularly	Yes	99	90.8	10	9.2	2.078 (0.604-7.142)	0.046
		No	78	81.2	18	18.8		
2	Attending health education	Yes	170	88.1	23	11.9	1.621 (0.179 - 14.639)	0.004
		No	7	58.3	5	41.7		
3	Availability of medication	Yes	172	94.5	10	5.5	76.174 (17.520 - 331.184)	0.000
		No	5	21.7	18	78.3		
4	Modification of dosing and timing of drug	Yes	34	87.2	5	12.7	3.076 (0.546- 17.324)	0.866
		No	143	86.1	23	13.9		
5	Forgetfulness	Yes	29	65.9	15	34.1	0.141 (0.037- 0.531)	0.000
		No	148	91.9	13	8.1		
6	Multiple medication	Yes	60	78.9	16	21.1	0.550 (0.164 - 1.841)	0.018
		No	117	90.7	12	9.3		
7	Complexity drug regimen	Yes	121	85.8	20	14.2	2.137 (0.602 - 7.587)	0.776
		No	55	87.3	8	12.7		
8	Financial problem	Yes	41	82	9	18%	0.883 (0.221 -3.533)	0.340
		No	136	87.7	19	12.3		
9	Habit of alcohol	Yes	11	78.6	14	21.3	0.761 (0.086 - 6.741)	0.380
		No	166	86.9	25	13.1		
10	Believes the medication useless	Yes	3	75	1	25	5.766 (0.018 - 1811.251)	0.540
		No	174	86.6	27	13.4		
11	Feeling the given dose is high	Yes	27	79.4	7	20.3	0.390 (0.089 -1.712)	0.180
		No	150	87.7	21	12.3		

RECOMMENDATION

A detailed and comprehensive health education should be further increased to be given to the patients as well as family members about the disease and anti-diabetic medication. The hospitals should develop manual guidelines for patient education regarding adherence towards medication and improving non-adherence factors. The barrier of forgetfulness can be overcome by assisting patients in organizing their medications with pillboxes and dosing alarms and family members can assist in medication adherence in those taking multiple medications.

LIMITATIONS OF THE STUDY

Self-reported was used as the only method of measuring adherence. This method has the disadvantage of recall bias and eliciting only socially acceptable response and hence, may overestimate the level of adherence moreover only registered patients who come for follow up care were participated in the study so this study cannot represent diabetic patients who were not registered. Due to the nature of the study design, cause and effect relationship between outcome variable and associated variable cannot be established.

ABBREVIATIONS

ACHS: Asmara College of Health Sciences
MOH: Ministry of Health
WHO: world health Organization,
SPSS: Statistical Package Social Science
DM: Diabetic Mellitus
T1D: Type One Diabetic
IDF: International Diabetes Federation
T2D: Type Two Diabetic.

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AUTHORS' CONTRIBUTIONS

All authors participated in all phases of the study including topic selection, design, data collection, data analysis, interpretation and presentation. Daniel contributes to write this manuscript.

AVAILABILITY OF DATA AND MATERIALS

The complete data set supporting the conclusions of this article is available from the corresponding author and can be accessed up on reasonable request.

CONCLUSION

In this study, the overall adherence rate to anti-diabetes medication was high (86.3%). Duration of diabetes mellitus, co-morbidity, forgetfulness, regular blood glucose level monitoring, attending health education about DM and its medication and availability of the medication, were significantly associated with anti-diabetes medication adherence. Sex, age, religion, educational level, monthly income, marital status, types of DM, DM drugs and frequency of dosage were not significantly associated with anti-diabetes medication adherence. The common reasons for non-adherence to anti-diabetes medication were forgetfulness and non-monitoring of blood glucose level regularly. Therefore, strategies that further improves anti-diabetic drug availability, provide health education, reduce the intervals of visit for follow-ups on diabetic care and giving explicit information and persistent close family support for those taking multiple medication may help in improving adherence levels among patients with diabetes.

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CONFLICT OF INTEREST

None declared.

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