

Disease and Medication profile of patients with Diabetes Mellitus in rural areas of district Ghaziabad

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ABSTRACT

Background: Diabetes Mellitus is a chronic non-communicable disease posing a significant burden on Indian health system, especially in rural areas due to multiple socio-demographic and health system barriers. **Aims & Objectives:** To assess the disease profile and medication profile along with level of treatment adherence among patients of diabetes mellitus in rural areas of district Ghaziabad and to determine factors associated with medication adherence. **Materials and Methods:** A community-based cross-sectional study was conducted among 371 adults (≥ 18 years) with Diabetes Mellitus. Patients registered in the NCD register of CHC Muradnagar, Ghaziabad were selected randomly. Data were collected using a pre-designed, pre-tested, semi-structured questionnaire. Chi-square was used to test statistical association. **Results:** The majority of participants (30.2%) were suffering from diabetes for 1–5 years. Oral hypoglycaemic agents were the most common therapy (65.9%). Majority of the participants (34.6%) demonstrated low adherence to prescribed treatment with common barrier being forgetfulness (46.8%). Significant associations were observed between medication adherence and type of therapy, duration and source of medication and side effects ($p < 0.002$). **Conclusion:** Majority of patients exhibited low (34.6%) and medium (38.2%) medication adherence contributed by various barriers such as forgetfulness, economic constraints, inadequate awareness and side effects contribute to poor compliance.

KEYWORDS

Diabetes Mellitus, disease profile, Ghaziabad, medication adherence, medication profile, Morisky scale, rural population.

INTRODUCTION

Diabetes Mellitus represents one of the most significant chronic non-communicable diseases of the present times and poses a substantial challenge in the health system. (1,2) The progressive nature of diabetes along with its lifelong course, necessitates a long-term adherence to therapeutic interventions. (2,3) Patients of diabetes living in rural settings face delay in diagnosis, have suboptimal glycaemic control and higher prevalence of complications, reflecting gaps in early detection and sustained disease management. (1,2) Understanding the disease profile of known diabetic patients by distribution of age, duration of diabetes, treatment patterns and associated comorbidities is essential for identifying population-specific pattern of diabetes. (3,4) The medication profile of diabetes includes a various treatment modalities depending on the type of diabetes, its duration and presence of any complication. (3,4) Consistent adherence to anti-diabetic medication is essential for achieving optimal glycaemic control. (3,4) Medication adherence among individuals with diabetes remains suboptimal particularly in rural settings. (2,3) Multiple barriers like economic constraints, inconsistent availability of medicines and financial constraints

compromise sustained adherence. (2,4) The present study has been undertaken to assess the disease profile and medication profile among patients with Diabetes Mellitus in rural areas along with factors influencing treatment adherence.

Aim & Objectives: The aim of the study is “Disease and Medication profile of patients with Diabetes Mellitus in rural areas of district Ghaziabad” with following objectives:

- To assess the disease profile and medication profile along with level of treatment adherence among patients of diabetes mellitus in rural areas of district Ghaziabad.
- To determine factors associated with medication adherence among patients of diabetes mellitus.

MATERIAL & METHODS

A community-based cross-sectional study was carried out in Muradnagar block selected randomly from all four blocks of district Ghaziabad. Cases of Diabetes Mellitus registered in NCD register of the Community Health Centre, Muradnagar were selected randomly. A total of 371 individuals with diabetes ≥ 18 years of age were included in the study based on calculated sample size.

Pre-designed, pre-tested and semi-structured questionnaire was used to collect data which included disease profile, medication profile of study participants and adherence to medication was assessed using Morisky medication adherence scale (MMAS).

Ethical clearance was obtained from Institutional Ethical Committee and data was collected through house-to-house visits.

The data was collected and entered in MS Excel 2016. Analysis was done with appropriate statistical method using STATA MP-17.

RESULTS

Table 1.1: Disease profile of study participants:

S. No.	Disease profile of study participants	Number (n)	Percentage (%)
1.	Duration (in years)		
	<1	34	9.1
	1-5	112	30.2
	6-10	96	25.9
	11-15	67	18.1
	16-20	42	11.3
	>20	20	5.4
2.	Presence of complication related to diabetes		
	Yes	158	42.6
	No	213	57.4
3.	Presence of family history of diabetes		
	Yes	152	41.0
	No	219	59.0
4.	Presence of other chronic disease		
	Yes	146	39.4
	No	225	60.6
Total		371	100

A considerable segment of the study population reported co-existing morbidities and family history, while a relatively larger proportion did not report diabetes-related complications or other chronic illnesses.

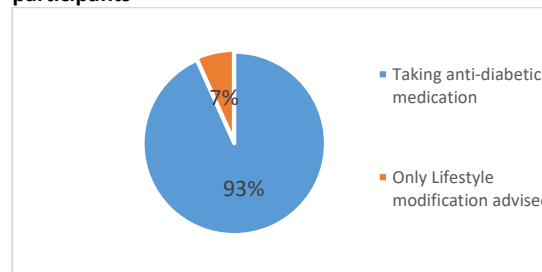
Table 1.2: Distribution of study participants according to initial symptoms at diagnosis (Multiple Response Table)

S. No	Initial symptoms at diagnosis	Number (n=371)	Percentage (100%)
1.	Increased appetite	96	25.9
2.	Increased thirst	198	53.4
3.	Increased frequency of urination	214	57.7
4.	Burning micturition	48	12.9
5.	Giddiness/Light headedness	102	27.5
6.	Generalized weakness	176	47.4
7.	Tingling in hands and feet	121	32.6
8.	Blurring of vision	88	23.7
9.	Unexplained weight gain	54	14.6
10.	Slow healing/non-healing ulcer or wound	63	17.0
11.	Coincidental diagnosis	71	19.1

The most commonly reported presenting features were polyuria and polydipsia, followed by generalized weakness and tingling sensations in the extremities. A notable proportion of participants also reported giddiness or light-headedness and increased appetite.

Visual disturbances, delayed wound healing and unexplained weight gain were reported by comparatively fewer participants. In addition, a subset of participants reported that their diabetes was detected coincidentally during routine health evaluation.

Figure 1: Management of Diabetes among study participants



The figure shows that the vast majority of participants were receiving pharmacological treatment for diabetes whereas only a small proportion were managed solely through lifestyle modification measures.

Table 2.1: Distribution of study participants according to Medication profile:

SN	Medication profile of patients on anti-diabetic medication	Number (n)	Percentage (%)
1.	Duration of anti-diabetic medication (in years)		
	<1	28	8.1
	1-5	88	25.4
	6-10	104	30.1
	11-15	72	20.8
	16-20	36	10.4
	>20	18	5.2
2.	Type of antidiabetic medication		
	Oral Hypoglycaemic agents	228	65.9
	Insulin	42	12.1
	Combined therapy (Oral Hypoglycaemic Agents + Insulin)	76	22.0
3.	Presence of side-effects		
	Yes	182	52.6
	No	164	47.4
3.	Source of anti-diabetic medication		
	Government hospital/ Pharmacy	224	64.8
	Private pharmacy	98	28.3
	Both government and private sources	24	6.9
Total		346	100

The table indicates that participants had varying durations of medication use, with a considerable proportion receiving treatment for several years. It also outlines the different treatment modalities used, including oral hypoglycaemic agents, insulin therapy, and combined therapy. Additionally, the table presents the distribution of participants reporting side effects related to anti-diabetic medications and the sources from which they obtained their medicines, including government facilities, private pharmacies, or both.

Figure 2: Morisky Medication Adherence Scale responses from Item 1 – Item 8:

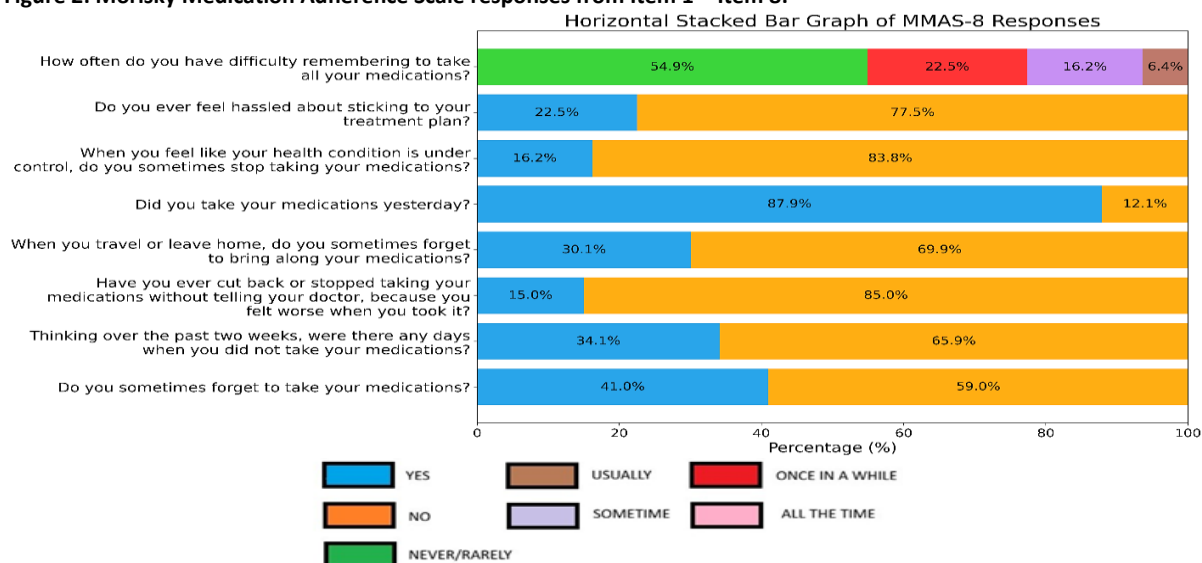
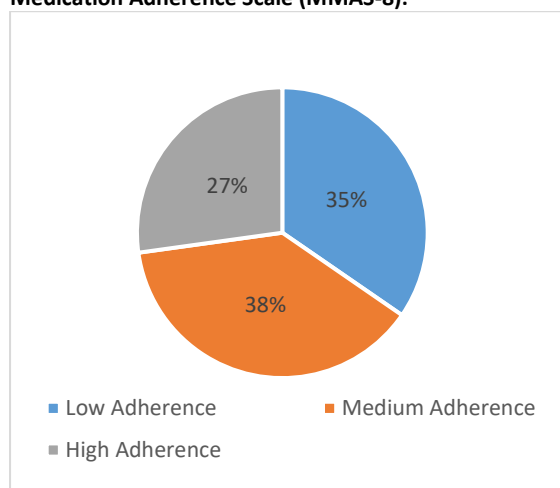


Figure 3: Distribution of study participants according to Level of Medication Adherence according to Morisky Medication Adherence Scale (MMAS-8):



The largest proportion of participants fell into the medium adherence category, followed by those with low adherence, while a comparatively smaller proportion demonstrated high adherence to anti-diabetic medication.

Table 2.3: Distribution of the study participants according to barriers encountered in adherence to medication (Multiple Response Table) (n=346)

S. No	Barriers encountered in adherence to medication	Number (n=346)	Percentage (100%)
1.	Forgetfulness	162	46.8
2.	Fear of side effects	102	29.4
3.	Financial constraints	126	36.5
4.	Lack of availability of medications	84	24.2
5.	Lack of Understanding	114	32.9
6.	Complexity of the regimen	78	22.6
7.	Ablation of symptoms/ Feeling better	95	27.4
8.	Treatment fatigue	66	19.0
9.	Social/ Family influence	56	16.3

The table highlights multiple factors influencing medication adherence, including personal, financial, and treatment-related barriers. These include forgetfulness, fear of side effects, financial constraints, and lack of understanding regarding the treatment. Additional barriers such as non-availability of medications, complexity of the treatment regimen, improvement in symptoms leading to discontinuation, treatment fatigue, and social or family influence were also reported by participants.

Table 3.1: Association between level of medication adherence and medication profile of study participants:

S. No.	Categories	Level of Medication Adherence			χ^2 df p-value
		Low n (%)	Medium n (%)	High n (%)	
1.	Duration of medication (in years)				
	<1	4 (14.3)	10 (35.7)	14 (50.0)	28.23,
	1-5	20 (22.7)	38 (43.2)	30 (34.1)	10,
	6-10	36 (34.6)	44 (42.3)	24 (23.1)	0.002
	11-15	32 (44.4)	26 (36.1)	14 (19.5)	
	16-20	20 (55.6)	10 (27.8)	6 (16.7)	
>20	8 (44.4)	4 (22.2)	6 (33.3)		
2.	Type of anti-diabetic medication				
	Oral hypoglycaemic agents	5 (24.1)	100 (43.9)	73 (32.0)	56.03,
	Insulin therapy	35 (83.3)	5 (11.9)	2 (4.8)	4,

S. No.	Categories	Level of Medication Adherence			χ^2 df p-value
		Low n (%)	Medium n (%)	High n (%)	
3.	Combined therapy	30 (39.5)	27 (35.5)	19 (25.0)	0.001
	Presence of side-effects				
	Yes	82 (45.1)	70 (38.5)	30 (16.4)	
No	38 (23.2)	62 (37.8)	64 (39.0)		
4.	Source of anti-diabetic medication				45.35, 4, 0.001
	Government hospital/ Pharmacy	56 (25.0)	90 (40.2)	78 (34.8)	
	Private pharmacy	44 (44.9)	40 (40.8)	14 (14.3)	
	Both government and private	20 (83.4)	2 (8.3)	2 (8.3)	0.001
Total		120 (34.6)	132 (38.2)	94 (27.2)	

A statistically significant association was observed between the level of medication adherence and duration of medication use, type of anti-diabetic medication, presence of side effects, and source of medication. Participants receiving oral hypoglycaemic agents and those obtaining medicines from government facilities showed relatively better adherence patterns. In contrast, lower adherence was more frequently observed among those receiving insulin therapy, those reporting medication side effects, and those obtaining medicines from private or mixed sources. Overall, the findings indicate that treatment-related factors play an important role in influencing medication adherence among individuals with diabetes.

DISCUSSION

In the present study, the largest proportion of participants had a duration of diabetes of 1–5 years (30.2%) followed by participants with a duration of diabetes of 6–10 years (25.9%). Mishra et al. (11) conducted a cross-sectional study which was community health centre-based in West Bengal and reported that 34.6% of participants had diabetes for less than 5 years, one-fourth of participants (27.8%) had diabetes for 6–10 years, 18.2% for 11–15 years and only 6.4% had diabetes for >20 years Ghosh et al. (12), in a clinic-based study from West Bengal reported almost similarly that 29.3% of participants had diabetes for less than 5 years, 33.1% for 6–10 years, 19.5% for 11–15 years, and 6.8% for more than 20 years (Table 1.1) Diabetes-related complications (at least one) were reported in our study by 42.6% participants at the time of the study. A study conducted by Mishra et al.(11), among patients who attended a non-communicable disease clinic at a community health centre in Odisha reported that 45.2% of participants had at least one diabetes-related complication which is similar to the observation of our study while 54.8% did not have any complications. Almost comparable observations were present in study conducted by Saibindu et al.(13), in rural area of Telangana and reported to have observed the presence of complications in 39.6% of study participants whereas 60.4% of study participants had no documented complications. (Table 1.1)

Positive family history of diabetes mellitus was reported by 41.0% participants. Goyal et al.(9) conducted a community-based study conducted in Haldwani, Uttarakhand reported a positive family history of diabetes in 44.6% of participants which is comparable to the findings of the present study. Karthik et al.(14) in a

rural community-based study in Kancheepuram district of Tamil Nadu observed a family history of diabetes in 39.2% of participants (Table 1.1)

The presence of other chronic illnesses in addition to diabetes in our study was reported by 39.4% participants. Saibindu et al.(13) also conducted a community-based cross-sectional study in rural area of Vikarabad district in Telangana also observed the presence of at least one additional chronic condition in 38.6% of diabetic participants. Observations reported by Padmanabha et al.(5) in a study conducted among rural and urban populations of Bengaluru which reported comorbid chronic illnesses in 44.2% of participants with diabetes which was slightly higher than the present study. (Table 1.1)

The most commonly reported initial symptom in our study at the time of diagnosis was increased frequency of urination which was reported by 57.7% participants, followed by increased thirst (53.4%), generalized weakness (47.4%), tingling in hands and feet (32.6%), giddiness or light-headedness (27.5%), increased appetite (25.9%), blurring of vision (23.7%), coincidental diagnosis (19.1%), slow healing or non-healing wound (17.0%), unexplained weight gain (14.6%), and burning micturition (12.9%). Similar finding by Mishra et al.(11) were reported in a community health centre-based cross-sectional study conducted in rural Odisha and found most reported complaint was polyuria in 61.3% of participants followed by polydipsia (56.8%), generalized weakness in 44.9% and tingling or numbness in 29.4% of cases. Khan et al.(15) conducted a study in secondary and tertiary health-care centres in Lucknow, Uttar Pradesh also documenting increased urination most reported symptom (63.2%), increased thirst (59.4%), generalized weakness in 48.6% It was also reported that there was blurring of vision in 26.8% similar to the present study and presence of non-healing wounds in 18.5% of participants. Amerzadeh et al.(16) in a population-based study among elderly patients with type 2 diabetes in Iran reported similarly that polyuria was very common symptom (55.8%) followed by polydipsia in (51.6%), generalized weakness was reported in 49.2% participants, tingling or numbness was present in 34.1% and diabetes was coincidentally diagnosed in 17.9% of participants. (Table 1.2)

In the present study, the majority of participants were taking anti-diabetic medication (93.3%) while only 6.7% were advised lifestyle modification without medication. Parajuli et al.(17) in a community-based study conducted in Gokarneshwor municipality of Nepal reported that

91.6% of participants were on anti-diabetic medication whereas 8.4% were being managed with lifestyle modification alone. Bakhshi et al.(10) in a rural study done in a health centre in northern Iran, observed that 94.1% of patients were receiving pharmacological treatment, while 5.9% were advised lifestyle modification only. Arraji et al.(18) reported observation from a multicentric cross-sectional study conducted across Morocco which reported that 96.3% of patients with type 2 diabetes were on anti-diabetic medication (Figure 1)

In the present study, the majority were on oral hypoglycaemic agents, accounting for 65.9% participants, followed by combined therapy (oral hypoglycaemic agents with insulin) among 22.0% participants, while 12.1% were on insulin therapy alone. Similar findings have been reported in several studies. A study conducted in Uttar Pradesh, India by Khan et al.(15) reported that 68.4% of diabetic patients were managed with oral hypoglycaemic agents, closely comparable to the 65.9% observed in the present study. In a study from Bangladesh by Parajuli et al.(17), 61.7% of patients were on oral hypoglycaemic agents, while 14.5% were on insulin therapy, which is similar to the 12.1% insulin use observed in the present study. In contrast, a higher proportion of insulin use (18.9%) was reported by Amerzadeh et al.(16) in Iran, possibly reflecting differences in disease severity, duration of diabetes, and referral-level care. (Table 2.1).

In the present study, among the participants receiving anti-diabetic medication, majority (30.1%) for were on anti-diabetic medication for 6–10 years, followed by 20.8% participants on anti-diabetic medication for 11–15 years. Similar findings were reported by Mishra et al. (11) in a community health centre–based study conducted in Odisha where 27.6% of participants had a treatment duration of 1–5 years, 31.4% for 6–10 years, and 18.9% for 11–15 years. In contrast, a study conducted by Oluma et al.(21) in a public hospital of rural Ethiopia reported a shorter duration of treatment with 46.2% of participants having a duration of less than 5 years and only 12.8% receiving treatment for more than 10 years. (Table 2.1)

Among participants receiving anti-diabetic medication, Majority (64.8%) obtained their medicines from government hospitals or pharmacies. Similar findings were reported by Mishra et al.(11) in a community health centre–based study from eastern India where 61.8% of participants procured anti-diabetic medicines from government facilities and 31.4% from private pharmacies. In contrast to this, Parajuli et al.(17) conducted a community-based study from Nepal and documented that 54.9% of participants procured anti-diabetic medicines from private pharmacies, while only 32.7% relied on government facilities (Table 2.1)

Medication adherence assessed using the MMAS-8 scale showed that 34.6% participants had low adherence, 38.2% had medium adherence and 27.2% had high adherence. Similar findings were reported by Juneja et al.(22) in a study conducted among diabetic patients attending primary health centres in rural Uttar Pradesh, where low adherence was observed in 36.4% of participants, medium adherence in 40.1% and high adherence in 23.5. In contrast to the findings of the present study, study by Gupta et al.(20) in rural Punjab

reported a comparatively lower proportion of low adherence at 24.1% and a higher proportion of high adherence at 35.7% among diabetic patients. (Figure 3)

The reason for poor compliance was documented which revealed that, forgetfulness emerged as the most common reason for poor compliance to anti-diabetic medication which was reported by 46.8% participants. This finding is closely comparable with the observations of Juneja et al.(22) from rural Uttar Pradesh, where forgetfulness was reported by 44.2% of participants and study by Mishra et al.(11) conducted in Bhubaneswar, who reported forgetfulness in 48.1% of patients. Financial constraints were the second most commonly reported reason for poor compliance in the present study (36.5%). This finding aligns with the study by Juneja et al.(22) in rural Uttar Pradesh who reported financial barriers in 35.6% of patients and study conducted by Mishra et al.(11) in Bhubaneswar, who observed financial constraints in 34.9% of participants. Lack of availability of medications was reported by 24.2% participants in the present study. This finding is consistent with study by Gupta et al.(20) from rural Punjab, who reported non-availability of medications in 28.3% of patients. Treatment fatigue was reported by 19.0% participants in the present study, a finding comparable to that reported by Alqarni et al.(23) who conducted a cross-sectional study in Saudi Arabia and observed treatment fatigue in 18.6% of participants. In contrast to the present study, Gupta et al.(20) study reported findings from study conducted in Punjab documenting financial constraints as the most common reason for poor adherence (42.6%) followed by forgetfulness (39.1%). (Table 2.3)

In the present study, a statistically significant association was observed between the type of anti-diabetic medication and level of medication adherence. ($p = 0.001$). Ghosh et al.(12) in a study conducted in West Bengal observed significantly better adherence among patients receiving oral hypoglycaemic agents compared to those on insulin therapy. Amerzadeh et al.(16) in Iran found that patients on insulin therapy were significantly more likely to have poor adherence compared to those on oral anti-diabetic drugs. Tran et al.(7) conducted study in Vietnam also reported higher adherence among patients on oral hypoglycaemic agents, while insulin use was associated with treatment discontinuation and missed doses. (Table 3.1).

In the present study, a statistically significant association was observed between the duration of anti-diabetic medication use and level of medication adherence. ($p = 0.002$). A similar finding was reported in a study conducted in Maharashtra by Limaye et al.(19) who observed that patients with a longer duration of diabetes exhibited significantly lower medication adherence, attributing this to treatment fatigue and reduced motivation over time. However, these findings contradict a study conducted in Andhra Pradesh by Sridevi et al.(24), where better adherence was observed among patients with longer duration of diabetes. (Table 3.1).

In the present study, a statistically significant association was observed between the source of anti-diabetic medication and level of medication adherence ($p = 0.001$). A study conducted by Oluma et al.(21) in Ethiopia also demonstrated that patients obtaining medications

from government facilities had better adherence. However, these findings contradict observations reported by Granado-Casas *et al.*(25) from study conducted in Spain, where higher adherence was noted among patients purchasing medicines from private pharmacies. Albai *et al.*(26) conducted a study in Romania and reported no significant difference in adherence based on the source of medication. (Table 3.1).

In the present study, a statistically significant association was observed between the presence of medication side effects and level of medication adherence ($p = 0.001$). Similar findings were reported by Juneja *et al.*(22) in a study conducted in Uttar Pradesh, who observed that patients experiencing adverse drug effects were more likely to have poor adherence. However, these findings contradict observations reported by Angadi *et al.*(27) from a study conducted in Karnataka, where no significant association was found between reported side effects and medication adherence. (Table 3.1).

CONCLUSION

The conclusion of the study titled “Disease and Medication profile among patients of Diabetes Mellitus in rural areas of district Ghaziabad – A Cross-Sectional study” are as follows:

Majority of the study participants of patients had diabetes for a duration of 1-5 years. Oral hypoglycaemic agents were the most frequently prescribed treatment modality, while insulin therapy was utilized by a smaller proportion of participants for a long duration, with majority procuring medication from government hospitals or pharmacies. Assessment of medication adherence revealed that a substantial proportion of patients exhibited suboptimal adherence to prescribed anti-diabetic medications. Multiple factors were found to influence non-adherence including forgetfulness, financial constraints, perceived improvement in symptoms, fear of long-term side effects and complexity of treatment regimens. These findings indicate that medication non-adherence remains a significant barrier to effective diabetes control in rural areas.

In conclusion, adherence to treatment in rural areas can be improved only by understanding the addressing the barriers encountered in adherence to medication and taking appropriate steps to improve the outcomes.

RECOMMENDATION

- **Strengthening patient education and counselling** (to improve patients’ understanding of diabetes, importance of long-term medication adherence and management of side effects.)
- **Improving accessibility and uninterrupted supply of medicines** (to reduce financial burden and improve treatment adherence among rural patients.)
- **Use of reminder-based adherence interventions** (by interventions such as mobile reminders, family involvement and maintaining log can help address forgetfulness)
- **Regular follow-up and community-based support** (through involvement of ASHA/ANM support and periodic monitoring of diabetic patients)

LIMITATION OF THE STUDY

The present study has certain limitations that should be considered while interpreting the findings. As it is a cross-sectional study, it cannot establish a causal relationship between medication adherence and the associated factors. The study relied on self-reported information including responses to the Morisky Medication Adherence Scale, which may be subject to recall bias and social desirability bias. Additionally, the study was conducted in a single block of district Ghaziabad, which may limit the generalizability of the findings to other rural populations with different socio-demographic characteristics.

RELEVANCE OF THE STUDY

The present study provides important insights into the disease profile, medication profile, and level of medication adherence among patients with diabetes mellitus in rural areas of district Ghaziabad. Understanding these patterns is essential for strengthening diabetes management at the primary health-care level. The study highlights key barriers to medication adherence which can assist in public health planning and health-care providers in improving diabetes care, promoting adherence to treatment and ultimately reducing the burden of diabetes-related complications in rural populations.

AUTHORS CONTRIBUTION

All authors have contributed equally.

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Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors haven’t used any generative AI/AI assisted technologies in the writing process.

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