ORIGINAL ARTICLE

Glycaemic control and self-care practices among patients with type 2 diabetes mellitus: A facility-based study in rural Puducherry

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Abstract

Background: Diabetes mellitus is a chronic public health problem in India, and maintenance of glycaemic targets remains difficult in many primary-care and rural settings. Inadequate control increases the risk of complications, making it important to assess both blood glucose status and patient self-care behaviours. *Aim and Objectives:* To assess glycaemic control status and related self-care practices among adults with type 2 diabetes mellitus attending a rural Community Health Centre in Puducherry. The objectives were to determine glycaemic control status, assess selected self-care practices and examine the association between selected factors and glycaemic control. *Material and Methods:* A facility-based cross-sectional study was conducted among 396 adults with type 2 diabetes mellitus attending the diabetic clinic from May to June 2024. Data on socio-demographic profile, medication adherence, blood glucose monitoring, dietary practice and physical activity were collected using a validated pretested questionnaire. Fasting and post-prandial blood glucose values were obtained from patient records and categorized according to the Indian Council of Medical Research criteria. Frequencies, percentages and chi-square test were used for analyses. *Results:* Of the 396 participants, 236 (59.6%) were males. Unsatisfactory glycaemic control was observed in 317 (80.0%) participants, while 68 (17.2%) had satisfactory control and 11 (2.8%) had ideal control. Medication adherence was reported by 301 (76.0%) participants. Home-based self-monitoring of blood glucose was practiced by 32 (8.1%) participants. Medication adherence was significantly associated with glycaemic control. *Conclusion:* Unsatisfactory glycaemic control was common among patients attending the rural diabetes clinic. Strengthening adherence support, periodic monitoring, dietary counselling and physical activity guidance may improve diabetes management in primary-care settings.

Keywords: Diabetes Mellitus, Glycaemic Control, Rural Health Centre, Medication Adherence, Self-Monitoring, Cross-Sectional Study

Introduction

Diabetes mellitus requires continuous care, periodic assessment and daily self-management. Persistently elevated blood glucose exposes patients to avoidable complications and higher treatment costs. The Indian Council of Medical Research guidelines for type 2 diabetes provides

practical metabolic targets for blood glucose, blood pressure, body mass index and waist circumference, which are useful for routine patient follow-up in primary care settings [1]. The UK Prospective Diabetes Study demonstrated that lower glycaemic exposure is associated with a reduction in diabetes-related vascular complications [2]. The number of adults living with diabetes remains high globally and in India. The International Diabetes Federation has highlighted India as one of the countries with a large diabetes burden [3]. Indian studies conducted across different settings have shown that many patients receiving treatment do not achieve recommended glycaemic targets [4-9]. This suggests that clinic attendance alone may not be sufficient unless it is supported by counselling, monitoring and sustained self-care practices. In the study setting, patients with diabetes attend a weekly clinic at a rural Community Health Centre for consultation, blood sugar testing and monthly drug collection. However, local data on the proportion of patients attaining glycaemic targets and their self-care practices were limited. This study was therefore undertaken to assess glycaemic control and selected self-care behaviours among patients with type 2 diabetes mellitus attending a rural Community Health Centre in Puducherry. Our objectives were to assess self-care practices related to medication adherence, blood glucose monitoring, dietary practices and physical activity among study participants, and to examine the association between selected participant characteristics and glycaemic control status.

Material and Methods

A facility-based cross-sectional study was carried out at the diabetic clinic of a rural Community Health Centre attached to a Government medical college in Puducherry. Data were collected during May and June 2024. Adults aged 20 years and above with type 2 diabetes mellitus who attended the diabetic clinic and provided informed consent were included. Patients with type 1 diabetes mellitus were excluded.

The study was initiated after approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants. Patient information sheets and consent forms were provided in the local language. Participant confidentiality was maintained throughout the study.

The sample size was estimated using the formula for a single proportion. Since earlier studies reported poor glycaemic control between 70% and 93%, a conservative expected proportion of 50% was used to obtain the maximum sample size. With 5% absolute precision and 5% alpha error, the required sample size was 396. All eligible patients attending the diabetic clinic on Tuesdays during the study period were invited until the required sample size was reached. Patients attending for repeat monthly visits were interviewed only once.

Data were collected before consultation using a validated pretested questionnaire. The questionnaire was validated by a team of experts (from Departments of Community Medicine and General Medicine), and content validity was done. The questionnaire was pretested among 20 diabetic patients attending a similar facility. Internal consistency reliability of the questionnaire was found to be good, with a Cronbach's alpha coefficient of 0.81. The tool included socio-demographic details, blood glucose monitoring practice, medication adherence, diet and physical activity. Medication adherence items were adapted from the Morisky Medication Adherence Scale [10]. Blood pressure, height, weight and waist

Table 1: Operational definitions for glycaemic and metabolic target categories according to ICMR guidelines [1]

Parameter	Ideal	Satisfactory	Unsatisfactory
Fasting plasma glucose (mg/dL)	80-110	111-125	> 125
2-hour post-prandial glucose (mg/dL)	120-140	141-180	> 180
Blood pressure (mmHg) [11]	< 130/80	< 140/90	> = 140/90
Body mass index (kg/m²) [12]	20-23	23.1-25	> 25
Waist circumference (cm) [13]	Men < 90; Women < 80	-	-

circumference were measured using standard procedures. The latest fasting and post-prandial blood glucose values were recorded from patient records. HbA1c was not routinely available at the centre and was therefore not used for classification.

Study variables included age, gender, educational status, and duration of diabetes, family history of diabetes, blood glucose values, body mass index, waist circumference, medication adherence, dietary practice, physical activity and diabetes-related complications.

Data were entered daily in Microsoft Excel and checked for completeness. Cross-verification with the diabetes register was done. Weekly review meetings were conducted with investigators and clinic staff to ensure uniform data collection. Data were analysed using Statistical Package for the Social Sciences version 23. Categorical variables were summarized as frequencies and percentages. Glycaemic control was dichotomized as good control, comprising ideal and satisfactory control, and poor control, comprising unsatisfactory control. Associations between glycaemic control and selected categorical variables were tested using Chi-square test. Value of $p < 0.05$ was considered statistically significant.

Results

A total of 396 adults with type 2 diabetes mellitus were included. The socio-demographic and clinical profile is shown in Table 2. Of the participants, 236 (59.6%) were males and 160 (40.4%) were females. The largest age groups were 51-60 years (35.4%) and 41-50 years (32.6%). Most participants had diabetes for ten years or less. A positive family history of diabetes was reported by 117 (29.6%) participants, while 29 (7.3%) were unaware of their family history. Treatment practices and self-care behaviours are summarized in Table 3. Medication adherence was reported by 301 (76.0%) participants. Forgetfulness was the most common reason for non-adherence. Home-based self-monitoring of blood glucose and adherence to a diabetic diet plan were uncommon, whereas more than half of the participants reported some form of physical activity. Glycaemic control status, body mass index and complications are presented in Table 4. Unsatisfactory glycaemic control was found in 317 (80.0%) participants. Overweight or obesity was present in more than half of the study population. At least one diabetes-related complication was reported by 125 (31.6%) participants. For analytical comparison, ideal and satisfactory control were

combined as good glycaemic control. Medication adherence showed a statistically significant association with glycaemic control (p = 0.043). Gender, duration of diabetes and body mass index were not significantly associated with glycaemic control in this analysis (Table 5).

Table 2: Socio-demographic and clinical profile of study participants (N = 396)

Characteristics	N (%)
Age group (years)	
21–30	4 (1.0)
31–40	37 (9.3)
41–50	129 (32.6)
51–60	140 (35.4)
> 60	86 (21.7)
Gender	
Male	236 (59.6)
Female	160 (40.4)
Educational status	
Illiterate	70 (17.7)
Less than high school	106 (26.8)
High / higher secondary	147 (37.1)
Graduate and above	73 (18.4)
Duration of diabetes	
≤ 10 years	318 (80.3)
> 10 years	78 (19.7)
Family history of diabetes	
Yes	117 (29.6%)
No	250 (63.1%)
Don't know	29 (7.3%)

Table 3: Treatment practices and self-care behaviors among participants (N = 396)

Variable	N (%)
Medication adherence	
Adherent	301 (76.0)
Non-adherent	95 (24.0)
Reasons for non-adherence*	
Forgetfulness	89 (22.5)
Side effects (giddiness, tiredness)	34 (8.6)
Financial constraints	21 (5.3)
Blood sugar monitoring frequency	
Less than once a month	73 (18.4)
Once in 1–3 months	235 (59.3)
More than 3 months	88 (22.2)
Self-Monitoring of Blood Glucose (SMBG)	
Yes	32 (8.1)
No	364 (91.9)
Following diabetic diet plan	
Yes	11 (2.8)
No	385 (97.2)
Physical activity practiced	
Yes	224 (56.6)
No	172 (43.4)

**Multiple responses*

Table 4: Glycemic control status, obesity and complications among participants (N = 396)

Variable	N (%)
Glycemic control status	
Ideal	11 (2.8)
Satisfactory	68 (17.2)
Unsatisfactory	317 (80.0)
Body Mass Index (BMI)	
Underweight	3 (0.8)
Normal	160 (40.4)
Overweight	129 (32.6)
Obese	104 (26.2)
Any diabetic complication	
Yes	125 (31.6)
No	271 (68.4)
Type of complications*	
Hypoglycemia	58 (14.7)
Peripheral neuropathy	51 (12.9)
Retinopathy	30 (7.6)
Nephropathy	7 (1.8)

**Multiple responses*

Table 5: Association between various factors and glycemic control status among participants

Variable	Good control n (%)	Poor control n (%)	χ^2	*p*
Gender				
Male	54 (22.9)	182 (77.1)	1.64	0.197
Female	25 (15.7)	135 (84.3)		
Duration of diabetes				
≤ 10 years	66 (20.8)	252 (79.2)	0.53	0.46
> 10 years	13 (16.7)	65 (83.3)		

Continued...

Medication adherence				
Adherent	67 (22.3)	234 (77.7)	4.10	**0.043***
Non-adherent	12 (12.6)	83 (87.4)		
Body mass index				
Normal	38 (23.8)	122 (76.2)	2.31	0.315
Overweight / Obese	40 (17.2)	193 (82.8)		
Underweight	1 (33.3)	2 (66.7)		

**Statistically significant at $p < 0.05$*

Discussion

In this facility-based study, four out of five participants had unsatisfactory glycaemic control. This finding points to a clear implementation gap: patients were in contact with the health system, but many had not achieved recommended glucose targets. Similar concerns have been reported by Indian studies in which a large proportion of adults with type 2 diabetes had poor control despite receiving treatment [4-8]. International evidence also indicates that metabolic and demographic factors, knowledge and adherence can influence glycaemic outcomes [14-15].

The findings suggest that diabetes services at the primary-care level should not be limited to drug distribution and occasional glucose testing. Very few participants practiced home-based selfmonitoring, and adherence to a diabetic diet plan was low. These gaps are important because diabetes care in India requires patient-centred counselling, realistic goal-setting and repeated reinforcement of self-care behaviours [16-18]. Resource constraints and ethical challenges in diabetes care can further affect the ability of patients to follow recommended care consistently [19].

Medication adherence was significantly associated with glycaemic control in this study. Forgetfulness, drug-related discomfort and financial constraints were the main barriers reported by participants. These reasons are comparable to those observed among South Indian patients with diabetes, where non-adherence was linked to practical and financial difficulties [20]. Simple adherence support such as reminder systems, counselling during drug refills, family involvement and clarification of side effects may be useful in similar settings.

Self-monitoring of blood glucose was uncommon in the present study. Although regular home monitoring may not be feasible for every patient because of cost and access barriers, facility-based monitoring can still be made more meaningful when patients are informed about their target values and the implications of abnormal results. Deshmukh *et.al.* (2012) have discussed the role of self-monitoring of blood glucose in achieving better diabetes control [17].

John *et.al.* (2019) reported gaps between knowledge, attitude and practice among people with type 2 diabetes and emphasized the need for awareness and standard care [21]. Kalaivani (2022) described foot self-care as an important component of diabetes management, including drug compliance, diet, physical activity, monitoring and periodic foot

examination [22]. Singh *et al.* (2017) highlighted common myths related to diabetes, showing how beliefs and misconceptions can influence health-seeking and adherence behaviour [23].

Nearly one-third of participants reported at least one diabetes-related complication. Although the present study did not use detailed diagnostic screening for complications, this finding is relevant because prolonged poor glycaemic control increases the risk of neuropathy, retinopathy, nephropathy and cardiovascular outcomes. A rural Goa study also documented a considerable burden of diabetic complications, supporting the need for early detection and preventive follow-up in rural populations [19].

Gender, duration of diabetes and body mass index were not significantly associated with glycaemic control in the present analysis. These findings should be interpreted cautiously because the study was cross-sectional and could not establish temporality. Glycaemic control is influenced by several clinical, behavioural and health-system factors. Studies with HbA1c estimation and multivariable analysis would provide stronger evidence on independent predictors of poor control.

Strengths of the study

The study included a relatively large number of patients from a rural diabetes clinic. It assessed glycaemic status along with selected self-care practices, making the findings useful for strengthening primary-care diabetes services.

Limitations of the study

The study was cross-sectional, and causal relationships could not be established. HbA1c was not available at the study centre; therefore, glycaemic classification was based on fasting and post-prandial blood glucose records. The study did not collect information on use of non-allopathic medications, traditional remedies or home remedies, which may influence treatment adherence and glycaemic control and hence can be used as basis for future research.

Conclusion

There was poor glycemic control among patients with diabetes mellitus attending this community health centre. The non-adherence rate was also high with reasons of forgetfulness and financial issues. Self-monitoring of blood glucose also needs to be improved in this population. Other risk factors like no proper diabetic plan, lesser physical activity, lesser knowledge level needs to be overcome in this population. Strengthening patient education, improving adherence counselling, promoting regular self-monitoring of blood glucose and providing individualized dietary counselling may improve glycaemic control in this population.

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