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Original Research

Medication Adherence and Associated Factors among Diabetic Patients Attending the Clinic at a Tertiary Hospital in Northern Sri Lanka

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Abstract

Diabetes mellitus is one of the most important chronic diseases. The prevalence rate of diabetes is increasing worldwide, and it is rapidly rising in Sri Lanka. Uncontrolled diabetes leads to the development of complications, which will increase morbidity and mortality. Medication non-adherence is one reason for uncontrolled diabetes. Therefore, objective of the study was determination of adherence to oral hypoglycemic drugs among patients with diabetes, and the factors associated with adherence and the barriers to adherence, at the Teaching Hospital, Jaffna, in Northern Sri Lanka. This was a hospital-based cross-sectional study conducted among 420 patients with diabetes mellitus attending the Teaching Hospital in Jaffna, Sri Lanka. A pretested, interviewer-administered questionnaire and a data extraction form were used to collect data on medication adherence and associated factors. Data were analysed using SPSS, version 21.0. The Chi-square test was used to assess the association between variables. A *p*-value less than 0.05 was considered significant. The response rate was 99% (n=416). The majority of the patients (78.1%) adhered to their therapy. The most reported reasons for non-adherence to oral anti-diabetic drugs were lack of reminders, followed by misplaced medication, and being busy or late for work. Age, occupation, family support, frequency of blood glucose checks, regular clinic visits, total number of drugs, number of oral hypoglycemic agents, and total weekly doses of oral hypoglycemic agents were significantly associated with adherence. Most patients reported good adherence to diabetic medication at the Teaching Hospital in Jaffna. More attention should be taken among non-adherent patients by considering the factors associated with non-adherence and providing proper counselling on medication usage to them.

Key Words: *Associated factors, Diabetic patients, Medication adherence*

Introduction

Diabetes mellitus (DM) is caused by either diminished pancreatic insulin secretion or the emergence of insulin resistance, which impairs the body's ability to use insulin [1]. The prevalence of adult-onset diabetes was 10.5% worldwide [2]. In Sri Lanka, 23 % of adults have diabetes mellitus [3], which is greater than the prevalence of diabetes worldwide.

The treatment guidelines for diabetes are based on the type of diabetes. The mainstay treatment for type 1 diabetes is insulin. For the treatment of type 2 diabetes, insulin and various hypoglycemic agents are used [4]. Glycemic control in patients with diabetes reduces diabetes-related complications [5,6]. Adherence to medication is associated with a controlled blood glucose level [7]. Nonadherence to glucose-lowering drugs is associated with higher glycated haemoglobin [8].

The World Health Organisation (WHO) defined medication adherence as “The extent to which a person’s behaviour in taking medication, following a diet, and executing lifestyle changes, corresponds with agreed recommendations from a healthcare provider” [9]. Adherence problems are common in the management of diabetes [10]. Medication non-adherence may begin at any stage of treatment, including not filling the prescription regularly, non-persistence with the therapy, incorrect drug or dose administration, or skipping doses.

Diabetic patients who were non-adherent to medication have a greater risk of developing cardiovascular complications [11,12]. The medication non-adherence affects mainly the older adult groups, as they are more susceptible to adverse health effects due to the change in their pharmacokinetics and pharmacodynamics [13].

A gold-standard method for measuring drug adherence is not available [14]. Drug adherence can be measured directly or indirectly. Direct methods are relatively accurate and objective, including biomedical measurements and direct observations. Self-reported questionnaires, electronic monitoring devices, and pill counts are examples of indirect methods [15]. Because self-report questionnaires are affordable and easy to administer, they are frequently used [16].

Medication non-adherence among diabetic patients could develop different complications and affect patients’ quality of life. There are limited studies on medication adherence of diabetes patients in Northern Sri Lanka. It is essential to determine the factors associated with non-adherence and barriers to adherence among diabetic patients. Such a study will help elaborate on strategies to improve medication adherence among health care professionals. Self-reported questionnaires were used to determine adherence in other countries. However, such a questionnaire should be used only after validation to obtain reliable results. Self-reported missed doses by patients is one method used to measure medication adherence.

This study aims to evaluate medication adherence, related factors, and barriers to adherence among diabetic patients at the Jaffna Teaching Hospital in Northern Sri Lanka.

Methods

Study setting

A hospital-based cross-sectional study was conducted among patients with diabetes mellitus attending the Diabetes clinic at Teaching Hospital, Jaffna.

Study population

Adult patients with type II diabetes mellitus who had been taking oral anti diabetic drugs for at least the past three months were selected in this study. Patients who could not communicate properly and had insulin therapy were excluded from the study. The study was conducted from November 2020 to November 2021.

Sample size

The sample size was determined using the following formula: $N=Z^2 p (1-p)/d^2$. An anticipated population proportion of 0.565 was used, based on a study conducted at a tertiary hospital in India that reported patients' adherence to diabetic medication at 56.5% [17]. According to this study the estimated sample size was 378. A 10% non-response rate was added, yielding a total sample size of 420.

Sampling technique

Approximately 450 patients attend the diabetes clinic per month. Therefore, all patients visiting the clinic in a month were included in this study without any sampling technique.

Study instruments

Data was gathered using a data extraction form and a pretested, interviewer-administered questionnaire. Information on medication adherence, barriers to adherence, socio-demographic factors, and patient-, disease-, and therapy-related factors was collected using an interviewer-administered questionnaire. The data extraction form was used to collect information from individual patients' clinic books. This information included prescribed oral hypoglycemic agents and doses, dosing frequency, and the total number of prescribed medications.

Data collection

The data were collected through a face-to-face interview conducted by the researcher with the help of a trained data collector. The purpose of the research was explained to the patients, and informed consent was obtained. Patient privacy was maintained during data collection by interviewing patients in a separate place from other patients.

Data analysis

The total number of doses missed by the patient during the last week was obtained from the adherence questionnaire. The adherence percentage was calculated using the following equations.

Adherence = (Number of doses recommended – number of doses missed)/(Total number of doses recommended) * 100%

According to the value obtained from the above equation, values ≥ 80% were considered good adherence to the medication, and values < 80% were considered poor adherence [18].

The Chi-square test was employed to evaluate the relationship between selected factors and

medication adherence using Statistical Package for the Social Sciences (SPSS) software, version 21.0. Statistical significance was defined as a *p*-value < 0.05.

Results

Among participants, the response rate was 99 % (n=416).

Socio-demographic characteristics of patients

Table 1 depicts the participants' socio-demographic characteristics. Most participants (70.9%, n=295) were aged 18-64 years. The mean age of the patients was 57.69 ±12.2 years. Most of them (83.2%, n=346) were married. Two-thirds of the participants (68.8%, n=286) were female, and over half (57.9%, n=241) had completed secondary/tertiary education. The majority of the participants (71.4%, n=297) were unemployed.

Table 1 Distribution of socio-demographic factors of Diabetic patients (N=416)

Socio-demographic factors	Categories	Frequency (Percentage)
Age (in years)	18-64	295 (70.9%)
	>64	121(29.1%)
Gender	Male	130 (31.2%)
	Female	286 (68.8%)
Marital status	Single	21 (05%)
	Married	346 (83.2%)
	Divorce/ Widowed	49 (11.8%)
Level of education	No formal education	40 (9.6%)
	Primary	35 (32.5%)
	Secondary/ Tertiary	241(57.9%)
Occupation	Employed	119 (28.6%)
	Unemployed	297 (71.4%)

Medication adherence of diabetic patients

The majority of participants (78.1%) adhered well to their therapy.

Reasons for medication non-adherence among the study participants

The most common reasons for not taking oral hypoglycemic agents (OHA) were lack of reminders (89.2%, n=140), misplaced medication (56.2%, n=89), and being busy or late for work (34.4%, n=54), as shown in Table 2.

Table 2 Reasons for medication non-adherence of Diabetic patients (N=157)

Reasons*	Frequency (Percentage)
Busy or late for work	54 (34.4%)
Being away on weekends/vacation	17 (10.8%)
Lack of reminders	140 (89.2%)
Misplacing the medication	89 (56.2%)
Finishing the pills	36 (22.9%)
Having too many medications	30 (19.1%)
Lack of money to refill the medication	14 (8.9%)
Being outside and forgetting to take the medication	41 (26.1%)

** Multiple options*

Factors associated with medication adherence

Table 3 shows the association between the sociodemographic factors and medication adherence. Sociodemographic factors, such as age (*p*=0.046) and occupation (*p*=0.037), were significantly associated with medication adherence.

According to Table 5, Patient-related factors, such as the frequency of blood glucose checkups (*p*=0.003), family support (*p*=0.016), and regular clinic visits (*p*=0.004), were significantly

associated with medication adherence. According to Table 6, all therapy-related factors, such as the total number of drugs (p=0.013), the number of OHA drugs (p>0.001), and the total number of OHA doses per week (p>0.001), were significantly associated with medication adherence.

Table 3 Association between sociodemographic factors and medication adherence among Diabetic patients

Factor	Category	Medication adherence level		Total	Chi-square test *p* value
		Good adherence N (%)	Poor adherence N (%)		
Age (years)	18-64	228 (77.3%)	67 (22.7%)	295 (100%)	**0.046**
	≥65	104 (86.0%)	17 (14.0%)	121 (100%)	
Gender	Male	99 (76.2%)	31 (23.8%)	130 (100%)	0.512
	Female	226 (79.0%)	60 (21.0%)	286 (100%)	
Marital status	Single	17 (81.0%)	4 (19.0%)	21 (100%)	0.860
	Married	271 (78.3%)	75 (21.7%)	346 (100%)	
	Divorced/Widowed	37 (75.5%)	12 (24.5%)	49 (100%)	
Level of education	No formal education	27 (67.5%)	13 (32.5%)	40 (100%)	0.135
	Primary	111 (82.2%)	24 (17.8%)	135 (100%)	
	Secondary/Tertiary	187 (77.6%)	54 (22.4%)	241 (100%)	
Financial support	Adequate	256 (77.6%)	74 (22.4%)	330 (100%)	0.596
	Not adequate	69 (80.2%)	17 (19.8%)	86 (100%)	
Occupation	Employed	85(71.4%)	34 (28.6%)	119 (100%)	**0.037**
	Unemployed	240 (80.8%)	57 (19.2%)	297 (100%)	

Table 4 Association between disease-related factors and medication adherence among Diabetic patients

Factor	Category	Medication adherence level		Total	Chi-square test *p* value
		Good adherence N (%)	Poor adherence N (%)		
Duration of treatment of DM	≤ 10 years	211 (77.6%)	61 (22.4%)	272 (100%)	0.708
	>1 years	114 (79.2%)	30 (20.8%)	144 (100%)	
Having co-morbidities	Yes	206 (79.2%)	54 (20.8%)	260 (100%)	0.481
	No	119 (76.3%)	37 (23.7%)	156 (100%)	
Having DM complications	Yes	226 (77.7%)	65 (22.3%)	291 (100%)	0.728
	No	99 (79.2%)	26 (20.8%)	125 (100%)	
Family history of DM	Yes	174 (78.7%)	47 (21.3%)	221 (100%)	0.749
	No	151 (77.4%)	44 (22.6%)	195 (100%)	

Table 5 Association between patient-related factors and medication adherence among Diabetic patients

Factor	Category	Medication adherence level		Total	Chi-square/Fisher's exact tests *p* value
		Good adherence N (%)	Poor adherence N (%)		
Family support	Yes	123 (84.8%)	22 (15.2%)	145 (100%)	**0.016**
	No	202 (74.5%)	69 (25.5%)	271 (100%)	
Frequency of blood glucose level checkup	Regularly	83 (88.3%)	11 (11.7%)	94 (100%)	**0.003**
	Sometimes	184 (78.0%)	52 (22.0%)	236 (100%)	
	Rarely	58 (67.4%)	28 (32.6%)	86 (100%)	
Regular clinic visit	Yes	224 (82.4%)	48 (17.6%)	272 (100%)	**0.004**
	No	101 (70.1%)	43 (29.9%)	144 (100%)	
Alcohol consumption	Yes	18 (75.0%)	06 (25.0%)	24 (100%)	0.703
	No	307 (78.3%)	85 (21.7%)	392 (100%)	
Smoking	Yes	8 (66.7%)	4 (33.3%)	12 (100%)	0.477
	No	317 (78.5%)	87 (21.5%)	404 (100%)	

Table 6 Association between therapy-related factors and medication adherence among Diabetic patients

Factor	Category	Medication adherence level		Total	Chi-square test *p* value
		Good adherence N (%)	Poor adherence N (%)		
Total number of drugs	< 5 drugs	174 (73.7%)	62 (26.3%)	236 (100%)	**0.013**
	≥ 5 drugs	151 (83.9%)	29 (16.1%)	180 (100%)	
No. of OHA drugs	One	149 (67.42%)	72 (32.58%)	221 (100%)	**< 0.001**
	More than one	176 (90.26%)	19 (9.74%)	195 (100%)	
Total number of OHA doses per week	≤ 14	79 (54.5%)	66 (45.5%)	145 (100%)	**< 0.001**
	>14	246 (90.7%)	25 (9.3%)	271 (100%)	

None of the disease-related factors showed a significant association with medication adherence, as depicted in Table 4.

Discussion

This study examined medication adherence to oral hypoglycemic drugs, factors associated with adherence, and barriers to adherence among patients with diabetes at the Teaching Hospital in Jaffna, in the Northern Province of Sri Lanka. More than three-fourths of patients (78.1%) had good medication adherence in this study. Medication adherence to diabetic medications was low to moderate in the Asian region [19]. And it was 26% to 97% in low- and middle-income counties [20]. Medication adherence to anti-diabetic medications was 61% in South India [21], 79.5% in North India [22], 34.14% in eastern India [23], 82% in Pakistan [24], 53.7% in Bangladesh [25], 61% in Nepal [26], 17.7% in Iran [27], and 65.8% in Malaysia [28]. Even though medication adherence in our study was higher than in other studies, the inconsistent adherence rates are due to differences in patients' socio-demographic characteristics, the methods used to measure

adherence, and study settings (e.g., community vs hospital).

Lack of reminder, misplaced medication, and being busy or late for work were the reported reasons for non-adherence in this study. The most commonly reported reason for poor adherence is forgetfulness, as reported in other studies [29,30,31]. Busy work schedules, misplaced medication, perceived side effects, lack of finances, and being away from home were also reported as reasons for non-adherence in other studies [31, 32]. By considering the reasons for non-adherence in our study, proper counselling should be provided by introducing appropriate reminder systems for drug use, such as encouraging patients to keep medication in a pill box, using mobile apps or mobile messages, and reminding family or caregivers at medication-taking time.

Among sociodemographic factors, only patients' age and occupation were significantly associated with medication adherence. However, gender, educational level, financial support, and marital status showed no association with medication adherence. A study done at the tertiary care hospital in eastern India also reported that gender, marital status, and educational status failed to show an association with medication adherence [23]. Older adults were more likely to adhere to the treatment in our study. A study conducted at a primary health center in Spain found that elders adhered to medication more than others [30]. A Singaporean study conducted among community-dwelling adults also reported higher adherence among older adults than young adults [33]. This could be because most participants are retired at 60 and may have had more time to adhere to the treatment regimen properly. Gender did not show a significant association with medication adherence in our study. In a study of patients attending pharmacies in Germany, adherence to antidiabetic agents did not show a gender pattern [34]. However, in a study conducted among patients at a tertiary hospital in eastern India [21] and in a hospital-based cross-sectional study in Ethiopia [35], females showed lower adherence than males. Even though patients without formal education had lower adherence than their counterparts, education level was not associated with adherence. Lower adherence among patients with low educational levels was also reported in studies conducted in a diabetic clinic in India [36] and among outpatients at a tertiary hospital in Nepal [37]. Unemployed patients have more adherence than others in our study. Homemakers were more adherent among patients at the Teaching Hospital of Ethiopia [38]. In our study, homemakers were included in the unemployed category. Since homemakers have adequate time to follow the treatment, they showed high adherence.

A systematic review conducted in Asian studies reported that patient-related factors were associated with medication adherence [19]. In our study, Family support in managing DM is significantly associated with medication adherence. Reminding them to take medication or helping them organise medication in boxes, etc., are considered family support and could positively impact medication adherence [39,40]. Regular blood glucose monitoring was also significantly associated with medication adherence in our study. Patients who regularly

checked their glucose levels showed better medication adherence. Other studies also observed an association between blood glucose monitoring and adherence [17, 31, 40]. In our study, having regular clinic visits was associated with medication adherence. This finding was supported by a study done at primary health centers in Saudi Arabia [41]. During regular clinic visits, patients meet healthcare professionals and receive advice on medication use, improving their adherence. Alcohol consumption and smoking had no association with adherence in our study. Alcohol consumption was significantly influenced by non-adherence in a study conducted in a regional hospital in Cameroon [29]. Alcohol usage and smoking were significantly associated with adherence in a study done at a tertiary care hospital in eastern India [23].

There was an association between medication adherence and the number of medicines, OHA drugs, and OHA doses under therapy-related factors. Polypharmacy is defined as the use of more than five drugs, excluding antibiotics, injectable medications, and over-the-counter medicines. Polypharmacy increases the risk of nonadherence [42]. According to a systematic review, polypharmacy was negatively associated with medication adherence in many studies, but in some studies it was not [19]. Surprisingly, in our research, polypharmacy significantly influenced adherence, consistent with previous studies in a nationwide claim-based database in Japan [43] and a prospective cohort study in Germany [44]. Taking more medications for a longer duration of time could have become a habitual action for patients, which could be the reason for good adherence among patients on polypharmacy. Patients who have poor glycemic control were prescribed more medications to control blood sugar and reduce complications [45]. Patients would also be advised by healthcare professionals about the development of diabetes complications in uncontrolled glycemic status, so that patients can pay more attention to adhering to therapy in such conditions.

None of the disease-related factors, such as duration of diabetes treatment, comorbidities, diabetes-related complications, and family history, showed a significant association with medication adherence in this study. Diabetes duration was not associated with adherence in a study conducted in Bangladesh [46]. However, a study done in eastern India reported that having diabetic complications, having comorbidities, and having a family history of diabetes showed an association with medication adherence [23].

It is crucial to ensure medication adherence among non-adherents. Especially adults and employed patients, patients with less family support and those who have irregular clinic visits, need more attention, and they need proper counselling to address the importance of taking medications regularly.

To obtain generalizable results, the same study needs to be conducted in community settings and expanded to other parts of Sri Lanka. The findings would be helpful for improving adherence to antidiabetic medications during patient counselling. Recall bias and social desirability could have affected our findings. Lack of control for confounders is another limitation in this study.

Conclusion

More than three-fourths of patients with diabetes adhered to oral hypoglycemic therapy in the Teaching Hospital, Jaffna. However, among non-adherents, more attention should be given to improve medication adherence, especially among older adults and employed patients. Further, therapy- and patient-related factors need to be considered to improve medication adherence while counselling is given to non-adherent patients. Since this study was conducted among hospital-based patients, further research in community settings is needed to evaluate medication adherence.

List of abbreviations

DM - Diabetes mellitus
OHA - Oral hypoglycemic agents

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Ethical considerations

Ethical approval was obtained from the Ethics Review Committee, Faculty of Medicine, University of Jaffna. Administrative clearance was obtained from the Director and the Consultant Endocrinologist at the Teaching Hospital, Jaffna.

Declaration of conflicting interest

The authors declare that they have no conflict of interest.

Author contributions

ST and PADC were involved in the Study conception and design. PADC critically revise the manuscript for intellectual content. ST is responsible for data collection. Both authors have read and approved the final version of the manuscript.

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