ORIGINAL RESEARCH ARTICLE

Prevalence and Determinants of Uncontrolled Diabetes Mellitus: A Community-Based Study from Karnataka, India

Imaad Mohammed Ismail[1], Poonam R Naik[2*]

[1,2]Yenepoya Medical College, Mangaluru, Karnataka, India

DOI: 10.55489/njcm.151020244459

ABSTRACT

Background: Uncontrolled diabetes mellitus is a significant health challenge, especially in developing countries. Factors contributing to it vary by region, making it crucial to understand them for effective blood sugar control. The study's objectives were to estimate the prevalence of uncontrolled diabetes mellitus and its determinants among residents of selected areas of Dakshina Kannada, Karnataka.

Methodology: This study was conducted from October 2021 to May 2023 among adult diabetics residing in the Jokatte and Madani Nagar areas of Dakshina Kannada. The required sample size was estimated at 180 and 90 diabetic patients were randomly selected from each study area. Data were collected by field workers using a pre-tested questionnaire, and a lab technician obtained blood samples for HbA1c. Data analysis was performed using SPSS Ver 27.

Results: The study enrolled 180 diabetics with a mean (± S.D) age of 56.9 (±10.3) years. Uncontrolled diabetes was noted in 75.6% of diabetics. Significant determinants for uncontrolled diabetes were longer duration of diabetes, poor knowledge of blood sugar tests, irregular testing and insufficient physical activity.

Conclusion: The study observed an alarming prevalence of uncontrolled diabetes and identified its key determinants. Healthcare providers must implement targeted interventions addressing these factors to achieve effective diabetes control.

Keywords: Diabetes mellitus, uncontrolled, determinants, knowledge, practice, India

ARTICLE INFO

Financial Support: None declared
Conflict of Interest: None declared
Received: 09-07-2024, **Accepted**: 13-09-2024, **Published**: 01-10-2024
***Correspondence:** Dr. Poonam R Naik (Email: drpoonamnaik@gmail.com)

How to cite this article: Ismail IM, Naik PR. Prevalence and Determinants of Uncontrolled Diabetes Mellitus: A Community-Based Study from Karnataka, India. Natl J Community Med 2024;15(10):842-849. DOI: 10.55489/njcm.151020244459

www.njcmindia.com | pISSN: 0976-3325 | eISSN: 2229-6816 | Published by Medsci Publications

INTRODUCTION

The American Diabetes Association defines diabetes mellitus as "a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin section, insulin action, or both".[1] The estimated global prevalence of diabetes in adults is 10.5% with about 537 million people living with the disease.[2] In India, the prevalence ranges from 9.3% to 16.1%, contributing significantly to the burden of chronic diseases.[3,4] Over time, diabetes can result in microvascular complications such as nephropathy, neuropathy, and retinopathy, as well as macrovascular complications such as coronary artery disease, peripheral artery disease and stroke.[5]

Uncontrolled diabetes mellitus is the primary reason for most complications and mortality in diabetes people. Diabetic people who have their disease in control with the right treatment lead a near-normal life and have a better quality of life as compared to people with uncontrolled diabetes. It is surprising to note that uncontrolled diabetes is more common than controlled in most parts of the world.

Research studies from different countries over the last 10 years have reported the prevalence of uncontrolled diabetes from 30.3% to 90.7%.[6-15] This big range of uncontrolled diabetes is both due to the actual problem of uncontrolled diabetes as well as differences in the methodology used to assess it. Nevertheless, high rates were reported both from developing countries like Ethiopia and developed countries like the USA. The scenario in India is similar, with uncontrolled diabetes ranging from 69.0% to 93.0%.[3,4,16,17]

Despite diabetes being a common disease with treatment available for its control, the problem of uncontrolled diabetes continues to remain high and unacceptable. There could be multiple reasons for uncontrolled diabetes such as poverty, illiteracy, lack of health care access, irregular physician visits, improper monitoring, inadequate treatment, and inappropriate lifestyle choices.[13,18-20] These reasons vary from place to place and change over time.

If there is a disease for which effective treatment is available and still more than half of them do not have control, then we must assess where we are going wrong. We need to identify the specific reasons for uncontrolled diabetes in different populations. This will help in devising targeted local strategies to overcome the problem and ultimately benefit diabetes patients to have a better quality of life.

The current study was undertaken in Dakshina Kannada which is a coastal District of South India known for its rich cultural heritage.

The objectives were to estimate the prevalence of uncontrolled diabetes mellitus and its determinants among residents of selected areas of Dakshina Kannada.

METHODOLOGY

This community-based cross-sectional study was conducted from October 2021 to May 2023 in the Jokatte and Madani Nagar areas of Dakshina Kannada District of Karnataka, India. The research was part of a larger community trial focused on diabetes control utilizing a diabetes monitoring chart. Jokatte is a rural area having an estimated population of 7,470 and comes under Jokatte panchayat, while Madani Nagar which is also a rural area has an estimated population of 3,350 and falls under Munnuru panchayat.

The study population comprised adult diabetic individuals residing in the study areas. The sample size calculated on G power software based on a study done by Fathima FN et al. was determined to be 180.[21] The inclusion criteria were diabetics aged ≥18 years residing in the study areas and the exclusion criteria were critically ill patients. A list of diabetic individuals residing in the study areas was compiled by the field healthcare workers. From this list, simple random sampling using computer-generated numbers was employed to select 90 diabetics from each of the Jokatte and Madani Nagar areas.

Ethical clearance for the study was taken from the Yenepoya Ethics Committee-1 (Reference No. YEC-1/2022/036 dated 16.06.2022). Permission to conduct was granted by the District Health Officer and heads of the local panchayats. Trained healthcare workers conducted home visits, explained the study procedure, and addressed any concerns. Written informed consent in the local language was then obtained from participants who agreed to take part in the study. A validated and pre-tested questionnaire in the local language was used to collect data. The questionnaire had sections on socio-demographic information, diabetic profile, knowledge, and practice on diabetes control. Weight was measured using a digital weighing scale and height was measured using a non-elastic measuring tape of 2 meters length. Blood samples for HbA1c analysis were collected and transported to the central lab of the institution by a trained lab technician. The HbA1c sample was analysed by high-performance liquid chromatography in a Bio-Rad D-10 glycated haemoglobin analyser. HbA1c level of ≥ 7% was considered as uncontrolled diabetes.[22]

The following operational definitions were used in the study. A person was considered diabetic if they were ever diagnosed as having diabetes mellitus by a doctor irrespective of the treatment taken. For diabetes-related knowledge, good knowledge of normal blood sugar levels was considered when the participant knew these levels. A person was considered to have good knowledge of the frequency of blood sugar testing if they knew it should be done at least once a month. A person was considered to have good knowledge of the HbA1c test if they knew that it measures blood sugar control over a few months.

Good knowledge of the frequency of doctor visits was considered if the participant knew that visits should occur at least once every six months. A person was considered to have good knowledge of the duration of diabetes medication if they knew it needs to be taken for life. A person was considered to have good knowledge of the diabetic diet if they correctly answered all four questions asked of them on the diabetes diet. The correct answers for two or three were considered as some knowledge and one or zero correct answers were considered as poor knowledge. A person was considered to have good knowledge of the effect of exercise on diabetes control if they knew that it helps in the control of blood sugar levels. Good knowledge of recommended exercise was considered if the person knew that physical activity of 30 minutes or more needs to be done daily. A person was considered to have good knowledge of the effects of tobacco and alcohol consumption if they knew that their use would impair blood sugar control. A person was considered to have good knowledge of effects of obesity on diabetes control if they knew that obesity impairs blood sugar control.

For practices related to diabetes, the frequency of blood sugar testing was considered regular if it was done at least once a month. The follow-up with the doctor was considered regular if at least two doctor visits were done in a year. A person was considered to have good compliance with the doctor's advice if they were following all or most instructions given by the doctor. Regular medication was considered as not missing any medicine or missing up to five medicines per month. A person was considered following a diabetic diet if they followed all the instructions on diet given by their treating doctor. A person was considered to have regular physical activity if they did 30 minutes or more of physical activity for at least five days a week. A person was considered a tobacco user if they consumed tobacco products (smoking/chewing) daily, and an alcohol user if they consumed alcohol at least once a week. A person was considered to be practising meditation if they engaged in any form of meditation, prayer or mind-focussed yoga activities for a total duration of at least 15 minutes per day, either in a single session or multiple sessions.

Table 1: Comparison of Sociodemographic and diabetes profile between uncontrolled and controlled diabetes mellitus participants (N=180)

Variables	Total	Uncontrolled diabetes (%)	Controlled diabetes (%)	OR (95% CI)	p value
Cases	180	136 (75.6)	44 (24.4)		
Age groups in years					
31 - 40	10	6 (60)	4 (40)	Reference	
41 - 50	43	37 (86)	6 (14)	4.11 (0.89-19.0)	0.07
51 - 60	59	42 (71.2)	17 (28.8)	1.65 (0.41-6.58)	0.48
61 - 70	50	38 (76)	12 (24)	2.11 (0.51-8.75)	0.303
> 70	18	13 (72.2)	5 (27.8)	1.73 (0.34-8.87)	0.509
Gender					
Male	70	53 (75.7)	17 (24.3)	1.01 (0.51-2.04)	0.968
Female	110	83 (75.5)	27 (24.5)	Reference	
Education					
Not literate	21	15 (71.4)	6 (28.6)	Reference	
Less than primary school	17	13 (76.5)	4 (23.5)	1.30 (0.30-5.64)	0.726
Primary school completed	49	35 (71.4)	14 (28.6)	1.00 (0.32-3.10)	1
Secondary school completed	39	30 (76.9)	9 (23.1)	1.33 (0.40-4.45)	0.64
High school completed	37	30 (81.1)	7 (18.9)	1.71 (0.49-6.00)	0.4
PUC / Diploma / Graduate	17	13 (76.5)	4 (23.5)	1.30 (0.30-5.64)	0.726
Occupation					
Officials/Professionals/Technicians	9	5 (55.6)	4 (44.4)	Reference	
Clerks/Operators/Elementary	49	38 (77.6)	11 (22.4)	2.76 (0.63-12.09)	0.177
Housewife	89	68 (76.4)	21 (23.6)	2.59 (0.64-10.54)	0.184
Retired	33	25 (75.8)	8 (24.2)	2.50 (0.54-11.63)	0.243
Socio-economic status					
Below poverty line	97	73 (75.3)	24 (24.7)	Reference	
Above poverty line	83	63 (75.9)	20 (24.1)	1.04 (0.52-2.05)	0.92
Duration of diabetes (in years)					
<1	31	17 (54.8)	14 (45.2)	Reference	
1-5	76	59 (77.6)	17 (22.4)	2.86 (1.17-6.96)	**0.021**
6-10	48	39 (81.3)	9 (18.8)	3.57 (1.30-9.86)	**0.014**
11-15	15	14 (93.3)	1 (6.7)	11.53 (1.35-98.83)	**0.026**
>15	10	7 (70)	3 (30)	1.92 (0.42-8.84)	0.402
Health care provider					
Government	21	17 (81)	4 (19)	Reference	
Private	159	119 (74.8)	40 (25.2)	0.70 (0.22-2.20)	0.542
Comorbidities					
Present	49	36 (73.5)	13 (26.5)	0.86 (0.41-1.82)	0.858
Absent	131	100 (76.3)	31 (23.7)	Reference	

The study data was entered into Microsoft Excel and analysed using SPSS (version 27.0 IBM, New York, USA). Categorical variables are expressed as percentages and continuous variables are expressed as mean and standard deviation. Chi-square test and logistic regression analysis were performed and a p-value of less than 0.05 was considered statistically significant.

RESULTS

The study included 180 diabetic individuals with a mean (±S.D) age of 56.9 (±10.3) years. Approximately 60% of the population was between 51 to 70 years and females constituted 61.1% of the total participants. The majority of the participants were literate; however, the proportion of graduates/diploma holders was only 3.3%. The participants were employed in various occupations such as electrician, accountant, driver, real estate broker, tailer, machine operator, daily wage elementary worker, beedi roller etc. and 53.9% belonged to lower socio-economic status.

The prevalence of uncontrolled diabetes mellitus in the study was 75.6%. The mean (±SD) HbA1c in the study participants was 8.5 (±1.9), with a significant difference between uncontrolled (9.1±1.6) and controlled (6.3±0.5) diabetes.

Univariate analysis of socio-demographic information and diabetic profile revealed increasing duration of diabetes as a determinant of uncontrolled diabetes [Table 1]. Regarding knowledge of diabetes control, poor knowledge of the frequency of blood sugar testing and the benefits of exercise were associated with uncontrolled diabetes [Table 2]. In terms of practices, irregular blood sugar testing, poor compliance with doctor's advice, insufficient physical activity and obesity/overweight were associated with uncontrolled diabetes [Table 3].

Multivariate logistic regression analysis showed increasing duration of diabetes, poor knowledge of testing blood sugar, irregular blood sugar testing and insufficient physical activity to be significantly associated with uncontrolled diabetes [Table 4].

Table 2: Knowledge on control of diabetes in uncontrolled and controlled diabetes mellitus participants (N=180)

Variables	Total	Uncontrolled diabetes n (%)	Controlled diabetes n (%)	OR (95% CI)	p value
Cases	180	136 (75.6)	44 (24.4)		
Normal blood sugar levels					
Poor Knowledge	134	101 (75.4)	33 (24.6)	0.96 (0.44-2.11)	0.923
Good Knowledge	46	35 (76.1)	11 (23.9)	Reference	
Frequency of blood sugar testing					
Poor Knowledge	45	39 (86.7)	06 (13.3)	2.55 (1.03-6.50)	**0.045**
Good Knowledge	135	97 (71.9)	38 (28.1)	Reference	
Use of HbA1c test					
Poor Knowledge	130	96 (73.8)	34 (26.2)	0.71 (0.32-1.56)	0.39
Good Knowledge	50	40 (80.0)	10 (20.0)	Reference	
Frequency of doctor visits					
Poor Knowledge	41	32 (78.0)	09 (22.0)	1.19 (0.52-2.76)	0.672
Good Knowledge	139	104 (74.8)	35 (25.2)	Reference	
Duration of diabetes medication					
Poor Knowledge	18	14 (77.8)	04 (22.2)	1.15 (0.36-3.69)	0.817
Good Knowledge	162	122 (75.3)	40 (24.7)	Reference	
Diabetic diet					
Poor knowledge	45	36 (80.0)	09 (20.0)	1.22 (0.47-3.13)	0.683
Some knowledge	75	54 (72.0)	21 (28.0)	0.78 (0.36-1.71)	0.539
Good knowledge	60	46 (76.7)	14 (23.3)	Reference	
Exercise effect on diabetes control					
Poor Knowledge	56	48 (85.7)	08 (14.3)	2.46 (1.06-5.70)	**0.033**
Good Knowledge	124	88 (71.0)	36 (29.0)	Reference	
Recommended exercise					
Poor Knowledge	93	72 (77.4)	21 (22.6)	1.23 (0.62-2.43)	0.547
Good Knowledge	87	64 (73.6)	23 (26.4)	Reference	
Effects of tobacco consumption					
Poor Knowledge	62	43 (69.4)	19 (30.6)	0.61 (0.30-1.22)	0.161
Good Knowledge	118	93 (78.8)	25 (21.2)	Reference	
Effects of alcohol consumption					
Poor Knowledge	71	54 (76.1)	17 (23.9)	1.05 (0.52-2.10)	0.9
Good Knowledge	109	82 (75.2)	27 (24.8)	Reference	
Obesity relation with diabetes control					
Poor Knowledge	85	69 (81.2)	16 (18.8)	1.80 (0.89-3.63)	0.097
Good Knowledge	95	67 (70.5)	28 (29.5)	Reference	

Table 3: Practices related to the control of diabetes in uncontrolled and controlled diabetes mellitus participants (N=180)

Variables	Total	Uncontrolled diabetes n (%)	Controlled diabetes n (%)	OR (95% CI)	p value
Cases	180	136 (75.6)	44 (24.4)		
Frequency of blood sugar testing					
Irregular	87	76 (87.4)	11 (12.6)	3.80 (1.77-8.14)	**<0.001**
Regular	93	60 (64.5)	33 (35.5)	Reference	
If blood sugar is high on 2 or more occasions					
Nothing or try other measures	24	17 (70.8)	7 (29.2)	0.76 (0.29-1.96)	0.563
Visit doctor	156	119 (76.3)	37 (23.7)	Reference	
Follow up with the doctor					
Irregular	22	18 (81.8)	4 (18.2)	1.53 (0.49-4.78)	0.466
Regular	158	118 (74.7)	40 (25.3)	Reference	
Compliance with doctor's advice					
Poor compliance	68	57 (83.8)	11 (16.2)	2.17 (1.01-4.64)	**0.044**
Good compliance	112	79 (70.5)	33 (29.5)	Reference	
Medication intake					
Irregular	34	27 (79.4)	7 (20.6)	1.31 (0.53-3.26)	0.561
Regular	146	109 (74.7)	37 (25.3)	Reference	
Diet					
Do not follow diabetic diet	62	48 (77.4)	14 (22.6)	1.50 (0.52-4.37)	0.457
Follow to some extent	95	72 (75.8)	23 (24.2)	1.37 (0.50-3.74)	0.54
Follow diabetic diet	23	16 (69.6)	7 (30.4)	Reference	
Physical activity					
Irregular	127	102 (80.3)	25 (19.7)	2.28 (1.12-4.65)	**0.021**
Regular	53	34 (64.2)	19 (35.8)	Reference	
Tobacco consumption					
Yes	17	14 (82.4)	3 (17.6)	1.57 (0.43-5.74)	0.493
No	163	122 (74.8)	41 (25.2)	Reference	
Alcohol consumption					
Yes	11	7 (63.6)	4 (36.4)	0.54 (0.15-1.95)	0.342
No	169	129 (76.3)	40 (23.7)	Reference	
Meditation					
Yes	155	117 (75.5)	38 (24.5)	Reference	
No	25	19 (76)	6 (24)	1.03 (0.38-2.76)	0.956
BMI					
BMI ≥ 23	147	116 (78.9)	31 (21.1)	2.43 (1.09-5.43)	**0.027**
BMI < 23	33	20 (60.6)	13 (39.4)	Reference	

Table 4: Multivariate logistic regression analysis of selected study variables for uncontrolled diabetes among study participants (N=180)

Variables	Adjusted Odds Ratio	95% CI	p value
Duration of diabetes (in years)			
<1	Reference		
1 - 5	5.64	1.86 - 17.10	**0.002**
6 - 10	6.21	1.85 - 20.87	**0.003**
11 - 15	44.85	4.12 - 487.87	**0.002**
>15	3.77	0.64 - 22.22	0.143
Knowledge of frequency of blood sugar testing			
Poor Knowledge	3.47	1.20 - 10.07	**0.022**
Good Knowledge	Reference		
Knowledge of exercise effect on diabetes control			
Poor Knowledge	1.20	0.42 - 3.43	0.736
Good Knowledge	Reference		
Frequency of blood sugar testing			
Irregular	3.84	1.52 - 9.72	**0.004**
Regular	Reference		
Compliance with doctor's advice			
Poor compliance	1.88	0.75 - 4.69	0.175
Good compliance	Reference		
Physical activity			
Irregular	2.58	1.04 - 6.21	**0.040**
Regular	Reference		
BMI			
BMI ≥ 23	2.57	0.97 - 6.79	0.058
BMI < 23	Reference		

Discussion

This community-based study was conducted to know the prevalence of uncontrolled diabetes and the reasons for it in the selected populations of Dakshina Kannada District of Karnataka. A high prevalence (75.6%) of uncontrolled diabetes was observed in the study population and longer duration of diabetes, poor knowledge of blood sugar tests, irregular blood sugar testing, and insufficient physical activity were its significant determinants.

The study had a good representation of different age groups and high uncontrolled diabetes was noted across all age groups. Previous studies have varied findings, where some found higher uncontrolled diabetes in older people and some found it to be higher in younger people.[3,7,11,15,16,20,23] The higher uncontrolled diabetes in older people could be due to a longer duration of their diabetes which results in complications and higher sugar levels, whereas in the younger population, this could be due to negligence as diabetes is a silent disease in the initial stages.

The female gender had a higher representation in the study as the data collection was done during working hours when a higher proportion of men compared to females had gone out for work. Regarding education and occupation, it was noted that higher education was achieved only by a small proportion of people, and most participants were employed in low-paying jobs. About half of the study population was below the poverty line and were depending on Government welfare schemes. No association was seen between uncontrolled diabetes with gender, education, occupation, or socioeconomic status.

The prevalence of uncontrolled diabetes in the study participants was 75.6%. The high prevalence is not surprising as other Indian studies having nationally representative samples have reported a prevalence of uncontrolled diabetes from 76.6% to 93.0%.[3,4,17] Dakshina Kannada District is a well-performing district of India with above-national average literary rates and a health care system. Thus, three in four people having uncontrolled diabetes in a well-performing district is highly concerning as a large proportion of these cases over time will develop micro and macrovascular complications resulting in premature mortality.

With regards to the diabetic profile of the patients, it was noted that diabetic patients with longer duration of the disease had more uncontrolled diabetes. Few other studies conducted in Saudi Arabia, Ethiopia and India have also reported longer duration of diabetes leading to uncontrolled diabetes.[13,16,23,24] As there is no cure for diabetes mellitus and if it is not adequately controlled, the disease will keep progressing resulting in worsening of the disease and higher blood sugar levels. Hence, it is imperative that patients must be educated to have good diabetes control throughout their lives and not neglect the treatment if they have good glycaemic control for a few years.

Regarding the knowledge of participants on the control of diabetes, only one in four knew about normal blood sugar levels. They rely on the physician to tell them if their blood sugar levels are normal. They are usually informed by the physician about the follow-up visits and blood sugar testing (empty stomach test, after-food test, and random test), hence in the study it was noted that many of the participants knew about the frequency of blood sugar testing, and it was significantly associated with blood sugar control. Knowledge of the HbA1c test was poor, and only a few participants knew that it was a useful test for long-term diabetes control. Other studies have reported that uncontrolled diabetes was more common in diabetics who had poor knowledge about the disease.[13,25]

Knowledge about regular doctor visits and lifelong medication for diabetes was good among the study participants, however, this was not significantly associated with blood sugar control. The knowledge about diabetic diet was not satisfactory as only about a third of the participants correctly knew about it. This is an important finding as without correct knowledge about diet it cannot be expected that people will consume a diet appropriate for diabetes. Efforts should be made by the Government under the national programme for non-communicable diseases to educate diabetic people about their diet.

The participants knew that exercise has a positive effect on the control of blood sugar levels, however, they did not know about the recommended exercise for diabetes. Knowledge about exercise was associated with better blood sugar control in univariate analysis but was not found to be significant in multivariate regression analysis. It is common for physicians to advise diabetic patients regarding regular walks and exercise; hence, the participants knew that exercise should be done but did not know about its duration and types in detail.

Regarding the practices related to diabetes control, it was found that only about half of the participants were regularly testing their blood sugar levels. Blood sugar control was better among those people who regularly tested their blood sugar levels, and this was statistically significant. Similar findings have been reported in another study by Mamo Y et al.[26] It's logical that if someone is regularly checking their blood sugar levels, they will get to know if their values are high and they can take corrective action.

The vast majority of participants had a regular follow-up with their doctors and about two-thirds of the participants had good compliance with the doctor's advice. Good compliance with doctor's advice was associated with better blood sugar control and similar findings were reported by other studies.[18,24] Visiting the doctor at regular intervals is important and it is also equally important to follow the instructions given by the doctor as only ceremonial visits to

the doctor's office will not serve the purpose of good blood sugar control.

The study participants were mainly relying on medications for their diabetes control and only a few participants were following medications, diet, and physical activity together. Participants consuming regular medication had better control of diabetes; however, this was not statistically significant. As discussed before, the knowledge of diabetic diet was poor among the study participants, and this was reflected in their practice where only about 15% of participants were consuming a diabetic diet.

Regular physical activity was seen in about 1 in 4 participants and this was associated with good control of diabetes. The findings are comparable to other studies conducted in different settings across the world.[19,26,27] Regular exercise leads to decreased insulin resistance, improved lipid profile and endothelial resistance, decreased blood pressure, lowered cardiovascular risk, and improved weight management.[28,29] The study found no association between tobacco and alcohol use with the control of diabetes, and this may be attributed to low consumption of these items. Overweight and obesity were high among the diabetic participants and on univariate analysis, it was associated with uncontrolled diabetes, however, no association was seen with multivariate logistic regression.

The study has certain limitations. The practices related to diabetes control were self-reported by the participants and there is a possibility of social desirability bias. Also, the comorbid conditions were not actively checked. The strengths of the study were that it adopted a community-based approach, gathering information directly from households, and the assessment for control of diabetes was done using the gold standard HbA1c test in an accredited lab.

Conclusion And Recommendations

A high prevalence (75.6%) of uncontrolled diabetes was noted in the study population. The significant determinants of it were longer duration of diabetes, poor knowledge of blood sugar tests, irregular blood sugar testing and insufficient physical activity. The alarming prevalence of uncontrolled diabetes is a matter of great concern as diabetes is a common disease in India with the potential for serious complications.

As irregular blood sugar testing and insufficient physical activity were identified as important determinants, the doctors must explicitly counsel patients on the importance of consistent monitoring and regular physical activity. Simultaneously, the policymakers should prioritize regular testing of diabetes patients and promote practical physical activity techniques in the national programme. Thus, collaborative targeted interventions for the identified determinants will help mitigate the impact of uncontrolled diabetes and improve the overall outcomes in diabetic patients.

Acknowledgement

We express our sincere gratitude to the management of Yenepoya (Deemed to be University) for providing logistic support to carry out the study. Our heartfelt thanks to Dr Vinitha R. Pai, Director of the MPhil and PhD Program, Yenepoya (Deemed to be University) and Dr Rashmi Kundapur, Additional Professor in the Department of Community and Family Medicine, AIIMS, Bibinagar, for their invaluable advice during the course of the study. Special thanks to Dr Indira S Puthran, Deputy Director of the Central Laboratory of Yenepoya Medical Hospital for her technical guidance on field sample collection and testing. We appreciate Mrs Shifali and Mr Ansar for their assistance in blood sample collection and analysis. Our heartfelt thanks to Mrs Gayathri (medico-social worker), Ms Mufeeda (Ayurvedic medicine student), Mrs Kavitha (ASHA worker) and Mrs Bhavya (ASHA worker) for their support in data collection.

References

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2014;37(Suppl 1):S81-90.
2. International Diabetes Federation. Diabetes facts and figures [Internet]. Available at: https://idf.org/about-diabetes/ diabetes-facts-figures/. Accessed Jun 5th, 2024.
3. Mathur P, Leburu S, Kulothungan V. Prevalence, awareness, treatment and control of diabetes in India from the country-wide national NCD monitoring survey. Front Public Health. 2022;10:748153.
4. Maiti S, Akhtar S, Upadhyay AK, Mohanty SK. Socioeconomic inequality in awareness, treatment and control of diabetes among adults in India: Evidence from National Family Health Survey of India (NFHS), 2019-2021. Sci Rep. 2023;13(1):2971.
5. Fowler MJ. Microvascular and macrovascular complications of diabetes. Clin Diabetes. 2008;26(2):77-82.
6. El Bcheraoui C, Basulaiman M, Tuffaha M, Daoud F, Robinson M, Jaber S, et al. Status of the diabetes epidemic in the Kingdom of Saudi Arabia, 2013. Int J Public Health. 2014; 59(6):1011-21.
7. Siddiqui FJ, Avan BI, Mahmud S, Nanan DJ, Jabbar A, Assam PN. Uncontrolled diabetes mellitus: Prevalence and risk factors among people with type 2 diabetes mellitus in an urban district of Karachi, Pakistan. Diabetes Res Clin Pract. 2015;107(1):148-56.
8. De Silva AP, De Silva SHP, Haniffa R, Liyanage IK, Jayasinghe KSA, Katulanda P, et al. A survey on socioeconomic determinants of diabetes mellitus management in a lower middle income setting. Int J Equity Health. 2016;15:74.
9. Al Makhmari AAK, Ullah MM, Salim Al Alawi FS, Al Saadi KD. Identifying the prevalence and risk factors associated with uncontrolled diabetes (Type 2) in Al Buraimi Governorate, Sultanate of Oman. Glob J Health Sci. 2018;10(11):39-45.
10. Gebreyohannes EA, Netere AK, Belachew SA. Glycemic control among diabetic patients in Ethiopia: A systematic review and meta-analysis. PLoS One. 2019;14(8):e0221790.
11. Ayele BH, Roba HS, Beyene AS, Mengesha MM. Prevalent, uncontrolled, and undiagnosed diabetes mellitus among urban

adults in Dire Dawa, Eastern Ethiopia: A population-based cross-sectional study. SAGE Open Med. 2020;8:1-11.

12. Phuwilert P, Khiewkhern S, Wongprachum K, Phajan T. Google maps: Prevalence and distribution of uncontrolled type 2 diabetes mellitus in Kalasin Province, Thailand. Stud Health Technol Inform. 2020;272:403-6.
13. Alsuliman MA, Alotaibi SA, Zhang Q, Durgampudi PK. A systematic review of factors associated with uncontrolled diabetes and meta-analysis of its prevalence in Saudi Arabia since 2006. Diabetes Metab Res Rev. 2021;37(3):e3395.
14. Fang M, Wang D, Coresh J, Selvin E. Trends in diabetes treatment and control in U.S. adults, 1999-2018. N Engl J Med. 2021 Jun 10;384(23):2219-28.
15. Najafipour H, Farjami M, Sanjari M, Amirzadeh R, Shadkam Farokhi M, Mirzazadeh A. Prevalence and incidence rate of diabetes, pre-diabetes, uncontrolled diabetes, and their predictors in the adult population in southeastern Iran: Findings from KERCADR study. Front Public Health. 2021;9:611652.
16. Unnikrishnan R, Anjana RM, Deepa M, Pradeepa R, Joshi SR, Bhansali A, et al. Glycemic control among individuals with self-reported diabetes in India, the ICMR-INDIAB Study. Diabetes Technol Ther. 2014;16(9):596-603.
17. Borgharkar SS, Das SS. Real-world evidence of glycemic control among patients with type 2 diabetes mellitus in India: The TIGHT study. BMJ Open Diabetes Res Care. 2019;7:e000654.
18. Najeeb SS, Joy TM, Sreedevi A, Vijayakumar K, Syama, Glycaemic Control and Determinants Team. Glycemic control and its determinants among people with type 2 diabetes mellitus in Ernakulam district, Kerala. Indian J Public Health. 2022;66(Supplement):S80-6.
19. Djonor SK, Ako-Nnubeng IT, Owusu EA, Akuffo KO, Nortey P, Agyei-Manu E, et al. Determinants of blood glucose control among people with Type 2 diabetes in a regional hospital in Ghana. PLoS One. 2021;16(12):e0261455.
20. Liu L, Wang F, Gracely EJ, Moore K, Melly S, Zhang F, et al. Burden of uncontrolled hyperglycemia and its association with patients characteristics and socioeconomic status in Philadelphia, USA. Health Equity. 2020;4(1):525-32.
21. Fathima F, George N, George M, Mathew S, Rajitha M, Agrawal T, et al. Effectiveness of color coded diabetic control monitoring charts among elderly diabetics attending outreach primary care geriatric clinics in rural Karnataka: An open label randomized control trial. Indian Jou Community Med. 2019;44(1):39-43.
22. American Diabetes Association. Standards of medical care in diabetes-2022 abridged for primary care providers. Clin Diabetes. 2022;40(1):10-38.
23. Riaz F, Al Shaikh A, Anjum Q, Mudawi Alqahtani Y, Shahid S. Factors related to the uncontrolled fasting blood sugar among type 2 diabetic patients attending primary health care center, Abha city, Saudi Arabia. Int J Clin Pract. 2021;75(7):e14168.
24. Alemu T, Tadesse T, Amogne G. Glycemic control and its determinants among patients with type 2 diabetes mellitus at Menelik II Referral Hospital, Ethiopia. SAGE Open Med. 2021;9:1-8.
25. Khan H, Lasker SS, Chowdhury TA. Exploring reasons for very poor glycaemic control in patients with Type 2 diabetes. Prim Care Diabetes. 2011;5(4):251-5.
26. Mamo Y, Bekele F, Nigussie T, Zewudie A. Determinants of poor glycemic control among adult patients with type 2 diabetes mellitus in Jimma University Medical Center, Jimma zone, south west Ethiopia: a case control study. BMC Endocr Disord. 2019;19(1):91.
27. Rasheed M, Islam N, Mahjabeen W. Factors associated with uncontrolled type 2 diabetes mellitus. J Islamabad Med Den Coll. 2015;4(2):68-71.
28. Hawley JA. Exercise as a therapeutic intervention for the prevention and treatment of insulin resistance. Diabetes Metab Res Rev. 2004;20(5):383-93.
29. Sluik D, Buijsse B, Muckelbauer R, Kaaks R, Teucher B, Johnsen NF, et al. Physical activity and mortality in individuals with diabetes mellitus. Arch Intern Med. 2012;172(17):1285-95.