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Prevalence and Predictors of Glycemic Control among Diabetic Patients in in Lalitpur, Nepal

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ABSTRACT

Background: Diabetes Mellitus is a growing public health concern. Despite advancements in treatment, prevalence of uncontrolled diabetes continues to rise. Hence, this study aimed to find out prevalence of glycemic control and its predictors among diabetic patients.

Methods: A cross-sectional study was conducted in Lalitpur. Diabetic patients aged 18 years or older, on treatment for more than three months, and with HbA1c test within last three months were included. Data were collected through interviews using semi-structured questionnaire based on WHO Stepwise approach. Total 212 participants were selected through convenience sampling. Data were analyzed using descriptive statistics, chi-square tests, and logistic regression.

Results: More than half of the participants were middle-aged (53.77%) and female (51.89%), with 82.08% residing in urban areas. Most of participants (93.87%) had Type 2 diabetes. Nearly all participants (99.52%) were on oral antidiabetic drugs, while 9.43% also received insulin therapy. Overall, 67% had poor glycemic control (HbA1c ≥7%), and 33% had good control (HbA1c <7%). Poor control was significantly associated with current residence, duration of diagnosis, duration of treatment, insulin therapy, and blood pressure. Regression analysis showed that rural residents had 2.54 times higher odds of poor glycemic control ($p = 0.04$), and participants with uncontrolled blood pressure were 2.47 times more likely to have poor glycemic control ($p = 0.03$).

Conclusions: Two thirds of participants had poor glycemic control, highlighting the need for targeted interventions, particularly for rural residents and those with uncontrolled blood pressure to prevent diabetes related complications.

Keywords: Diabetes; glycemic control; Nepal.

INTRODUCTION

Diabetes mellitus (DM) has become a global epidemic, affecting 537 million people and causing 6.7 million deaths.[1] The prevalence of uncontrolled diabetes varies significantly, ranging from 49% to 78% across different countries.[2-5] In Nepal, two-thirds of Type 2 diabetes patients had poor glycemic control.[6]

Glycemic control is crucial for effective diabetes management, with Glycated Hb(A1c) being a key indicator. Poor glycemic control increases risk of hospitalization, progression of complications, [7] and cost of diabetes care. [8] Every 1% rise in HbA1c above threshold is associated with 38% increase in macrovascular events, 40% higher risk of microvascular event, and 38% higher risk of death. [9]

Although maintaining good glycemic control can significantly delay diabetic complications and extend life expectancy, many diabetic patients are unable to achieve it due to various factors. Hence, this study aims to assess prevalence of glycemic control and its associated factors among diabetic patients.

METHODS

A descriptive cross-sectional study was conducted at Endocrine OPD of Alka Hospital, Lalitpur. Data was collected from 1st December 2024 to 30th December 2024. Ethical approval was granted by Nepal Health Research Council (Reg. No. 508_2024). Participants

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were invited to take part voluntarily, and they had right to refuse or withdraw from the study at any time. Informed verbal and written consent was obtained from each participants and privacy and confidentiality was maintained throughout the study. Diabetic patients aged ≥18 years, diagnosed for at least one year, on treatment for over three months, and with HbA1c test within last three months were included. Pregnant and mentally incompetent participants were excluded from study. Sample size was determined using Cochran's formula, considering 14.7% prevalence of uncontrolled diabetes among adults in Nepal. [10] Total of 212 participants were selected via convenience sampling, accounting for 10% non-response rate.

A semi-structured questionnaire based on WHO Stepwise approach for non-communicable disease surveillance questionnaire was used for the interview. [11] The research instrument was divided into four parts: Part I includes questions related to socio-demographic characteristics such as age, sex, residence, ethnicity, etc., Part II includes questions related to health-related information such as family history of diabetes, types of diabetes, duration of diabetes etc., Part III includes questions related to behavioural measurement such as tobacco use, alcohol consumption, diet etc. and Part IV: includes measurement such as Height, weight, BMI, blood pressure and HbA1c.

Anthropometric measurements were taken by standardized techniques and calibrated equipment. Weight was recorded using digital scale, and height measured by stadiometer, with participants in light clothing and barefoot. Body Mass Index (BMI) was calculated and classified as WHO criteria: underweight (<18.5 kg / m^2), normal (18.5–24.9 kg / m^2), overweight (25–29.9 kg / m^2), and obese (≥30 kg / m^2). Blood pressure was measured manually using sphygmomanometer, after 10-minute rest with appropriate-size cuff in a sitting position, with the arm maintained at heart level. Blood pressure was categorized as controlled and uncontrolled, with uncontrolled BP defined as systolic ≥140 mmHg and/or diastolic ≥90 mmHg. Glycemic control was assessed based on the latest HbA1c test (within 3 months), obtained from medical records and categorized per American Diabetes Association's definitions: good control (<7%) and poor control (≥7%). Face-to-face interview was conducted in separate room during waiting time, took 15-20 minutes to complete data.

The data were analyzed using Statistical Package for Social Sciences (SPSS) version 20. Descriptive statistics such as frequency, percentage, mean and standard deviation were calculated. The Chi-square test was used to find out the association between selected variables and glycemic control, with p-value of < 0.05 considered statistically significant. Logistic regression was then used to find out predictors of glycemic control, considering 95% confidence interval.

RESULTS

Total of 212 diabetic patients were included in this study. The age of participants ranged from 26 to 85 years, with mean age of 56.31 ± 11.74 years. More than half of the participants were middle aged adults (53.77%) and female (51.89%). Most of the participants were married (91.04%), and residing in Urban areas (82.08%). Likewise, most of the participants were literate (83.97%) and employed (84.44%) and more than half of the participants (56.60%) had family income of 60,000 and above (Table 1).

Regarding health related information, most of the participants (93.87%) were diagnosed as Type 2 diabetes with comorbidities (67%) and 48.11% had family history of diabetes. The most common comorbidities were Hypertension and Dyslipidemia. In terms of duration, one third of the participants had been living with Diabetes (33.49%) and receiving treatment (31.60%) for 5 to 9 years. Interestingly, nearly all participants (99.52%) were on oral antidiabetic drugs and 9.43% were receiving insulin therapy also. Likewise, majority of the participants (79.25%) had controlled blood pressure (Table 2).

In terms of behavioral characteristics, 7.54%, 11.32% and 20.28% of the participants were current user of tobacco, smokeless tobacco and alcohol respectively. Likewise, majority of the participants were taking 5 or more servings of fruits and vegetables per day (65.56%), performing daily physical activities (68.39%) and taking medications daily (78.30%). Majority of the participants (74.05%) never received any self-care related education.

Regarding glycemic control, majority of the participants (67%) had poor glycemic control (HbA1c ≥7%) and only one third of the participants (33%) had good glycemic control (HbA1c <7%) (Figure 1). The Chi-square test showed that current residence (p=0.03), duration of diagnosis (p=0.02), duration of treatment (p=0.02), treatment with insulin therapy (<0.001) and control of blood pressure (p=0.04) were significantly associated with poor glycemic level (Table 3 and Table 4). Furthermore, binary logistic regression analysis indicated that the

significant predictors of poor glycemic control were rural residents (AOR 2.54, 95% CI 1.04-6.20; p=0.04) and uncontrolled blood pressure (AOR 2.47, 95% CI 1.09-5.62; p=0.03) (Table 5).

Table 1. Socio-demographic characteristics of the participants. (n=212)

Socio-demographic characteristics	Frequency (%)
Age (in years)	
Young adults (20-39)	20 (9.43)
Middle adults (40-59)	114 (53.77)
Older adults (60 and above) (Mean ± SD: 56.31 ± 11.74)	78 (36.80)
Sex	
Male	102 (48.11)
Female	110 (51.89)
Marital status	
Married	193 (91.04)
Unmarried / Divorced/ Widowed	19 (8.96)
Current residence	
Urban	174(82.08)
Rural	38(17.92)
Level of education	
Illiterate	34 (16.03)
Can read and write only	40 (18.87)
Basic Level	21 (9.90)
Secondary Level	71 (33.50)
University level	46 (21.70)
Employment status	
Employed	179 (84.44)
Unemployed/Retired	33 (15.56)
Family income (in Nepalese rupees)	
Less than 60,000	92 (43.40)
60,000 and above Median (IQR): 60,000 (30,000)	120 (56.60)

Table 2. Health related information of the participants. (n=212)

Characteristics	Frequency (%)
Family history of Diabetes	
Yes	102 (48.11)
No	110 (51.89)
Types of Diabetes	
Type 1	13 (6.13)
Type 2	199 (93.87)
Duration of diagnosis (in years)	
1-4	54 (25.47)
5-9	71 (33.49)
10-14	47 (22.17)
15 or more (Mean ± SD: 9.07 ± 6.40)	40 (18.87)
Duration of treatment (in years)	
1-4	62 (29.25)
5-9	67 (31.60)
10-14	47 (22.17)
15 or more (Mean ± SD: 8.50 ± 6.10)	36 (16.98)
Treatment modalities *	
Oral anti-diabetic drugs	211 (99.52)
Insulin	20 (9.43)
Comorbidities with Diabetes	
Yes	142 (67)
No	70 (33)
Blood pressure	
Controlled	168 (79.25)
Uncontrolled	44 (20.75)

Note. *: Multiple response

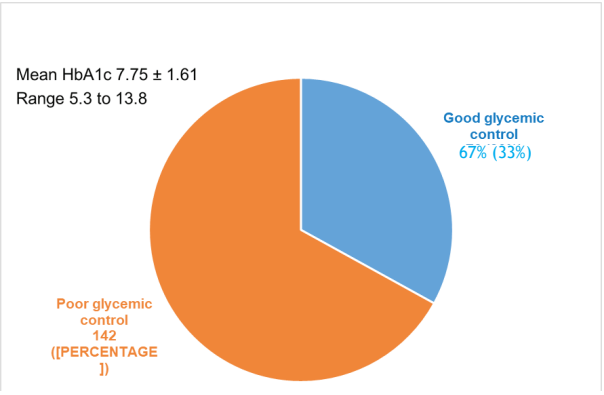

Figure 1. Glycemic control of the participants

Table 3. Association of glycemic control with socio-demographic and bio-physiological measurements of the participants. (n=212)

Characteristics	Glycemic level		χ2 value	p-value
	Poor control	Good control		
Age groups				
Young adults	11(55)	9(45)	1.57	0.45
Middle adults	79(69.30)	35(30.70)		
older adults	52(66.67)	26(33.33)		
Sex				
Male	73(71.56)	29(28.44)	1.87	0.17
Female	69(62.72)	41(37.28)		
Current residence				
Urban	111(63.80)	63(36.20)	4.46	0.03*
Rural	31(81.57)	7(18.43)		
Marital status				
Currently married	131(67.87)	62(32.13)	0.77	0.37
Others	11(57.89)	8(42.11)		
Educational level				
Illiterate	24(70.59)	10(29.41)	0.23	0.62
Literate	118(66.29)	60(33.71)		
Employment status				
Unemployed	20(60.60)	13(39.40)	0.71	0.39
Employed	122(68.15)	57(31.85)		
BMI				
Normal	42(60.87)	27(39.13)	1.72	0.18
Abnormal	100(69.93)	43(30.07)		
Blood pressure				
Controlled	107(63.69)	61(36.31)	3.96	0.04*
Uncontrolled	35(79.54)	9(20.46)		

Note. *: Significant association at p-value <0.05

Table 4. Association of glycemic control with health related and behavioral characteristics of the participants. (n=212)

Characteristics	Glycemic level		χ2 value	p-value
	Poor control	Good control		
Family history of Diabetes				
Yes	66(64.70)	36(35.30)	0.46	0.49
No	76(69.09)	34(30.91)		
Types of Diabetes				
Type 1	8(61.53)	5(38.47)	0.18	0.66
Type 2	134(67.33)	65(32.67)		
Comorbidities with Diabetes				
Yes	94(66.19)	48(33.81)	0.12	0.73

Table 4. Association of glycemic control with health related and behavioral characteristics of the participants. (n=212)

Characteristics	Glycemic level		χ2 value	p-value
	Poor control	Good control		
No	48(68.57)	22(31.43)		
Duration of diagnosis				
Less than 10 years	76(60.80)	49(39.20)	5.26	0.02*
10 years or more	66(75.86)	21(24.14)		
Duration of treatment				
Less than 10 years	79(61.24)	50(38.76)	4.91	0.02*
10 years or more	63(75.90)	20(24.10)		
Insulin therapy†				
Treatment with insulin	20(100)	0	-	<0.001*
Treatment without insulin	122(63.54)	70(36.46)		
Diet (Fruits and vegetables per day)				
Less than 5 servings	53(72.60)	20(27.40)	1.59	0.20
5 servings or more	89(64.02)	50(35.98)		
Physical activities				
Inadequate (Less than 5 days/ week)	45(71.42)	18(28.58)	0.80	0.37
Adequate (5 days or more/week)	97(65.10)	52(34.90)		
Smoking tobacco				
Current smoker	11(68.75)	5(31.25)	0.02	0.87
Never/Past smoker	131(66.83)	65(33.17)		
Alcohol consumption				
Current user	29(67.44)	14(32.56)	0.005	0.94
Never/Past user	113(66.86)	56(33.14)		

Note. *: Significant association at p-value <0.05; †: Fisher's Exact Test

Table 5. Predictors associated with poor glycemic control (Logistic regression analysis).

Characteristics	Crude OR (95% CI)	Adjusted OR (95% CI)	p-value
Residence			
Urban	Ref.		
Rural	2.51 (1.04-6.02)	2.54 (1.04-6.20)	0.04*
Duration of Diagnosis			
Less than 10 years	Ref.		
10 years or more	2.02 (1.10-3.71)	1.38 (0.13-14.48)	0.78
Duration of Treatment			
Less than 10 years	Ref.		
10 years or more	1.99 (1.07-3.69)	1.52 (0.14-16.43)	0.72
Blood pressure			
Controlled	Ref.		
Uncontrolled	2.21 (0.99-4.92)	2.47 (1.09-5.62)	0.03*

Note. *: Significant at p-value <0.05; Ref: Reference group

Omnibus test: p-value= 0.005, Hosmer- Lemeshow test: p-value = 0.301, Nagelkerke R^2 value= 9.5%

DISCUSSION

This study aims to determine prevalence of glycemic control and its predictors among diabetic patients. HbA1c was used as an indicator of good and poor glycemic control.

The findings of this study reveal that 67% of participants had poor glycemic control, indicated by an HbA1c level of ≥7%, while 33% had good glycemic control (HbA1c <7%). Interestingly, despite the lower overall prevalence of diabetes in rural areas compared to urban areas of Nepal,[12] this study found that rural participants had poor glycemic control. This highlights an important regional disparity in diabetes management. Similar findings were reported in previous studies of Nepal, where 64.44% [13] and 66.39% [6] of participants had poor glycemic control. The results of this study are also consistent with estimates from various countries, including Brazil (60%),[14] Jordan (65.15%), [15] India (76.56%), [16] and South Africa (77.71%).[17] However, the prevalence of poor glycemic control (67%) in this study is lower than that reported in Ghana (86.40%) [18] and Bangladesh (81.81%) [19] but higher compared to Denmark (26.03%), [20] Saudi Arabia (49.11%), [2] Thailand (54.80%), [21] and Ethiopia (55.32%). [22] These discrepancies may be attributed to differences in study methodologies, healthcare systems, and demographic characteristics of participants across different regions.

In addition, findings of this study highlight several key factors that significantly influence glycemic control among diabetic patients. Notably, both duration of diabetes diagnosis (p=0.02) and duration of treatment (p=0.02) for 10 years or longer were found to be significantly associated with poor glycemic control. A similar study reported that participants diagnosed with diabetes for 11 to 20 years and for 21 years or more had 1.98 and 2.46 times higher odds, respectively, of experiencing suboptimal glycemic control, compared to those diagnosed within 10 years.[21]

In the present study, nearly all participants (99.52%) were using oral antidiabetic drugs, while 9.43% were undergoing insulin therapy also. The analysis revealed that poor glycemic control was more prevalent among those receiving insulin therapy (p<0.001), which aligns with findings from a study conducted in Bangladesh, where insulin users also exhibited higher prevalence of poor glycemic control (p<0.001).[19] Poor adherence to insulin therapy is a significant factor contributing to poor glycemic control.[23] Barriers to adherence include practical issues such as being away from home, dietary concerns, and embarrassment about administering injections in public. Other challenges include risk of hypoglycemia, weight gain, needle phobia, and difficulties related to insulin preparation, administration, and storage. [24]

Interestingly, in contrast to the present study, previous research has identified additional factors significantly associated with poor glycemic control, including gender, education level, employment status, income, smokeless tobacco use, unhealthy dietary habits, and poor self-management behaviors. [13,19,25] These factors may further contribute to the variability in glycemic control, emphasizing the need for a comprehensive approach to diabetes management that incorporates both medical treatment and lifestyle factors.

Furthermore, Logistic regression analysis in this study identified residence and blood pressure as significant predictors of poor glycemic control. Rural residents were found to have 2.54 times higher odds of experiencing poor glycemic control (AOR 2.54, 95% CI 1.04–6.20; p=0.04) compared to their urban counterparts. This finding aligns with a study conducted in Bangladesh, which reported that rural patients had 2.4 times higher odds of poor glycemic control. [19] The disparity may be attributed to limited healthcare access and affordability in rural areas.[26] Patients in these regions may delay seeking medical attention until diabetes-related complications arise, contributing to poor glycemic control.

In this study, majority of participants (67%) had comorbidities, with hypertension and dyslipidemia being the most common. Additionally, participants with uncontrolled blood pressure were 2.47 times more likely to have poor glycemic control (AOR 2.47, 95% CI 1.09–5.62; p=0.03) compared to those with controlled blood pressure. This is consistent with findings from a study conducted in Saudi Arabia, which also reported that participants with hypertension and dyslipidemia were less likely to achieve good glycemic control. [27] Similarly, a study in Ethiopia showed that high systolic blood pressure was significantly associated with poor glycemic control. [28] Moreover, the odds of poor glycemic control increased with the severity of hypertension, from stage I (OR=1.65) to stage II (OR=2.73, p<0.0001). [16] The shared pathophysiological mechanisms between hypertension and diabetes, such as insulin resistance, vascular inflammation, and endothelial dysfunction, may explain these findings. [29] However, these results contrast with a study in Ghana, which found that individuals with hypertension were 3.37 times more

likely to have controlled blood glucose compared to those with normal blood pressure. [18] This discrepancy may be due to more favorable attitude toward lifestyle modifications for hypertension management in Ghana, [30] which may contribute to better glycemic control in hypertensive individuals. Lifestyle modifications play a significant role in managing both hypertension and diabetes that ultimately reduce complications and improve overall health outcomes. [31]

This study offers valuable insights into the predictors of glycemic control, highlighting priority groups for targeted interventions. However, it has several limitations. First, self-reported method of data collection was used to some items, so there is possibility of social desirability bias. Likewise, the single-center, hospital-based nature of the study design limits the generalizability of the study findings. Additionally, as a cross-sectional study, it only assessed participants at one point in time, so it cannot track changes or improvements in glycemic control over time. Future longitudinal studies would be valuable in establishing causal relationships between significant factors and poor glycemic control over time.

CONCLUSIONS

This study found that two thirds of participants had poor glycemic control. The significant predictors of poor glycemic control were rural residents and uncontrolled blood pressure. This highlight the need for targeted interventions to improve long-term glycemic control and reduce the risk of diabetes-related complications.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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