Section: Community Medicine

Original Research Article

MEDICATION ADHERENCE AND ITS DETERMINANTS IN TYPE 2 DIABETES MELLITUS PATIENTS IN KERALA

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ABSTRACT

Background: Type 2 diabetes mellitus is a major public health concern in India, with high prevalence rates and a huge number of people with complications. Despite the availability of effective treatments, poor medication adherence and uncontrolled diabetes remains a widespread issue, leading to suboptimal glycemic control and complications. While numerous studies have explored this among patients admitted to hospitals, there is a lack of data from community-based populations in Kerala, a state with a unique socio-cultural context. This study aimed to investigate medication adherence among diabetic bystanders in the Government Medical College in Ernakulam and to identify associated factors.

Materials and Methods: A cross-sectional study was conducted from June to October 2024 among 295 diabetic bystanders. Participants were recruited from various hospital wards or OPDs. Medication adherence was measured using the MARS-5 questionnaire, with scores of <20 indicating poor adherence, 20-24 as moderate, and 25 as high. A semi-structured interview schedule was used to collect data on socio-demographic factors, knowledge of diabetes, family support, and other potential influencing factors. Statistical analysis was performed using JAMOVI, with the Chi-square test and binary logistic regression used to determine associations. A p-value of less than 0.05 was taken as statistically significant.

Results: The study found that 79.7% of participants were adherent to their medication (23.7% highly and 55.9% moderately adherent), while 20.3% were non-adherent. Factors significantly associated with non-adherence included low educational status, poor knowledge about diabetes, lack of family support, irregular blood glucose monitoring, lack of physical exercise, presence of multiple comorbidities and place of treatment of diabetes mellitus($p<0.05$). Binary logistic regression revealed that being illiterate or primary-educated (OR=8.0), having low knowledge (OR=2.68), and lacking family support (OR=3.02) and irregular monitoring of blood glucose were independent predictors of non-adherence.

Conclusion: More than 3/4th of the population studied were either moderately adherent or highly adherent to their diabetic medications. Socio-educational factors, personal knowledge, and social support systems are crucial determinants of medication adherence. These insights can inform the development of targeted public health interventions to improve diabetes management in the region.

Keywords: Diabetes Mellitus, Chronic Disease.

INTRODUCTION

Diabetes is a chronic disease characterised by hyperglycemia, and if left uncontrolled over a long time, can lead to serious damage to many of the body's systems, including the heart, brain and blood vessels. According to the International Diabetes Federation (IDF) statistics, in 2024, there were 589 million adults affected by type 2 diabetes mellitus.[1] The prevalence is expected to rise to 853 million by 2050. In the year 2021, diabetes directly caused 1.6 million deaths worldwide, with 47% of these deaths occurring before the age of 70. Additionally, diabetes contributed to 530,000 deaths due to kidney disease.[2]

India accounts for 89.8 million diabetics as per IDF statistics, which is almost 1/6th of the total world prevalence.[3] The state of Kerala, known as God's Own Country and is unique in that the health indicators of Kerala are on par with those of developed countries. But the prevalence of diabetes is one of the highest in India, with 23.6% of the adult population affected with Type 2 DM.[4] Also, in a 10-year follow-up study conducted by researchers from 2007-17 in Kerala, the incidence rate of impaired fasting glucose (IFG) was 45.01 per 1000 person-years, and nearly 60% of participants with baseline IFG were converted to Type2DM during the follow-up period.[5] So Kerala is expected to have an even bigger burden of diabetes in the near future. This high burden will place immense strain on the healthcare system and the quality of life of individuals.

The most important thing to avoid complications in diabetes is to maintain consistent and effective control of your blood sugar levels. But the prevalence of uncontrolled diabetes in India is extremely high, with a prevalence of 65% to 78% being reported by multiple studies from Karnataka, Tamilnadu and Kerala. This puts the majority of patients at risk of various complications of diabetes.

The cornerstone of effective Type 2 DM management and maintenance of euglycemia is consistent adherence to the prescribed treatment regimen, which includes medications, diet, and lifestyle modifications. However, poor medication adherence is a common issue in India, with some studies showing non-adherence rates of 39% to 74%.[6,7] Such levels of non-adherence can lead to suboptimal glycaemic control and a high chance of patients going in for long-term complications of diabetes mellitus.

Although the issue of inadequate medication adherence in T2DM is acknowledged worldwide, the particular factors affecting it can differ greatly among various populations. In Kerala, a region with a distinctive socio-cultural environment, elevated health literacy, and a significant focus on family assistance, the factors influencing medication adherence could be different from other areas.

There are multiple studies from Kerala which address non-adherence and its factors among patients attending hospitals, but their adherence rates cannot be taken as a proxy for the community setting because of the inherent selection bias associated with them. The current study aims to investigate the adherence to medication among bystanders at Government Medical College, Ernakulam, who are also diabetic themselves. It also intends to find out the associated factors of non-adherence among the above population. As bystanders come to the hospital not for treatment of ailments and come from different districts, they can be seen as a better representation of the community.

The findings will provide critical insights to healthcare providers and policymakers in designing context-specific strategies to enhance adherence and improve glycaemic outcomes in the region.

MATERIALS AND METHODS

The cross-sectional study on drug adherence to diabetic medication was conducted in Government Medical College, Ernakulam, a teaching hospital in Kerala, South India. The data collection was done between June 2024 and October 2024 among the bystanders of patients admitted to the hospital.

We specifically recruited bystanders who themselves had a confirmed diagnosis of diabetes and were currently on medication for it. These individuals, who accompany their loved ones to the hospital from various districts in Kerala (primarily Ernakulam and Idukki), are not themselves seeking care for an acute illness at the time of recruitment. This approach allows us to capture a more naturalistic representation of medication adherence among diabetic individuals living in the community served by this hospital. The diverse socio-economic and geographic backgrounds of these bystanders are expected to provide a robust 'cross-section' of the community, enabling us to estimate diabetic medication adherence rates that are more reflective of the general population in these regions.

The sample size for the study was calculated using the formula 4pq/d2, and the prevalence of adherence to diabetic medication was taken from a previous study conducted by Uma V Sankar and others in Kerala, where the prevalence of good adherence to medication was found to be 26%(7). Taking this as P and an absolute precision of 5% the sample size required was found to be 295.

The bystanders who accompanied the patients to the hospital were approached using a screening questionnaire about their diabetic status either in the waiting areas or in the wards of the Department of Medicine, Surgery and Orthopaedics. Those bystanders who have been diagnosed with type 2 Diabetes mellitus and are currently on drugs or insulin or both for more than 6 months were included in the study. Those who were below 18 years of age, those who did not know either Malayalam or English and those who were not willing to study were excluded.

Among those included, the data collection was done using a semi-structured interview schedule after getting informed consent from the participants. The adherence to diabetic medication was measured using the MARS-5(Medication Adherence Report Scale). Permission for using the MARS-5 questionnaire was obtained from the owners of the questionnaire through email. A score of 25 was taken as high adherence, and any score above or equal to 20 was taken as moderate adherence. Any value less than 20 was taken as poor adherence. The rest of the data collection regarding factors related to non-adherence was done by a one-to-one interview in private using a semi-structured interview schedule between the study participants and the investigators.

The data collected was properly coded and entered into Microsoft Excel, and further analysis was done using the software JAMOVI version 2.7.5. Chi-square test was used for finding out the association between non-adherence and factors associated with it, and a p-value of less than 0.05 was taken as statistically significant. The diabetes knowledge was assessed using 4 questions on symptoms, diagnosis, management and control of diabetes, with each question carrying a maximum of 3 marks and a minimum of 0. The scores were added so that the maximum score possible was 12, with a minimum of 0. A score of more than 8 was taken as very good knowledge, a score between 5-8 as moderate knowledge and less than 5 as poor knowledge on diabetes.

Those factors that were found to be statistically significant or those with a p-value of less than 0.1 were also analysed using binary logistic regression. The method of analysis was the enter method.

RESULTS

Among the 295 participants studied, the mean age of the study group was 56 years, with a standard deviation of 11 years. The proportion of males and females in the study was almost equal (48.8% and 52.2%). The highest percentage of study participants was of the age group >60 years(36%), followed by the 50-60 years age group (35.6%). Most of the study population were from rural areas (63.7%), and 58% of them were followers of the Hindu religion. 87.5% were married, and the rest were either single or divorced. 30.9% had an education of high school and above, and 30.5% were primary school educated or illiterate. A good number of the study population were following skilled jobs or were shopkeepers or clerks, or similar (29.1%), and 27.5% were housewives. Basic age, sex composition and sociodemographic details are shown in [Table 1&2]

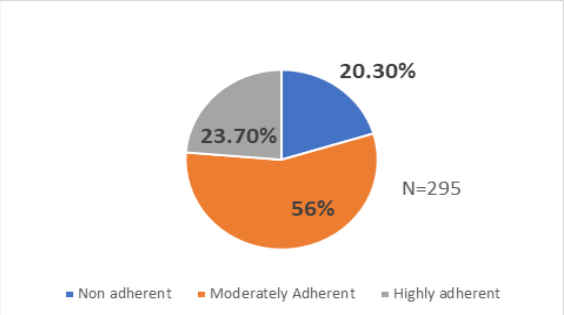

Figure 1: Showing adherence to diabetic medication among the study population.

Table 1: shows the age and gender composition of the study population

			Gender		Total
			Male	Female	
Age	below 40 years	Number	9	14	23
		%	39.1%	60.9%	100.0%
	40-50 years	Number	39	22	61
		%	63.9%	36.1%	100.0%
	50-60 years	Number	49	56	105
		%	46.7%	53.3%	100.0%
	More than 60 years	Number	47	59	106
		%	44.3%	55.7%	100.0%
Total		Number	144	151	295
		%	48.8%	51.2%	100.0%

Table 2: Basic demographic characteristics of the study population

Variable	Frequency	Percentage
Residence		
Rural	188	63.7
Urban	107	36.3
Religion		
Christian	67	22.7%
Hindu	172	58.3%
Muslim	56	19%
Marital status		
Married	5	1.7%
Single/Divorced/Widow	258	87.5%
Education		
Graduate or above	21	7.1%
Intermediate or diploma	25	8.5%
High school	91	30.9%

Middle school	68	23%
Primary school or illiterate	90	30.5%
Occupation		
Housewives	81	27.5%
Unemployed	47	16%
Semi-skilled jobs	67	22.7%
Skilled jobs/Shopkeepers, clerks	86	29.1%
Professionals	14	4.7%

20.3% of the study population were non-adherent to the diabetic drugs, 55.9% were moderately adherent, and 23.7% were highly adherent. [Figure 1] shows the adherence rates in the study population.

To find out the association between non-adherence and factors, the non-adherent were taken as a group and were compared with the moderately or highly adherent group. The findings are shown in Table 3 below.

Table 3: shows the association of non-adherence to diabetic medications and risk factors

Risk factors	Non-adherent to drugs n (%)	Adherent to drugs n (%)	Chi-square	p-value
Educational status			23.2	0.0001
Illiterate or primary school	33 (36.7%)	57 (63.9%)		
Middle school or High school	25 (15.7%)	134 (84.3%)		
Diploma or above	2 (4.7%)	41 (95.3%)		
Frequency of glucose monitoring			14.05	0.001
Once every 3 months or irregularly	41 (29.7%)	197 (70.3%)		
Monthly	19 (12.1%)	138 (87.9%)		
Place of treatment for Diabetes			5.3	0.014
Government hospital	52 (23.4%)	170 (76.6%)		
Private clinic/Hospital	8 (11%)	65 (89%)		
Family support in taking drugs			11.04	0.02
Available	16 (40%)	24 (60%)		
Not available	44 (17.3%)	211 (82.7%)		
Regular physical activity			3.45	0.048
Yes	38 (24.1%)	120 (75.9%)		
No	22 (16.1%)	115 (83.9%)		
Presence of comorbidities			3.38	0.049
≥2 comorbidities	50 (22.7%)	170 (77.3%)		
<2 comorbidities	10 (13.3%)	85 (86.7%)		
Knowledge about diabetes			11.51	0.03
Low	18 (32.1%)	38 (67.9%)		
Moderate	32 (22.7%)	109 (77.3%)		
High	10 (10.2%)	88 (88.8%)		

Low educational status was found to be associated with non-adherence, with 36.7% non-adherence among those with primary school education or illiterate compared to those with a diploma or above (4.7%). Those who monitored their blood glucose irregularly had a high non-adherence rate (29.7%) compared to those who monitored their blood sugar monthly (12.1%). Another factor that was associated with non-adherence was their place of treatment, with those attending Government institutions having a non-adherence rate of 23.4% compared to those seen in private institutions(11%). Those who did not have family support in taking the diabetic drugs had a high non-adherence rate(40%) compared to those who had(17.3%). Those who did not do regular physical activities had a high non-adherence rate(24.1%) compared to those who did physical activities regularly(16.1%). Having 2 or more comorbidities was associated with higher non-adherence rates(22.7%) compared with those with a single comorbidity (13.3%). Another factor that was associated with non-adherence was low knowledge of diabetes (32.1%) compared to those with high knowledge(10.2%)

The factors that were found to be statistically significantly associated with non-adherence in binary logistic regression were being illiterate or primary educated, with an odds ratio of 8, low knowledge about diabetes mellitus, with an odds ratio of 8 and those who did not have family support in diabetic treatment, with an odds ratio of 3.02. Those who monitored their blood glucose monthly had a negative relationship with non-adherence, with an odds ratio of 0.35. The binary logistic regression details are given in [Table 4].

Table 4: shows the binary logistic regression results with odds ratios and their confidence intervals

Risk factor	P value	Odds ratio	Confidence interval
Being illiterate or primary school educated	009	8.036	1.66-38.74
Those having regular glucose monitoring	0.03	0.35	0.18-0.7
Low knowledge regarding diabetes	0.043	2.68	1.03-6.9
Not having family support for taking drugs	0.007	3.02	1.2-6.8

DISCUSSION

In the current study, the proportion of patients adherent to diabetic medication was found to be 79.7%, with 23.7% being highly adherent to the drugs and 55.9% being moderately adherent. This is similar to the study conducted by Aravindakshan and others in rural areas of Palakkad district, Kerala, in community settings, where adherence to diabetic medications was found to be 60.09%.[8] In another study conducted by Ajan Maheswaran Jaya in Thiruvananthapuram district in Kerala, again in community settings, the proportion of patients adherent to the drugs was 63%.[9] But the studies done in the hospital settings among patients in India give a lower adherence than those in the community settings. As per the study conducted by Shyamal Roy and others among patients attending the OPD in a tertiary care centre in Tripura, the compliance to diabetic medication was only 44%.[10] In yet another study conducted by Mohamed Nizamudheen in North Kerala among patients attending a secondary care hospital, only 39% of the patients were adherent to the diabetic drugs.[11] This higher prevalence of non-adherence in studies where study participants were selected from the hospital could be due to selection bias. People who are attending a hospital, especially a tertiary care hospital, for chronic conditions like diabetes, are often doing so because they are experiencing complications, have more severe or uncontrolled disease, or are seeking more intensive management. They may also be less adherent, necessitating more frequent hospital visits. However, our study, conducted among bystanders in a hospital, seems to be closer to the prevalence of adherence in the community, likely due to lower selection bias.

In the current study, low educational status and poor knowledge regarding diabetes had a close association with non-adherence to diabetic drugs, with 36.7% non-adherence among illiterate or primary school educated compared to only 4.7% in those who had studied up to or above a diploma. Similar results were obtained in the study conducted by Tefera Kassahun and others in South West Ethiopia, where non-adherence among illiterates was 37.7% compared to 23.3% among secondary school educated or above.[12] A similar relationship between low drug adherence and low educational status has also been found in other studies, like the one conducted by Saurav Basu in Delhi, India and William H Polonsky in California, USA.[13,14] People with lower educational backgrounds may have restricted access to trustworthy health information and can have difficulty comprehending complicated medical directions, resulting in poor compliance with medication plans. This might also be because people with higher education and knowledge typically possess a greater knowledge of diabetes, its complications, and how medication helps manage the illness.

Another factor that was related to non-adherence in the current study was irregular monitoring of blood glucose. This relationship has also been found in the study conducted by Rekha Thapar in Mangaluru, where 60% were non-adherent among those who were irregular in their glucose monitoring compared to 38.3% among those who monitored their glucose levels regularly.[15] Both regular monitoring of blood glucose and adherence to therapy are part of self-care in diabetes. One compliant to one of them may have a higher tendency to adhere to the second one also. It could also be due to the fact that those who monitor their blood glucose levels regularly get feedback on their blood sugar levels, and they may be motivated to adhere to their medications.

In the current study, those taking treatment from private facilities seem to be more adherent compared to those taking the drugs from the government facilities. A similar result was also obtained for the study conducted by Venkatesan and others in rural Tamil Nadu, where those who were taking the drugs from private institutions seem to be protected from non-adherence with an odds ratio of 0.54(0.34-0.87).[16] It has been shown in the study conducted by Uma V Sankar in rural areas that having limited time and instructions for diabetic self-care runs a higher risk of non-adherence to diabetic medications. There is a huge volume of patients coming to hospitals in India, and the time spent per patient on consultation is less, especially in Government hospitals,[17] leading to less time for self-care advice, which in turn could lead to low adherence.

As per the current study, having family support in taking the drugs is an important factor in determining adherence. This has been shown in multiple studies, like the one conducted by Olanrewaju Joel Olagbemide in Nigeria, where it was found that in those with a strong family support system, the drug adherence was 69.5% compared to 12.2% in those without.[17] Similar findings showing the relationship of family support and drug adherence have also been shown in studies conducted by Navinkumar Angadi in Karnataka, Arulmozhi S in Puducherry and Tricia A Miller in the United States.[18–20] Support from family members is very important in sticking to medications for individuals suffering from diabetes (DM). It gives a blend of help in the form of logistics, help to manage emotions, and motivation, which goes a long way in enabling a person to manage their diabetes properly.

Another factor that was associated with low adherence was a lack of physical activity. Physical activity and medication adherence are part of self-care in diabetes mellitus. One who practices one has a high tendency to practice the other. This relationship has been shown in the study conducted by Alireza Mirahmadizadeh in Iran, where adherence to physical activity among those with low, moderate, and high levels of adherence to diabetic medication was 21%, 68.6%, and 10.4%, respectively.[21]

In the current study presence of other comorbidities was found to be associated with lower adherence. The

relationship between having comorbidities and lower adherence to diabetic medication has been found in the study conducted by Jyotiranjan Sahoo and others in eastern India, where he found a 3.26 times higher risk of non-adherence among those with other comorbidities.[22] One reason for this could be the high pill burden and complex medication regimens in patients with multiple comorbidities, where the patients could have difficulty remembering their complex drug regimens. It could also be due to fear of side effects, patient burden of taking these drugs or socioeconomic factors.

CONCLUSION

The study found that medication adherence among diabetic individuals in the Kerala community is higher than previously reported in hospital-based studies, with 79.7% of participants showing adherence, of which 23.7% highly adherent and 55.9% moderately adherent, while 20.3% were non-adherent

The primary factors driving non-adherence are low educational status, poor knowledge of diabetes, and a lack of family support. Other contributing factors include irregular blood glucose monitoring, seeking treatment at government institutions, and a lack of regular physical activity.

Recommendations

The evidence suggests the need for targeted action. Healthcare programs should enhance patient education aimed specifically at individuals with limited health literacy, while moving beyond the individual to weave family support into every treatment plan.

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