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ORIGINAL RESEARCH

Self-Care Adherence And Barriers To Good Glycaemic Control In Nepalese Type 2 Diabetes Mellitus Patients: A Hospital-Based Cross-Sectional Study

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Purpose: The patient believes in adherence to medication rather than to self-care adherence and lifestyle changes for the management of diabetes. This study was carried out to establish the association of self-care adherence and their barriers in poor glycemic control in our diabetic population.

Patients and methods: This cross-sectional study was conducted among 480 already diagnosed diabetes outpatients attended in our two hospitals. Glycaemic control was defined by levels of $HbA_{1c.}$ Socio-demographic data, lifestyle variables and anthropometric measurements were recorded using a standard questionnaire. Fasting blood glucose, HbA_{1c} and lipid profiles were estimated using the manufacturer's guideline. Student's *t*-test and one-way ANOVA were used for comparison between different groups and the correlation was established by Spearman correlation. Risk factors associated with poor glycaemic control were verified by logistic regression analysis.

Results: The mean HbA_{1c} of the study population was 7.4±1.3% and 65.4% had poor glycaemic control with mean 8.0±1.1%. Higher HbA_{1c} levels were significantly associated with duration of diabetes, a number of drugs used, patient–physician relationship and knowledge about diabetes. The poor glycaemic control was significantly associated with low adherence of following the meal plan, regular medication and regular exercising ($p<0.001$). Among all the barriers, a too busy schedule for following the meal plan, taking medications and exercising regularly was significantly correlated with HbA1c levels. Multivariable logistic regression analysis showed irregular meal plan (OR=5.27), irregular exercise (OR=2.25), number of medication used (OR= 0.19) and lesser extent patient–physician relationship (OR=2.68) were independent risk factors for poor glycaemic control.

Conclusion: The poor glycaemic control was associated with poor adherence to self-care adherence and their barriers in our diabetic population. Integrated knowledge on diabetes management should be targeted to improve glycaemic control in our communities.

Keywords: type 2 diabetes mellitus, HbA1c, lifestyle variables, risk factors

Introduction

Diabetes mellitus requires specific enduring self-care adherence which is a process followed by the patient to maintain the blood glucose and quality of life, minimizing the fatal complications. Lack of proper prognosis and management often leads to fatal complications associated with diabetes like blindness, kidney failure, amputations, peripheral neuropathy and cardiovascular defects which can lead to

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premature death. Early, effective and intensive care over diabetes prevents diabetic complication and its deleterious effect.[3,4]

World Health Organization (WHO) reported that globally 422 million adults living with diabetes mellitus and the prevalence had nearly doubled since 1980, increasing from 4.7% to 8.5% in adults.[1] Likewise in Asian countries India and Pakistan, the prevalence of diabetes were found to be 8.5% and 6.7%, respectively, and in Nepal, it was found to be 4.5%.[2]

Many studies show that control of hyperglycemia (HbA1c ≤7%) controls the risk of complications.[5–8] The reasons of acquiring poor control on diabetes mellitus are socio-demographic factors, aging, obesity, high BMI, hypertension, economic development, urbanization, education, income, unhealthy eating habits, dyslipidemia, physical inactivity, sedentary lifestyles and impaired glucose intolerance.[5,9–11] Nevertheless from all the factors, to prevent from severe poor glycaemic control or detain the number of fatal complication associated with diabetes mellitus, it is imperative to follow self-care adherence.[12]

The patient believes in adherence to medication rather than to self-care adherence and lifestyle changes for the management of diabetes. Patients' perceptions and their beliefs in social, cultural and religious faith influence the patients' lifestyle and self-care adherence.[13] Patient–physician relationship and family support also play the major role in patients' self-care adherence.[14] Some studies have reported that self-efficacy and positive attitude also can minimize the barriers to self-care adherence towards management of diabetes.[14,15] Health belief and patient attitude towards management of diabetes may be affected by inadequate knowledge about diabetes, inability to understand doctor's instruction and fear on the side effect of long-term medication.[16] Alongside, improvement on self-care adherence and minimization of their barriers can be achieved by focusing on diabetic education and self-management support programs to the specific population.[15]

Limited access to adequate health services and a lack of standard laboratory tests may also influence on glycaemic control and even more challenging in our developing country. To minimize these factors and to establish association of self-care adherence and their barriers on long-term glycaemic control (level of HbA1c), this study was carried out in the Capital City where health services are adequate.

Materials And Methods

This descriptive cross-sectional study was conducted during the period of 6 months (February 2018 to July 2018) in Manmohan Memorial Teaching Hospital (MMTH) and Manmohan Memorial Community Hospital (MMCH), Kathmandu, Nepal.

Inclusion And Exclusion Criteria

Already diagnosed patients with T2DM attending the Department of Medicine and Endocrinology were conveniently selected for the study. Among 556 outpatients attended in hospital during the study period, 492 satisfied the inclusion criteria, 12 patients denied to attend for the questionnaire (response rate 97.56%). So, totally 480 patients were included in the study. We exclude the inpatient (hospitalized) during the study period because measuring the self-care adherence and thiers barriers in hospitalized patient (they depend on others for proper adherence) may confound the result outcome. Patient with a history of less than a year of diabetes was considered as recently diagnosed patient and may influence to establish the association of self-care adherence on long-term glycaemic control. Hence, they were excluded from the study.

Socio-Demographic And Lifestyle Variables

After informed and written consent, all 480 patients fulfilled with the above inclusion criteria were recorded with demographic data such as age, marital status, education level, occupation, year of diagnosis of diabetes mellitus. Lifestyle variables of the patient were recorded as, the treatment modality of patients, a number of medications, smoking history, alcohol consumption history, family support, patient–physician relationship and presence or absence of complications based on previous diagnosis report.

The questionnaire used in this study was designed after reviewing the previous similar studies.[5,13] This cross-sectional study includes questions about self-care adherence like "following meal plan", "taking medications", "exercising" and "monitoring of blood glucose". A patient who followed the physician dietary plan was considered as following the meal plan and with regular medication was regarded as following regular medication as prescribed by the clinician. Evaluating the pattern and time of exercise patients were categorized as regular, irregular and without

exercise. Blood glucose monitoring was recorded as weekly, monthly, once or twice or four times per year. Good and bad adherence were defined based on the patient self-report and physician prescription. Patients following the regular meal plan as recommendation from dietician or physician for control of diabetes were classified in higher adherence of following meal plan. Patients who did not follow the regular meal plan or follow occasionally were considered as low adherence of following meal plan. The number of medication was defined by the physician prescription used for management of diabetes mellitus. Medication Assessment Questionnaire, which is commonly used self-report tool, was used to define adherence to medication.[5]

Diabetes knowledge questionnaire (DKQ) was used to define lesser and higher extent knowledge about diabetes.[13] This questionnaire included the questions about cause, types, complications and management of diabetes Mellitus. Patients with average of at least half-hour exercise daily were classified into high adherence to exercise. Patients who frequently visit physician (at least once a month) for the regular prognosis and concerned about the diabetes and its complications and along with physician who responds patient frequently and maintain a good relation with patient and concerned about their status were categorized into the higher extent of patient–physician relationship.

All the possible barriers for above self-care adherence were tested in 20 diabetic population prior to the study and "too busy and care about other things", "forgot", "don't like", "don't understand", "depression interference", "doctor referred pattern" and "disabled" were included in the questionnaire of this study.

Anthropometric And Blood Pressure Measurement

According to the guidelines of the WHO 2008 report, waist circumference and hip circumference was measured.[17] All the patients have measured their height and weight without shoes standing erect on fixed to the wall by Harpendenwall-mounted stadiometer and digital weighing machine, respectively.[18] Body mass index (BMI) was calculated (kg/m^2) and the cut-off value was considered as 25 kg/m^2; higher values were considered overweight.

Blood pressure was measured using sphygmomanometer from the left hand which is placed on a desk facing palm upward, with the antecubital fossa level to the heart.[18] Hypertension was described as a patient with systolic blood pressure (SBP) above 140 mm of Hg or diastolic blood pressure (DBP) above 90 mm of Hg or patient under treatment with hypertensive drugs.[19]

Biochemical Analysis

Fasting (8 to 12 hrs) and post-prandial venous blood samples were collected for biochemical analysis. Fasting Blood Sugar (FBS) and post-prandial blood sugar and lipid profile were estimated. The standard methods for the assays were based on the guidelines provided by the reagent manufacturer (Human GmBh, Wiesbaden, Germany).

Fasting blood samples were analyzed for total cholesterol (TC), triglyceride (TG), high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C) as per the instructions provided by the reagent manufacturer (Human GmBh, Wiesbaden, Germany). All the parameters were analyzed using Statfax 3300 (Awareness Technology, Inc. Bellport, USA, semi-automated analyzer) in the Department of Biochemistry, MMTH. HbA1c was estimated by the ion exchange resin method as per the instructions provided by the reagent manufacturer (Human GmBh, Wiesbaden, Germany).

All the biochemical variables were expressed in mg/dL while HbA_{1c} was in percentage (%). The diabetic population with a level of HbA_{1c}<7.0% was considered as good glycaemic control and ≥7.0% was considered as poor glycaemic control (high HbA1c) as defined by the International Diabetic Federation (IDF).[9] High glucose level was defined with patient fasting serum glucose equal or more than 126 mg/dL or post-prandial serum glucose equal or above 200 mg/dL.[20] Dyslipidaemia was defined as triglyceride >150 mg/dL, high total cholesterol (>200 mg/dL), low HDL-C (<40 mg/dL) in men and (<45 mg/dL) in women.[21]

Statistical Analysis

Data were analyzed using SPSS version 20.0 (IBM Corp., Armonk, NY, USA) and Microsoft Excel 2013. Independent Sample *t*-test was used to analyze the differences in biochemical markers between good glycaemic control and poor glycaemic control population. Student's independent *t*-test was used to analyse significance between two variable and One-way Anova test was used to analyse significance between more than two variables. Barriers of self-care adherence were coded in binomial scale in SPSS and Correlation (Spearman correlation and significance) was established with HbA_{1c} level. Likewise, bivariate analysis was done to obtain the crude effect of

risk factors (independent variables) on the poor glycaemic control (HbA1c ≥7%). Variables with p-values <0.05 were entered into multivariable logistic regression analysis. The association between risk factors with poor glycaemic control was measured using odds ratio (OR) with 95% Confidence Interval. The p-value of <0.05 was considered as statistically significant in this study.

The proposal was submitted and discussed under the Institutional Review Committee (IRC) of Manmohan Memorial Institute of Health Sciences (MMIHS) for the approval. Informed and written consent was obtained from each participant for the study.

Results

The positive response rate of patients for participation in this study was 97.56%. The mean age of study participants during study time was 58.3±12.5 years. From the total participants, 236 (49.2%) were males. The mean duration of diabetes since diagnosis was 7.9±7.73 years. The mean HbA1c of the study population was 7.4±1.3. Among the total respondents, 65.4% had poor glycaemic control with mean 8.05±1.06%. Higher HbA1c levels were significantly associated with duration of diabetes, a number of drugs used, and the patient–physician relationship, knowledge about diabetes and its complication and dyslipidemia (Table 1).

Figure 1 illustrates TC, TG and waist circumference were higher at a significant level in poor glycaemic control compared to the population with good glycemic control.

Based on the clinical reports review and self-report, comorbidities and complication of diabetes were diagnosed in 91.7% of the patients. Co-morbidities like Dyslipidemia (68.3%) and Hypertension (60.4%) were found in major population whereas, cardio-vascular disease, thyroid disorder, diabetic retinopathy, peripheral vascular disease and renal complication were present in less than 20% of the population (Figure 2).

The lower HbA1c levels were associated with higher adherence to following the meal plan and regular medications, regular exercising and regular monitoring of blood sugar at a significant level. Further, participants who followed their meal plan and taking regular medication, following a meal plan and exercise regularly and following a meal plan, taking medication and exercised regularly had significantly lower HbA1c levels ($p < 0.001$) (Table 2).

Table 1 Sociodemographic, Lifestyle, And Clinical Characteristics Proportion To Type 2 Diabetic Patients

Patient Characteristics	Total Number (n =480), n (%)	Mean HbA_1c	*p*
Age (years)			
26–49	120 (25%)	7.4 ± 1.2	0.649[y]
50–64	202 (42.1%)	7.3 ± 1.2	
65–87	158 (32.9%)	7.5 ± 1.4	
Sex			
Male	236 (49.2%)	7.34 ± 1.09	0.844[x]
Female	244 (50.8%)	7.47 ± 1.42	
Educational Level			
Illiterate	262 (54.6%)	7.43 ± 1.33	0.720[y]
School level	130 (27.1%)	7.49 ± 1.29	
Higher secondary level	28 (5.8%)	7.05 ± 1.11	
Undergraduate level	34 (7.1%)	7.41 ± 1.08	
Graduate level	26 (5.4%)	7.12 ± 0.99	
Marital Status			
Single	20 (4.2%)	7.73 ± 1.31	0.430[y]
Married	366 (76.2%)	7.38 ± 1.30	
Widowed	86 (17.9%)	7.83 ± 0.61	
Divorced	8 (1.7%)	7.41 ± 1.87	
Occupation			
Unemployed	250 (52.1%)	7.42 ± 1.41	0.649[y]
Employed	52 (10.8%)	7.185 ± 1.28	
Self-employed	78 (16.3%)	7.49 ± 1.06	
Retired	96 (20%)	7.41 ± 1.06	
Others	4 (0.8%)	7.25 ± 1.34	
Duration of diabetes			
≤10 years	348 (72.5%)	7.27 ± 1.17	**0.013[x]**
>10 years	132 (27.5%)	7.76 ± 1.14	
Number of drugs			
<3 drugs	372 (77.5%)	7.30 ± 1.30	**0.023[x]**
≥3 drugs	108 (22.5%)	7.75 ± 1.09	
Treatment Modality			
Oral anti-diabetic agents	358 (74.6%)	7.26 ± 1.08	0.059[y]
Oral anti-diabetic agents with insulin	70 (14.6%)	8.10 ± 1.84	
Insulin only	24 (5.0%)	7.53 ± 1.34	
Past Insulin user	28 (5.8%)	7.36 ± 1.33	
Presence of comorbidities or diabetic complication, yes	320 (66.7%)	7.34 ± 1.20	0.533[x]

(*Continued*)

Table 1 (Continued).

Patient Characteristics	Total Number (n =480), n (%)	Mean HbA_1c	*p*
Use of other drugs, yes	332 (69.2%)	7.36 ± 1.21	0.64[x]
Smoking			
Smoker	74 (15.4%)	7.51 ± 1.15	0.763[y]
Non-Smoker	262 (54.6%)	7.40 ± 1.31	
Ex-smoker	144 (30%)	7.36 ± 1.26	
Alcohol consumption			
Yes	144 (30%)	7.48 ± 1.30	0.676[y]
No	250 (52.2%)	7.32 ± 1.22	
Ex-consumer	84 (17.8%)	7.51 ± 1.38	
Family support			
Lesser extent	86 (17.9%)	7.62 ± 1.18	0.065[x]
Greater extent	394 (82.1%)	7.36 ± 1.28	
Patient–Physician relationship			
Lesser extent	252 (52.5%)	7.583 ± 1.34	**0.021**[x]
Greater extent	228 (47.5%)	7.207 ± 1.155	
Knowledge about diabetes			
Lesser extent	312 (65%)	7.55 ± 1.31	**0.013**[x]
Greater extent	168 (35%)	7.13 ± 1.15	
Dyslipidemia, yes	328 (68.3%)	7.57 ± 1.24	**0.004**[x]
Hypertension, yes	290 (60.4%)	7.44 ± 1.29	0.481[x]

Notes: n, number of the population; bold p-value represents significant level ($p<0.05$). [x]Student's independent *t*-test used to analyse significance between two variables. [y]One-way Anova test used to analyse between different variables.

The barriers for meal plan such as too busy and care about other things, do not understand, do not like and depression was significantly positively correlated with higher HbA1c. Similarly, too busy, forgot and depression were the barriers in taking medications regularly, that is positively correlated with higher HbA1c value at significant levels, while the barriers too busy, do not like and disable showed a significantly positive correlation with HbA1c for regular exercise (Table 3).

Initially, crude effect of risk factors (independent variables) on the poor glycaemic control (HbA1c ≥7%) was measured using bivariate analysis. A stepwise backward elimination procedure was applied with variables with p-values <0.05 in multivariable logistic regression analysis. The result shows the independent risk factors for the high level of HbA1c are lower fidelity with following the meal plan (OR=5.27) and regular exercise (OR=2.25), number of medication <3 (OR=0.19), high triglyceride (OR=0.37) and lesser extent of patient–physician relationship (OR=2.68) (Table 4).

Discussion

The study measured the risk factors, self-care behaviors and their barriers, and their relationship with HbA_{1c} levels among Nepalese patients with T2DM. We found that 65.4% had poor glycaemic control. In other studies of Nepal, a similar prevalence of poor glycaemic control (61.3%) was reported.[22] Compared with other countries, poor glycaemic control of patients with diabetes was 74% in Saudi Arabia, 69% in UAE, 78% in Malaysia and 66.7% in Kuwait.[5,23–25]

Our study revealed that the duration of diabetes influenced the HbA_{1c} level and patients with more than 10 years duration of diabetes were found with higher HbA_{1c} level. The long duration of hyperglycemia and hyperinsulinemia impairs the sensitivity and secretion of insulin, and the body becomes more resistant to insulin. Thus, this

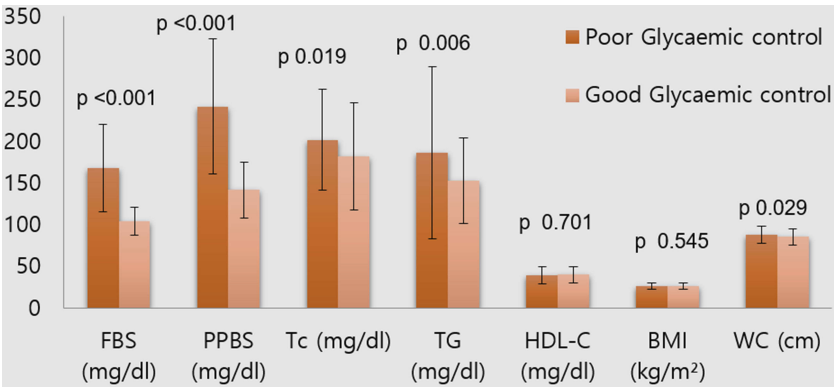

Figure 1 Comparison of biochemical parameters and anthropometric variable between poor and good glycemic control.

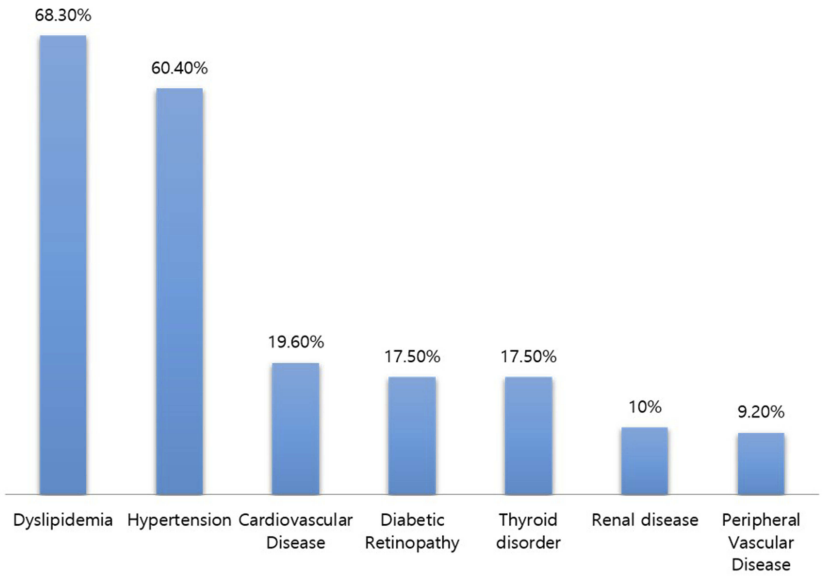

Figure 2 Co-morbidities among type 2 diabetes patients.

Table 2 Self-Care Adherence And HbA1c

Variable	Categories	n (%)	HbA1c	p
Following a meal plan	Low adherence High adherence	170 (35.4%) 310 (64.6%)	6.8±1.04 7.74±1.26	**<0.001**[x]
Taking medications	Low adherence High adherence	176 (36.6%) 304 (63.4%)	7.69±1.42 7.24±1.14	**0.007**[x]
Exercise	Regular Irregular No	184 (38.3%) 144 (30.0%) 152 (31.7%)	7.14±1.21 7.73±1.38 7.41±1.16	**0.011**[y]
Monitoring blood sugar	Weekly Monthly Triannual Biannual Yearly	10 (2.1%) 232 (48.3%) 150 (31.2%) 70 (14.6%) 18 (3.8%)	7.36±1.41 7.22±1.06 7.27±1.20 7.95±1.51 8.73±1.96	**0.024**[y]
Following a meal plan and taking medications	Low adherence High adherence	132 (27.5%) 126 (26.3%)	7.85±1.51 6.65±1.01	**<0.001**[x]
Following a meal plan and exercising regularly	Low adherence High adherence	212 (44.2%) 86 (17.9%)	7.83±1.27 6.71±1.03	**<0.001**[x]
Following a meal plan, taking medication and exercising	Low adherence High adherence	98 (20.4%) 62 (12.9%)	8.002±1.54 6.58±0.99	**<0.001**[x]

Notes: n, number of the population; bold represents p-value at a significant level (p<0.05). [x]Student's independent *t*-test used to analyse significance between two variables. [y]One-way Anova test used to analyse between different variables.

decreases the GLUT4 transportation and utilization, which results in an increment of carbohydrate in circulation, leads to its attachment to HbA_{1c}.[26–28]

The literacy rate among the study population had no significant relation with glycaemic control. However, patients who had a better understanding of diabetic complications and their management showed fair glycaemic control. This result is consistent with other findings.[5,6,29,30] Interaction of the patient with their physician determined their management of diabetes. The lesser extent of the

Table 3 Correlation Between Barriers Of Self-Care Adherence With Level Of HbA1c

Barriers	Following a Meal Plan HbA_1c (r)	Taking Medication HbA_1c (r)	Exercising Regularly HbA_1c (r)
Too busy & care about other things	0.169**	0.174**	0.145*
Forgot	0.047	0.194**	0.040
Don't understand	0.132*	0.080	0.012
Don't like	0.143*	0.078	0.13*
Depression interfere	0.127*	0.127*	0.069
Doctor referred pattern	N/A	0.041	N/A
Disable	N/A	N/A	0.142*

Notes: *P ≤ 0.05, **P ≤ 0.001, N/A-the barrier is not associated to self-care behavior.

patient–physician relationship was an independent factor for poor glycaemic control concordance to other studies[5,31,32] The physician can motivate patients on patient-report outcomes, be responsive to patient preferences, provide psychological support and understanding regarding diabetes-related distress, medication plan adherence and lifestyle and set a treatment goal to improve the hyperglycaemic state of the patient. Therefore, level of controlling for baseline HbA_{1c} and other measures of diabetes severity highly depends on physicians' characteristics.[31–33] As well, a patient who followed the advice of a physician regarding medication, meal plan and exercises had better control over diabetes in our population parallel with other studies.[34,35] Regular monitoring of blood sugar may encourage the physician to manage and provide confidence to their patients for the better management of the glycaemic control. The proper knowledge of family towards diabetes complications and their support and care to a patient has proved a fruitful effect on glycaemic control.[23] Previous studies showed a significant effect of family support on improvement and management of hyperglycemia among T2DM patients[5,36] but we could not find such significant relation in our population. In our study, patients who had support from their family had no better control over diabetes than patients without their family support. This might be due to a lack of knowledge of individuals and family regarding healthy lifestyle and dietary interventions toward management of metabolic diseases.

The study showed that self-care behavior plays a major significant role in the management and control of hyperglycemia in the diabetic population. Similar to other findings, lower adherence to following the meal plan is an important factor for higher levels of HbA_{1c} and FBG in our study.[5,23,24,37] This may be due to poor availability of dieticians in our country, as well as poor knowledge of patients towards diabetic management and its complications. Even an individual with a good level of education commonly fails to follow the dietary recommendation. According to previous research data, dietary control can improve fasting blood sugar by 50–100 mg/dL and HbA_{1c} by 1.0% to 2.5%.[23,38] The busy lifestyle of the majority of the study population had a major effect on their dietary habits. In our study, a positive correlation was seen between their busy lifestyle over the HbA1c levels. Similarly, a lack of knowledge about proper healthy diet required to control diabetes also had a significant positive correlation with HbA1c level ($r=0.132$, $p \leq 0.05$). Patients show unwillingness towards dietary restriction which is influenced by cultural backgrounds such as various festivals and events.[39] A significant positive correlation was observed between dislike of food restriction and HbA_{1c} ($r=0.143$, $p \leq 0.05$). Diabetes-related distress interferes the following the meal plan by the patient and shows positive significant correlation with poor glycaemic control.

According to our results, there is a significant correlation between regular physical activities with the value of HbA_{1c}in concordance to other findings,[40,41] despite some findings showing disagreement.[5] Regular physical activity improves physical fitness, increases insulin sensitivity[30] and improves glycaemic control by lowering HbA1c level-up to 0.6%.[31] Physical inactivity was caused due to the busy schedule among patients, similar to dietary plan disobedience. Lack of interest in the physical exercise had a positive correlation with their glycemic control. Unfaith on physical activity is due to the lack of awareness of diabetes and its complication and more belief in medicines.[42] Physical disability, old age, neuropathic complications and other co-morbidities contributed further to physical inactivity due to physical inability. Our study found a significant positive correlation between physical disability and poor glycemic control. A similar result was found on previous finding.[43]

In our study, patients with a higher level of HbA_{1c}were recommended with more than three numbers of drugs. Regular medication had a significant association with

Table 4 Regression Analysis For Risk Factor Associated With Poor Glycaemic Control

Variable	Categories	COR (95% CI)	AOR (95% CI)
Following meal plan	Low adherence High adherence	5.28 (2.962, 9.417)[a]	5.27 (2.73, 10.14)[a]
Taking medication	Low adherence High adherence	1.431 (0.81, 2.51)[c]	–
Regular exercise	Low adherence High adherence	2.11 (1.17, 3.807)[a]	2.25 (1.17, 4.33)[b]
Duration of diabetes	≤10 yrs >10 yrs	0.568 (0.302, 1.067)[c]	–
Number of medication	<3 ≥3	0.303 (0.14, 0.66)[b]	0.19 (0.078, 0.48)[a]
Triglyceride (mg/dL)	<150 ≥150	0.44 (0.255, 0.755)[b]	0.37 (0.19, 0.71)[b]
Knowledge about diabetes	Lesser extent Greater extent	2.59 (1.49, 4.51)[a]	1.74 (0.904, 3.35)[c]
Patient–physician relationship	Lesser extent Greater extent	2.20 (1.28, 3.79)[b]	2.68 (1.39, 5.14)[b]

Notes: [a]represents p-value at a significant level ($p<0.001$), [b]represents p-value at a significant level ($p<0.05$) and [c]represents p-value at non-significant level.
Abbreviations: COR, Crude Odds Ratio; AOR, Adjusted Odds Ratio; CI, Confidence interval.

good glycemic control. Among the barriers of regular medication busy schedule, forgetfulness and diabetes-related distress for regular medications showed a positive correlation with high HbA1c. In addition, regular monitoring of blood glucose may be the motivational factor and encourage self-management of diabetes.[30,44] There was a significant relationship between regular monitoring of blood sugar with good glycaemic control in our study.

Based on the findings of our research, high adherence to self-care behaviors has lower HbA_{1c}. High adherence to following a meal plan and taking medication, following a meal plan and exercising regularly and following a meal plan, taking medication and exercising regularly have significantly lower HbA_{1c} than those with low adherence. This finding agrees with other findings.[12,45] Hence, our studies show that low adherence to following meal plan (OR = 5.27), and low adherence to regular exercise (OR = 2.25) are the independent risk factors for poor glycaemic control.

Our finding shows that complication, hypertriglyceridemia in the population was an independent risk factor (OR = 0.37) for the increased level of HbA_{1c}. Our study also revealed that the extent of glycemic control had a direct effect on TC, TG level among patients. A significantly higher level of TC and TG was found among the poor glycemic control group compared to the good glycaemic control group as similarity with other findings.[46] The deregulation of lipid metabolism among diabetes is supposedly due to affected action of insulin in the key enzymes; further influx of fatty acids from adipose tissue may result in progressive insulin resistance and β-cell dysfunction worsening the condition.[47]

This study remains with some limitations. This time-framed study has a relatively small size and could not establish causality of a cross-sectional study. Large-scale studies are required to establish a risk factor associated with poor glycemic control in the diabetic population.

Conclusion

The HbA_{1c} level was significantly increased with a patient with a lesser extent relationship with a physician, lesser knowledge of diabetes and its complication and low adherence with self-care behavior. The level of HbA_{1c} shows a significant positive correlation with barriers to self-care behavior. The study also shows independent risk factors for poor glycaemic control were low fidelity to following the meal plan, low fidelity to regular exercise, high TG, number of medication (<3) and the lesser patient–physician relationship. Good patient–physician relationship and

proper lifestyle intervention strategies can improve the self-care behavior of patient. Integrated knowledge on diabetes management should be targeted to improve glycaemic control and to reduce co-morbidities in our communities. This study also recommended to conduct an epidemiological population-based study and that can be useful for future planning and policy formation.

Abbreviations

WHO, World Health Organization; T2DM, Type 2 Diabetes Mellitus; HbA_{1c}, Glycated hemoglobin; BMI, Body Mass Index; HTN, Hypertension; CVD, Cardiovascular disease; PVD, Peripheral vascular disease.

Data Sharing Statement

All the data generated during this study are presented in this paper. The primary raw data and questionnaire tool used for this study will be made available to interested researchers by the corresponding author if requested.

Ethics Statement

This research was approved by the Institutional Review Committee of Manmohan Memorial Institute of Health Sciences (IRC MMIHS), Kathmandu, Nepal (letter of approval Ref No: 215/MMIHS/2075). This work was conducted in accordance with the Helsinki Declaration. Informed and written consent was taken from the patients before participating in the study. Data regarding personal information were coded and kept confidential.

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Author Contributions

All authors contributed to the design of the study, data analysis, interpretation of data, drafting or revising the article, gave final approval of the version to be published and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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