İstanbul Med J 2023; 24(4): 375-8
DOI: 10.4274/imj.galenos.2023.25589

Impact of COVID-19 Lockdown on Glycemic Control in Patients with Type 2 Diabetes Mellitus

Fatıma Bahçacı Doğan[1], Mümtaz Takır[2], Özgür Doğan[3], Cundullah Torun[4]

[1] İstanbul Medeniyet University, Göztepe Training and Research Hospital, Clinic of Family Medicine, İstanbul, Turkey
[2] İstanbul Medeniyet University, Göztepe Training and Research Hospital, Clinic of Endocrinology, İstanbul, Turkey
[3]Sultanbeyli State Hospital, Clinic of Internal Medicine, İstanbul, Turkey
[4]İstanbul Medeniyet University, Göztepe Training and Research Hospital, Clinic of Internal Medicine, İstanbul, Turkey

ABSTRACT

Introduction: The coronavirus disease-2019 (COVID-19) pandemic resulted in social distancing measures. In this study, we investigated the impact of these measures on glycemic control in patients with type 2 diabetes mellitus.

Methods: This retrospective observational study was conducted at our hospital's obesity and diabetes clinic, involving patients who were regularly followed up. Data from two time points were retrieved from patient files: visit 1, which occurred within the three months before the lockdown, and visit 2, which occurred within the first two months following the lockdown. Exclusion criteria included pregnancy or breastfeeding, malignancy, start of medications influencing weight and body fat distribution, and non-compliance with regular follow-up appointments after lockdown. Anthropometric measurements and blood tests, including fasting glucose, lipid profile, and hemoglobin A1C (HbA1C) values, were compared between visits 1 and 2. The values of variables at visits 1 and 2 were compared using the Wilcoxon test.

Results: The study included 200 patients, with a mean age of 55.2±10 years, and a mean body mass index of 35.3±6.2 kg/m^2, with a female predominance (77.5%). Before the lockdown, the patients had a mean body weight of 91.4±16.0 kg, which increased to 93.1±16.3 kg after the lockdown ($p<0.001$). Blood examinations revealed a significant increase in mean fasting blood glucose levels, from 136±43.1 mg/dL to 148.0±53.6 mg/dL ($p=0.003$), as well as an increase in mean HbA1C levels from 7.2±1.4 to 7.9±1.7 ($p<0.001$).

Conclusion: During the lockdown period, patients with diabetes experienced weight gain and deterioration in diabetes regulation.

Keywords: Social distancing, lifestyle changes, glycemic control

Introduction

The coronavirus disease-2019 (COVID-19) pandemic, which is caused by the severe acute respiratory syndrome-coronavirus-2, originated in late 2019 in the People's Republic of China (1). Within a matter of weeks, COVID-19 swiftly spread to nearly all nations, prompting the World Health Organization to classify it as a pandemic. Diabetes mellitus (DM), another global pandemic, is an important public health problem worldwide, with its increasing prevalence at the beginning of the 21st-century. The data in our country show that the number of patients with diabetes has doubled in ten years, and the prevalence of diabetes in adults reached a critical level of 13.4% in 2010 (2). The coexistence of these two pandemics results in a poor prognosis in these patients (3).

One of the measures taken worldwide during the pandemic is social distancing, which includes maintaining a safe distance from others, avoiding large gatherings, and limiting physical contact. This has resulted in the interruption of the daily routines of the populace. In a prospective cohort study involving 1,565 Dutch patients with cardiovascular disease, a significant decrease in the amount of time spent exercising was observed, whereas sedentary time increased during the lockdown period (4). According to a recent study conducted by Elliot et al. (5), the percentage of people meeting the recommended levels of physical activity decreased during the lockdown period, dropping from 43% to 33%. In a cross-sectional study conducted in the adult population of Israel during COVID-19 measures, it was found that 70% of Israelis reduced their training compared with their usual routine (6).

Address for Correspondence: Cundullah Torun MD, İstanbul Medeniyet University, Göztepe Training and Research Hospital, Clinic of Internal Medicine, İstanbul, Turkey
Phone: +90 549 794 99 93 **E-mail:** cundullaht@gmail.com **ORCID ID:** orcid.org/0000-0003-4933-7635

Received: 12.09.2023
Accepted: 30.10.2023

Cite this article as: Bahçacı Doğan F, Takır M, Doğan Ö, Torun C. Impact of COVID-19 Lockdown on Glycemic Control in Patients with Type 2 Diabetes Mellitus. İstanbul Med J 2023; 24(4): 375-8.

In our nation, from March 2020 until June 2021, a series of social distancing measures, including lockdowns, were implemented to mitigate the transmission of COVID-19. The objective of this study was to assess the effect of the lockdown period on the management of glycemic control in patients with type 2 DM.

Methods

Study Population

This retrospective, cross-sectional study was conducted at a single center in accordance with the principles of the Declaration of Helsinki. Approval for the study was obtained from the İstanbul Medeniyet University, Göztepe Training and Research Hospital Clinical Research Ethics Committee (approval number: 2021/0374, date: 30.06.2021).

The records of patients with type 2 DM who were under regular follow-up at our hospital's obesity and diabetes outpatient clinic and who visited the clinic within the three months before the onset of the lockdown (visit 1) and within the two months following the beginning of the return to normalcy (visit 2) were retrospectively reviewed. The inclusion criteria comprised individuals who were 18 years of age or older and possessed comprehensive records of antidiabetic medication usage, anthropometric measurements, blood glucose levels, and HbA1C levels at both visits 1 and 2. Exclusion criteria included pregnancy or breastfeeding, diagnosis of malignancy, initiation of drugs affecting weight and body fat distribution (such as glucocorticoids), presence of critical illness that may impact nutritional status, and failure to attend regular follow-up after the lockdown. Eligible patients were consecutively included in the study.

Clinical Assessment

Patient data, including age, gender, height, body weight, treatment status, and results of full blood count and biochemical tests, were collected from the medical records of the obesity and diabetes clinic and the hospital's electronic information system (Nucleus®).

Height and weight measurements were obtained using an height scale and automatic weight machine, and the body mass index (BMI) was calculated.

Laboratory examinations were conducted after an overnight fast of 8-12 hours, including fasting plasma glucose, HbA1C, triglycerides, and high-density lipoprotein cholesterol (HDL-C) and low-density lipoprotein cholesterol (LDL-C). Complete blood counts were performed using venous blood samples on a Mindray BC-6800 (Mindray BioMedical Electronics Co., Ltd., Shenzhen, China) device. Thyroid function tests were performed using the Roche Cobas e801 (Roche Diagnostics, Basel, Switzerland) module.

Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) was calculated using the following equation: glucose (mg/dL) x insulin (mU/L)/405.

Statistical Analysis

Descriptive statistics, including mean, standard deviation, number, and percentage frequencies, were used to summarize the characteristics of the study participants. The normality of the continuous variables was assessed using the Kolmogorov-Smirnov test. For the assessment of differences between dependent variables, the Wilcoxon signed-rank test was used. Statistical analysis was conducted using IBM SPSS Statistics 18 software. The significance level was set at 0.05 for all analyses.

Results

Of the 200 patients included in the study, 45 (22.5%) were male and 155 (77.5%) were female. The mean age of the patients was 55.2±10 years. The mean height of the patients was 161.1±8.3 cm, mean weight was 91.4±16.0 kg, and mean BMI was 35.3±6.2. Table 1 presents the demographic data and clinical characteristics of the patients. Among the participants, 78 (39%) had a history of hypertension, 57 (28.5%) had hyperlipidemia, 25 (12.5%) had hypothyroidism, and 4 (2%) had coronary artery disease.

During the lockdown (between visit 1 and 2), laboratory examinations indicated a significant increase in the mean fasting glucose levels from 136±43.1 mg/dL to 148.0±53.6 mg/dL (p=0.003). The HbA1C levels of the patients also showed a significant increase from 7.2±1.3 to 7.9±1.7 (p<0.001). Other parameters associated with metabolic syndrome were examined, revealing that the mean triglyceride level increased from 176±153 mg/dL to 190±133 mg/dL (p=0.001). No significant changes were observed in HOMA-IR and HDL cholesterol levels (p=0.171 and 0.889, respectively). Additional laboratory findings are presented in Table 2. The mean weight of the patients increased from 91.4±16.0 kg to 93.1±16.3 kg (p<0.001), leading to a significant increase in the mean BMI (p<0.001). Table 2 presents a comparison of patients' anthropometric measurements between visits 1 and 2.

Table 1. Demographic data and clinical characteristics of patients during visit 1

Age, year (mean ± SD)	55±10
Gender, n (%)	
Female	155 (77.5)
Male	45 (22.5)
Height, cm (mean ± SD)	161.1±8.3
Weight, kg (mean ± SD)	91.4±16.0
BMI, kg/m² (mean ± SD)	35.3±6.2
Body mass index group, kg/m², n (%)	
20-24.9	8 (4.0)
25-29.9	35 (17.5)
30-34.9	54 (27.0)
35-44.9	87 (43.5)
45-49.9	12 (6.0)
50 and above	4 (2.0)
Hypertension, n (%)	78 (39)
Hyperlipidemia, n (%)	57 (28.5)
Hypotiroid, n (%)	25 (12.5)
Coronery artery disease, n (%)	4 (2.0)

SD: Standart deviation, BMI: Body mass index

Table 2. Changes in laboratory and anthropometric values of patients between visit 1 and visit 2

	Visit 1, (mean ± SD)	Visit 2, (mean ± SD)	p-value
Glucose (mg/dL)	136.3±43.1	148.0±53.6	0.003
HbA1C (mmol/mol)	7.2±1.3	7.9±1.7	<0.001
Insulin (mU/L)	16.1±18.6	12.5±10.2	0.043
HOMA-IR	5.5±7	4.6±3.9	0.171
Creatinine (mg/dL)	0.8±0.2	0.8±0.2	<0.001
ALT (U/L)	24±18	23±18	0.184
AST (U/L)	20±10	20±10	0.606
Total cholesterol (mg/dL)	198±46	188±43	0.002
Triglyceride (mg/dL)	176±153	190±133	0.001
LDL cholesterol (mg/dL)	114±37	101±35	<0.001
HDL cholesterol (mg/dL)	50±13	50±13	0.889
TSH (mIU/L)	2±2.08	2.4±2.2	<0.001
T4 (ng/dL)	1.0±0.2	1.2±0.2	<0.001
Hemoglobin (g/dL)	13.3±1.5	13.4±1.6	0.596
Weight (kg)	91.4±16.0	93.1±16.3	<0.001
BMI (kg/m^2)	35.3±6.2	38.5±6.3	<0.001

SD: Standart deviation, HbA1C: Hemoglobin A1C, HOMA-IR: Homeostatic Model Assessment for Insulin Resistance, ALT: Alanine aminotransferase, AST: Aspartate aminotransferase, LDL: Low density lipoprotein, HDL: High density lipoprotein, TSH: Thyroid-stimulating hormone, BMI: Body mass index

Discussion

Our study revealed significant increases in patients' body weight, fasting blood glucose, HbA1C, and triglyceride levels during the post-lockdown examination compared with the pre-lockdown findings.

To mitigate the transmission of the COVID-19 infection, social distancing measures were implemented in our country and worldwide during the pandemic. Previous studies have investigated the influence of these measures, including lockdown, on changes in weight, which are of significant importance for cardiometabolic diseases. A population-based study involving 3,473 American adults revealed that 48% of participants reported weight gain one year after the pandemic, with a higher tendency for weight gain among those who were already overweight before the pandemic (7). Our study aligns with these findings because, we observed a significant increase in weight during the lockdown period. A recent meta-analysis, which evaluated data from 36 studies, also revealed a prevailing tendency for weight gain during lockdown (8).

Studies investigating changes in metabolic parameters and anthropometric measurements during the pandemic period suggest that the increase in body weight during this period is associated with sudden lifestyle changes. A study conducted in Spain demonstrated that type 2 diabetes patients experienced physical inactivity during house arrest (9). According to a survey study on house arrest during the pandemic period, daily sitting time increased from 5 to 8 h and eating quality worsened (10). Although our study did not specifically examine patients' lifestyle changes, we excluded other factors such as medications and inflammatory processes that could contribute to weight change.

In our study, we found significant increases in patients' fasting blood glucose, triglyceride, and HbA1C levels. Numerous studies investigating the course of diabetes during the pandemic have also reported impaired metabolic parameters. In a study, Karataş et al. (11) evaluated the impact of COVID-19 on patients with diabetes and healthy individuals. They found weight gain in both groups, impaired glucose metabolism, and increased triglyceride levels in patients with diabetes (11). The recently conducted meta-analysis demonstrated a significant increase ($p<0.05$) in HbA1C levels, fasting glucose, and BMI among patients with type 2 diabetes during the COVID-19 lockdown, which is consistent with our findings. Interestingly, they also found that total cholesterol, triglyceride, and LDL cholesterol levels were lower than those in the pre-lockdown period. Similarly, in our study, we observed a significant decrease in LDL cholesterol and total cholesterol, which could be attributed to improved adherence to statin medication during the pandemic period (12).

The management of chronic illnesses was interrupted during the pandemic period (13,14). In their study, Khader et al. (15) demonstrated that the disruption in diabetes care during the lockdown has contributed to the decline in glycemic control among patients with diabetes. However, in our country, the fact that medications could be obtained from pharmacies without the need for a prescription during the lockdown period and the examination of post-lockdown medical records revealed no decrease in medication adherence among patients, challenges the assumption that healthcare access difficulties are the primary cause. In a study with type 2 diabetes, significant improvement in medication adherence was observed during the lockdown period (16). A review by Eberle et al. (17), which investigated the effect of COVID-19 quarantine on glycemic control in patients with diabetes, observed significant improvement in glycemic values among individuals with type 1 diabetes during the quarantine period, attributed to compliance with insulin treatment and scheduled meals. Taking into account these combined findings, we are inclined to believe that the decline in glycemic control during this period is primarily a result of sudden lifestyle changes.

Study Limitations

The strength of our study lies in the detailed examination and exclusion of other factors that could contribute to weight changes and deterioration of glycemic control, apart from lifestyle changes. However, there are some limitations to our study. First, since it was conducted in a single diabetes center with a homogeneous population, the findings may not be applicable to different populations. Second, we did not have information regarding whether patients continued their active work life during the lockdown, engaged in exercise, or had any dietary habits. Therefore, our study did not specifically investigate which lifestyle changes were more closely associated with a deterioration in glycemic control, such as alterations in diet quality, adherence to dietary recommendations, meal timings, frequency of snacking, consumption of ready-made meals, frequency of ordering food from external sources, fruit consumption, alcohol consumption, exercise duration and frequency, and the duration of time spent at home. Finally, upon reviewing the patient files during post-lockdown visits, although all patients indicated that they obtained their medications from the pharmacy during the lockdown period, we do not have any data to confirm whether they consistently used their medications.

Conclusion

Our findings indicate that during the lockdown period implemented because of the COVID-19 pandemic, there was a tendency for diabetes patients to gain weight and experience deterioration in glycemic control. The reason behind this is the sudden lifestyle changes resulting from the restrictions, and these results confirm the role of lifestyle recommendations in disease management for patients with diabetes.

Ethics Committee Approval: Approval for the study was obtained from the İstanbul Medeniyet University, Göztepe Training and Research Hospital Clinical Research Ethics Committee (approval number: 2021/0374, date: 30.06.2021).

Informed Consent: Retrospective study.

Peer-review: Internally peer-reviewed.

Authorship Contributions: Surgical and Medical Practices - F.B.D., M.T., Ö.D.; Concept - F.B.D., M.T., C.T.; Design - F.B.D., M.T., Ö.D.; Data Collection or Processing - F.B.D., M.T., Ö.D., C.T.; Analysis or Interpretation - F.B.D., M.T., Ö.D., C.T.; Literature Search - F.B.D., M.T., Ö.D., C.T.; Writing - F.B.D., C.T.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Sharma A, Ahmad Farouk I, Lal SK. COVID-19: A Review on the Novel Coronavirus Disease Evolution, Transmission, Detection, Control and Prevention. Viruses 2021; 13: 202.
2. Satman I, Omer B, Tutuncu Y, Kalaca S, Gedik S, Dinccag N, et al. Twelve-year trends in the prevalence and risk factors of diabetes and prediabetes in Turkish adults. Eur J Epidemiol 2013; 28: 169-80.
3. Maddaloni E, Buzzetti R. Covid-19 and diabetes mellitus: unveiling the interaction of two pandemics. Diabetes Metab Res Rev 2020; 36: e33213321.
4. van Bakel BMA, Bakker EA, de Vries F, Thijssen DHJ, Eijsvogels TMH. Impact of COVID-19 lockdown on physical activity and sedentary behaviour in Dutch cardiovascular disease patients. Neth Heart J 2021; 29: 273-9.
5. Elliott J, Munford L, Ahmed S, Littlewood A, Todd C. The impact of COVID-19 lockdowns on physical activity amongst older adults: evidence from longitudinal data in the UK. BMC Public Health 2022; 22: 1802.
6. Dor-Haim H, Katzburg S, Revach P, Levine H, Barak S. The impact of COVID-19 lockdown on physical activity and weight gain among active adult population in Israel: a cross-sectional study. BMC Public Health 2021; 21: 1521.
7. Khubchandani J, Price JH, Sharma S, Wiblishauser MJ, Webb FJ. COVID-19 pandemic and weight gain in American adults: A nationwide population-based study. Diabetes Metab Syndr 2022; 16: 102392.
8. Bakaloudi DR, Barazzoni R, Bischoff SC, Breda J, Wickramasinghe K, Chourdakis M. Impact of the first COVID-19 lockdown on body weight: A combined systematic review and a meta-analysis. Clin Nutr 2022; 41: 3046-54.
9. Ruiz-Roso MB, Knott-Torcal C, Matilla-Escalante DC, Garcimartín A, Sampedro-Nuñez MA, Dávalos A, et al. COVID-19 Lockdown and Changes of the Dietary Pattern and Physical Activity Habits in a Cohort of Patients with Type 2 Diabetes Mellitus. Nutrients 2020; 12: 2327.
10. Ammar A, Brach M, Trabelsi K, Chtourou H, Boukhris O, Masmoudi L, et al. Ammar A, Brach M, Trabelsi K, Chtourou H, Boukhris O, Masmoudi L, et al. Effects of COVID-19 Home Confinement on Eating Behaviour and Physical Activity: Results of the ECLB-COVID19 International Online Survey. Nutrients 2020; 12: 1583.
11. Karatas S, Yesim T, Beysel S. Impact of lockdown COVID-19 on metabolic control in type 2 diabetes mellitus and healthy people. Prim Care Diabetes 2021;15: 424-7.
12. Ojo O, Wang XH, Ojo OO, Orjih E, Pavithran N, Adegboye ARA, et al. The Effects of COVID-19 Lockdown on Glycaemic Control and Lipid Profile in Patients with Type 2 Diabetes: A Systematic Review and Meta-Analysis. Int J Environ Res Public Health 2022; 19: 1095.
13. Coma E, Mora N, Méndez L, Benítez M, Hermosilla E, Fàbregas M, et al. Primary care in the time of COVID-19: monitoring the effect of the pandemic and the lockdown measures on 34 quality of care indicators calculated for 288 primary care practices covering about 6 million people in Catalonia. BMC Fam Pract 2020; 21: 208.
14. Chudasama YV, Gillies CL, Zaccardi F, Coles B, Davies MJ, Seidu S, et al. Impact of COVID-19 on routine care for chronic diseases: A global survey of views from healthcare professionals. Diabetes Metab Syndr 2020; 14: 965-7.
15. Khader MA, Jabeen T, Namoju R. A cross sectional study reveals severe disruption in glycemic control in people with diabetes during and after lockdown in India. Diabetes Metab Syndr 2020; 14: 1579-84.
16. Verma M, Sharma P, Chaudhari A, Sharma M, Kalra S. Effect of Lockdown on Diabetes Care During the COVID-19 Pandemic: Result of a Telephone-Based Survey Among Patients Attending a Diabetic Clinic in Northern India. Cureus 2021; 13: e18489.
17. Eberle C, Stichling S. Impact of COVID-19 lockdown on glycemic control in patients with type 1 and type 2 diabetes mellitus: a systematic review. Diabetol Metab Syndr 2021; 13: 95.