Poor Glycemic Control in Type 2 Diabetes Mellitus Patients in Two Tertiary Care Centers during COVID-19 Lockdown: A Descriptive Cross-sectional Study

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ABSTRACT

Introduction: Lockdown enforced to control the rapid transmission of novel coronavirus has resulted in the confinement of people in the home and restrictions of movement. This may have altered the lifestyle and glycemic control of type 2 diabetes mellitus patients. This study aimed to find the prevalence of poor glycemic control in type 2 diabetes mellitus patients in two tertiary care centres during COVID-19 lockdown.

Methods: A descriptive cross-sectional study was conducted among 259 type 2 diabetes mellitus patients in selected hospitals from 1st September to 30th September 2020 after receiving ethical approval from the Departmental Research Unit, Biochemistry under Institutional Review Committee (Reference number: DRU/01/2020). A convenience sampling method was used. Data analysis was done by using Statistical Package for the Social Sciences version 26.0. Point estimate at 95% Confidence Interval was calculated along with frequency and proportion for binary data.

Results: Among 259 patients with type 2 Diabetes Mellitus, 183 (70.65%) (65.10-76.20 at 95% Confidence Interval) had poor glycemic control during the lockdown period. Mean fasting and post-prandial blood glucose among these patients were 164.16±49.30 mg/dl and 246.76±69.86 mg/dl respectively.

Conclusions: Our study depicts that the majority of the type 2 diabetes mellitus patients had poor glycemic control during the lockdown period which was similar when compared to other studies.

Keywords: COVID-19; glycemic control; healthy lifestyle; lockdown; type 2 diabetes.

INTRODUCTION

The Corona Virus disease (COVID-19) was first noticed in Wuhan, China, on 31st December 2019 was declared pandemic on 11th March 2020 by World Health Organization (WHO). With the confirmation of the first case in Nepal on 23rd January 2020, and the alarming rate of increasing COVID-19 patients in neighbouring countries China and India, the Government of Nepal imposed a nationwide lockdown on 24th March 2020.

Although lockdown effectively reduces the incidence and mortality of COVID-19, it has brought in the confinement of people in the home, restrictions of movement, shortage of food and medication supply, an economic burden which may have altered the patients' dietary habits, physical activity, compliance with drugs, a regular visit to doctor and blood glucose monitoring.

This study aimed to find out the prevalence of poor glycemic control in Type 2 Diabetes Mellitus (T2DM) patients from two tertiary care centres of Nepal during the COVID-19 lockdown period.

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METHODS

A descriptive cross-sectional study was conducted on Type 2 DM patients from the out-patient department of Rapti Provincial Hospital, Dang and Mahakali Hospital, Kanchanpur, Nepal from 1st September to 30th September 2020 after obtaining the ethical approval from Departmental Research Unit (DRU), Biochemistry, under Institutional Review Committee (IRC), B.P. Koirala Institute of Health Sciences (Reference number: DRU/01/2020). The convenience sampling method was used to recruit the patients. The sampling frame was prepared by the names and contact numbers of diagnosed patients of T2DM who visited the hospital for follow-up during the study period.

The sample size was calculated by using the formula,

\[ n = \frac{(Z^2 \times p \times q) \times e^2}{e^2} \]

Where,

\[ Z = 1.96 \text{ at 95\% Confidence Interval (CI)} \]
\[ p = \text{prevalence taken as 50\% for maximum sample size} \]
\[ q = 1 - p \]
\[ e = \text{margin of error, 6.5\%} \]

Adding 10\% for non-response rate, the sample size of 253 was calculated. However, we collected data from 259 patients.

Adult patients diagnosed with Type 2 Diabetes Mellitus for at least ten months, under medication, patients with blood glucose reports tested during the study period and who gave consent were included. Suspected or diagnosed COVID-19 cases and patients with mental retardation, patients older than 80 years of age were excluded from the study. The total patients fulfilling the inclusion criteria were interviewed over the telephone after getting informed consent from the study participants.

A well-structured questionnaire was used that contained four sections. Section A contained the Socio-demographic profile of study participants; section B contained the Clinical and nutritional status of study participants; section C contained Global Physical Activity Questionnaire (GPAQ), and section D contained Perceived Dietary Adherence Questionnaire (PDAQ). Dietary adherence was assessed using the validated Perceived Dietary Adherence Questionnaire (PDAQ), a seven-point Likert scale-based tool to measure dietary compliance.\(^5\) It had nine questions with scores ranging from zero to seven. The total score was 63. A score greater than or equal to 75\% of the total score was considered as high adherence, (50-75\%) of the total as medium adherence and less than 50\% of the total as low-adherence. For physical activity, the data was cleaned and analyzed as per GPAQ analysis guidelines.\(^7\)

Total Metabolic Equivalents (METs) values of individuals were calculated in weeks and were converted into MET- minutes per week (MET-min/week). A MET score greater than or equal to 1500 MET min/week was considered as a high level of Physical Activity, (600-1500) MET min/week was considered as moderate and less than 600 MET min/week as low level of Physical Activity.

Patients having fasting plasma glucose less than 130 mg/dl and postrandial plasma glucose less than 180 mg/dl were considered to have controlled blood glucose; else, they were said to have uncontrolled blood glucose.\(^8\)

Data was entered in Microsoft Excel 2016 and analyzed in Statistical Package for the Social Sciences version 26.0. Point estimate at 95\% Confidence Interval was calculated along with frequency and percentage for binary data.

RESULTS

Among 259 patients with Type 2 Diabetes Mellitus, 183 (70.65\%) (65.10-76.20 at 95\% Confidence Interval) had poor glycemic control during the lockdown period. Mean fasting and post-prandial blood glucose among these patients were 164.16±49.30 mg/dl and 246.76±69.86 mg/dl respectively. Both mean fasting and postrandial blood glucose levels were higher in patients aged >55 years and urban population in comparison to patients aged ≤55 years and rural population respectively. Patients diagnosed with T2DM for ≤5 years had higher mean blood glucose levels than those for >5 years (Table 1).

Table 1. Glycemic status and associated variables of patients with poor glycemic control (n= 183).

| Variables | Categories | Blood glucose level (Mean±SD) |
|-----------|------------|-----------------------------|
| Age       | ≤55 years  | 163.95±47.72                |
|           | >55 years  | 164.38±51.26                |
| Sex       | Male       | 164.10±46.85                |
|           | Female     | 164.29±54.64                |
| Duration  | ≤5 years   | 165.36±50.85                |
| of T2DM   | >5 years   | 162.48±47.31                |
| Residence | Rural      | 156.08±44.35                |
|           | Urban      | 169.40±51.78                |
| BMI       | Normal     | 162.92±50.65                |
|           | Overweight | 167.16±48.39                |
|           | Obese      | 157.82±50.65                |

Among 183 T2DM patients with poor glycemic control, 125 (68.31\%) were male, and 58 (31.69\%) were female.
female. The mean age of the patients was 55.56 ± 10.82 years. The majority of them were married 174 (95.08%) and self-employed 72 (39.34%). Patients residing in the urban area were 111 (60.66%). The majority of the study participants 107 (58.47%) had a history of T2DM for ≤5 years and 99 (54.09%) were overweight. The most common comorbidity associated with T2DM was hypertension 50 (27.32%). Most patients took oral hypoglycemic agents 172 (93.99%), followed by oral hypoglycemic agents with insulin 7 (3.82%) (Table 2).

| Characteristics     | Category               | n (%)      |
|---------------------|------------------------|------------|
| Age (in years)      | ≤55                    | 96 (52.46) |
|                     | >55                    | 87 (47.54) |
| Gender              | Male                   | 125 (68.31)|
|                     | Female                 | 58 (31.69)|
| Marital status      | Married                | 174 (95.08)|
|                     | Widow/Divorced         | 9 (4.92)   |
| Occupation          | Government             | 24 (13.11)|
|                     | Employed               | 72 (39.34)|
|                     | Self employed          | 17 (9.29) |
|                     | Retired                | 46 (25.14)|
|                     | Homemaker              | 11 (6.01) |
|                     | Unable to work         | 13 (7.10) |
| Educational status  | Informal education     | 51 (27.87)|
|                     | Primary                | 40 (21.86)|
|                     | Secondary              | 43 (23.49)|
|                     | Higher secondary       | 21 (11.48)|
|                     | Graduate               | 18 (9.84) |
|                     | Post-graduate and above| 10 (5.46) |
| Residence           | Rural                  | 72 (39.34)|
|                     | Urban                  | 111 (60.66)|
| Years of T2DM       | ≤5 years               | 107 (58.47)|
|                     | >5 years               | 76 (41.53)|
| BMI                 | Normal                 | 46 (25.14)|
|                     | Overweight             | 99 (54.09)|
|                     | Obese                  | 38 (20.77)|
| Smoking habit        | Always                 | 10 (5.46)|
|                     | Frequently             | 5 (2.73)|
|                     | Occasional             | 23 (12.57)|
|                     | Used to smoke, later stopped | 27 (14.75)|
|                     | Never                  | 118 (64.48)|
| Drinking habit       | Always                 | 3 (1.64)|
|                     | Frequently             | 5 (2.73)|
|                     | Occasional             | 50 (27.32)|
|                     | Used to drink, later stopped | 26 (14.21)|
|                     | Never                  | 99 (54.09)|

| Comorbidities       | Hypertension (HTN)     | 50 (27.32)|
|                     | Dyslipidemia           | 12 (6.56)|
|                     | HTN + Dyslipidemia     | 15 (8.19)|
|                     | HTN + Others           | 1 (0.55)|
|                     | Others                 | 11 (6.01)|
|                     | None                   | 94 (51.37)|

| Medications Taken   | Oral hypoglycemic agents (OHA) | 172 (93.99)|
|                     | Insulin                | 4 (2.19)|
|                     | OHA + Insulin          | 7 (3.82)|

After considering only high adherence as adherence and medium and low adherence as non-adherence, we found 14 (7.7%) of patients were adherent to diet while most of them, 169 (92.3%) were non-adherent. Out of 183 patients with poor glycemic control, 79 (43.2%) had below the recommended physical activity level (Table 3).

| Description | Categories | n (%) |
|-------------|------------|-------|
| Dietary adherence | High | 14 (7.65) |
|              | Medium     | 118 (64.48) |
|              | Low        | 51 (27.87) |

| Physical activity level | High | 44 (24.04) |
|                        | Moderate | 60 (32.79) |
|                        | Low      | 79 (43.17) |

Positive responses to Perceived Dietary Adherence Questionnaire (PDAQ) were that, in most of the days in a week, patients did not eat foods high in sugar (6.19 ± 1.27), did not eat foods high in fat (5.37 ± 1.95). However, patients rarely ate fish or foods rich in Omega-3 fatty acids (0.76 ± 1.25) (Table 4).

| Questions: In last 7 days | Means±SD (days in last one week) |
|---------------------------|---------------------------------|
| How many days have you followed a healthful eating plan with appropriate serving sizes? | 4.32 ± 1.47 |
| How many days did you eat an adequate number of fruit and vegetable servings? | 4.42 ± 2.08 |
| How many days did you eat carbohydrate-containing foods with a low Glycemic Index? (Example: dried beans, lentils, barley, pasta, low-fat dairy products) | 3.38 ± 2.22 |
| How many days did you eat foods high in sugar, such as cakes, cookies, desserts, candies? | 6.19 ± 1.27 |
Physical activity has benefits in increasing insulin sensitivity and glycemic control in all ranges of the population, from children to older adults, including healthy people, prediabetes, and T2DM patients. During physical activity and for some hours after physical activity, increased skeletal muscle contraction leads to increased glucose uptake via facilitated diffusion through glucose transporter type four (GLUT4) in sarcolemma and T-tubules. This is because of the translocation of GLUT4 vesicles from intracellular sites to the plasma membrane through activation of intracellular signalling pathways brought by exercise. Possible reasons behind poor physical activity level in our study were strict measures imposed during lockdown with restriction of movement including morning walk, the closing of gym centres, yoga centres, and lack of usual office activities.

Disruption of glycemic control also has been reported in other studies. Khader, M, et al. reported glycemic disruption in the Indian population, and the reasons for worsening glycemic control were decreased physical activity, increased food intake, and reduced frequency of clinical visits. However, the type of food intake is more important than the amount of food taken, which was not elucidated in this study. Likewise, during a lockdown, postprandial blood glucose level was significantly increased among T2DM patients in the study reported by Khare, J, et al. in Central India and increased fasting blood glucose among T2DM patients in a study by Biamonte, E, et al. in Italy. In contrast, a case-control study by D'onofrio, L, et al. in Italy showed no significant impact of lockdown on glycemic control.

Many factors might play a role in worsening glycemic control because glycemic control is determined by physical activity level, dietary adherence, frequency of self-monitoring of blood glucose, and medication adherence. Our findings support that the stricter measures applied to contain the coronavirus may adversely affect diabetes care, as depicted by Barone, M, et al. in South and Central American countries.

Most of the previous studies have reported an increase in fasting blood glucose or postprandial blood glucose. Still, it does not explicitly indicate the number of diabetes patients with controlled or uncontrolled blood glucose. Our study demonstrates the glycemic control (controlled as fasting plasma glucose <130 mg/dl and postprandial plasma glucose <180 mg/dl). We have quantified physical activity in MET min/week, including all aspects of daily living; carrying or lifting heavy loads, construction work, walking, running, cycling, playing games according to the standard questionnaire. We also have included the increased or decreased consumption of a specific type of food during lockdown as some foods are beneficial and others are harmful to the T2DM patients.

There are few limitations in our study. We interviewed patients via telephone. It would have been better if we...
had been able to do face-to-face interviews showing them the flashcards with examples of physical activities to be used in the Global Physical Activity Questionnaire (GPAQ). However, as there was fear of contracting COVID-19 infection during the pandemic situation, a telephone interview was the best possible way to make them understand the questionnaire. We accept possible recall bias in this study. We have taken strict targets for glycemic control. However, individual patients may have varying glycemic goals due to their diabetes duration, age, comorbid conditions, cardiovascular disease, microvascular complications, and hypoglycemia unawareness.8

CONCLUSIONS

Our study found that a majority of the study population with T2DM patients had poor glycemic control similar to the studies reported from other countries. There is poor adherence to diet and physical activity during the lockdown period. Also, the findings indicate the need for health care professionals to know the glycemic status in diabetic patients with a major focus on the importance of lifestyle changes and telemedicine services, especially during times like lockdown. Such study should be done in other parts of the country with a larger sample to determine the dietary adherence level and glycemic status in the usual time and lockdown. This might help to reduce the overall morbidity and mortality associated with complications due to poor glycemic control.

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Conflict of Interest: None.

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