Impact of the Covid-19 Pandemic on Blood Glucose Management in Diabetes Mellitus Patients

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ABSTRACT

The COVID-19 pandemic increases the risk of mortality and morbidity in patients with diabetes mellitus. This is due to the implementation of social restriction policies that can change patterns of physical activity, food consumption, psychological pressure, and medical history which will affect blood glucose management compliance in patients with DM. The purpose of this study was to determine the impact of the COVID-19 pandemic on blood glucose management in patients with DM. This study was literature review by searching four databases (Pubmed, Science direct, Microsoft Academic, and Wiley) for searches of past research on the same theme published in 2020-2021. The prism checklist is used as a protocol and evaluation, and critical appraisal is used to test the feasibility of the study results to be used. 12 articles were found that met the inclusion criteria. The results of the study consisted of case control, cohort, and cross sectional research with the total number of participants from 12 studies of 3,131 respondents. Things that affect the improvement of blood glucose management during the pandemic are the use of CGM, telemedicine, and improving the quality of life. While the things that affect the decrease in blood glucose management during the pandemic are the increase in psychological pressure, difficulty accessing health services, not monitoring blood glucose, as well as a decrease in physical activity and dietary compliance. The COVID-19 pandemic can affect improving blood glucose management and decreasing blood glucose management in patients with DM.

Keywords: *Covid-19, blood glucose, diabetes mellitus*

INTRODUCTION

DM (Diabetes Mellitus) is often referred to as the silent killer because people who suffer from DM can affect the performance of all organs of the body and cause various complaints, such as visual disturbances, heart disease, kidney disorders, impotence, gangrene wounds, lung infections, blood vessel disorders, strokes, and others (Fatimah, 2015). Improving the quality of life of DM patients is needed so that the activities and lives of people with diabetes can still be carried out without being disturbed. Perform blood glucose control, behavior change with education, eating arrangements, physical activity, and adherence to medication. With proper management and control, it is expected to minimize the occurrence of complications in DM patients (Ramadhan et al., 2018).

The new threat of increased morbidity and mortality of DM patients has been seen since the emergence of a new virus called The Novel Corona Virus Disease (COVID-19), where people who have a history of DM with uncontrolled blood glucose and are exposed to COVID-19 are more susceptible to worsening the disease (Zhu et al., 2020). Blood glucose management of DM patients is estimated to be disrupted due to the current pandemic conditions around the world. Policies such as social restrictions and lockdowns will of course change almost all of the activities and habits of the community, including people with DM. These changes can allude to various aspects related to blood glucose management, ranging from changes in food intake, physical activity, mental, economic, and others.

How does the COVID-19 pandemic affect blood glucose management in DM patients? This literature summary aims to identify how much influence the COVID-19 pandemic has on the blood glucose management of DM patients, so that it can be seen how the attitudes and readiness of the patients in carrying out blood glucose management so that unwanted acute and chronic complications can be prevented or minimized.

MATERIAL AND METHODS

This literature review was a scientific paper compiled through an integrated analysis of various journal articles according to the specified theme. The search for literature references was

carried out from March to April 2021. The data and information contained in this study were not the result of direct observation, but secondary data obtained from the results of research by previous researchers. The secondary data sources used were taken from national and international journal articles according to the theme "Impact of the COVID-19 Pandemic on Blood Glucose Management in Diabetes Mellitus Patients". Search literature references using databases with high quality criteria, namely Science Direct and Pubmed. As well as two other databases with moderate reputation, namely Wiley and Microsoft Academic. The prism checklist was used as a protocol and evaluation in determining study selection.

The search for journal articles related to the theme is carried out using keywords and Boolean operators (AND, OR, or AND NOT) in order to deepen and specify the search in determining the journal articles to be used. The strategy used in the literature search is using the PICOS framework.

Based on the results of a literature search through publications in the database and using keywords that have been adjusted to MeSH, the researchers found 188 articles from the four databases used. The reference results obtained were then checked for duplication, and found the same 6 journal articles so that they were excluded and the remaining 182 articles. Then, the title (n = 182), abstract (n = 73) and full text (n = 12) screening were carried out according to the topic of the literature review. Then, an assessment is carried out based on the feasibility of the inclusion and exclusion criteria, in order to obtain 12 articles that will be used.

The results of the assessment of the quality of the study are carried out based on critical appraisal. Then an analysis of the methodological quality was carried out in each study (n = 12). The assessment criteria are given a score of 'yes', 'no', 'not clear' or 'not applicable', where each criterion with a value of 'yes' is given a score of one point, while other values are given a score of zero, and the final results are summed. If the research score is above 50%, it means that it meets the critical appraisal criteria. At the last screening, there were twelve articles that met a score of more than 50% and were ready for data synthesis so that the articles used in this literature review totaled 12 articles.

RESULTS AND DISCUSSION

The results of the search for studies that passed the inclusion criteria, used a cross-sectional, cohort and case control study design. Overall, each study discusses how the COVID-19 pandemic affects blood glucose management in patients with diabetes mellitus. Studies according to this systematic review were conducted from various countries, including Spain, Italy, Turkey, China, India, United Kingdom and Saudi Arabia. Among the 12 studies used, 7 studies explained that the COVID-19 pandemic worsened blood glucose management in DM patients, and 5 other studies explained that DM patients' blood glucose management improved during the COVID-19 pandemic.

The total number of respondents from the 12 literature search results is 3,131 respondents, with the majority of respondents being 1,255 individuals. Respondents in this study were patients with type 1 DM and type 2 DM. The gender characteristics of the respondents in each article were mostly male. The age characteristics of the respondents in the research articles varied, ranging from children, adolescents, adults, and the elderly. All respondents are indigenous people from the research location.

Table 1. Literature Search Result

Authors and years	Study design, Sample, Variable, Instrument, Analysis	Outcome of Analysis	Summary of Results
(Mesa et al., 2020)	Design : Case control study Sample : 92 patient with T1DM Variable : Patient with Type 1 Diabetes Treated with injection insulin Instrument : Glucose monitoring data between two periods, pre-COVID-19 lockdown and within the COVID-19 lockdown Analysis : Chi Square	Glucose control did not deteriorate due to COVID-19 and increased in adolescents who did physical activity	Slowing down routine daily activities can have beneficial in general population with T1DM
(Aragona et al., 2020)	Design : Case control study Sample : 63 patient with T1DM Variable : Patient whom used Flash Glucose Monitoring (FGM) and Continuous Glucose Monitoring (CGM) system Instrument : Average glucose, Glucose management indicator, Glucose variability Analysis : Chi Square	The lockdown had no negative impact in glycemic control T1DM patients	T1DM patients well-educated on diabetes management used FGM or CGM can effectively manage their glycemic control even pandemic
(Predieri et al., 2020)	Design : Case control study Sample : 62 children and adolescent with T1DM Variable : Patient with T1DM using the real-time CGM (Continuous Glucose Monitoring) system Instrument : anthropometry, Glycemic control, and insulin therapy Analysis : Chi Square	Glycemic control improve during lockdown in children and adolescents with T1DM	Telemedicine and the real time CGM system together with the remote control access allowed us to report a large number data on glycemic control
(Önmez et al., 2020)	Design : Case control study Sample : 101 T2DM patients Variable : T2DM patients unable to attend follow-ups due to the lockdown Instrument : Demographic data, anthropometric measurements, dietary and exercise habits, anti-diabetic treatments, blood sugar measurement, frequencies of acute diabetic complication, and fasting glucose, postprandial glucose, HbA1c. Analysis : Chi-square	During the pandemic, the glycemic parameters of T2DM patient deteriorated.	In addition to control of glycemic parameters, patients also need to be supported emotionally, mentally, and in terms of social and physical functions
(Tao et al., 2020)	Design : Cross-sectional study Sample : 1159 patients with T2DM and 96 patients with T1DM Variable : patient who discharged from the endocrinology department of a hospital from January 2019 to January 2020. Instrument : Socio demographic variables, health risk variables, and adherence to self-management behaviors. Analysis : Chi-square	Glycemic control among patients with T1DM and T2DM during home quarantine amid the COVID-19 pandemic is poor.	More education, a higher frequency of SMBG, and improved medication compliance may contribute to glycemic control.
(Verma et al., 2020)	Design : Cross-sectional study Sample : 52 patients with T1DM Variable : T1DM patients were telephonically called at the end of lockdown period and asked to report within 15 days Instrument : Data regarding hypoglycemic and hyperglycemic episodes, diabetic ketoacidosis, insulin dose missed, regular glucose monitoring, dietary compliance Analysis : Chi-square	Glycemic control on T1DM patients has deteriorated during lockdown period.	The factors responsible such as non availability of insulin/ glucose trips, poor dietary compliance and decreased physical activity need to be taken into consideration in the future pandemic

(Wu et al., 2021)	Design : Cohort Study Sample : 43 children with T1DM Variable : Children with T1DM using continuous glucose management (CGM) Instrument : Demographic data and medical history from dataset of the T1DM China Registry Study Analysis : Chi-square	Glycemic control did not deteriorate in children and teenagers with T1DM around the COVID-19 pandemic	Better control at baseline were more likely to achieve amelioration in hypoglycemia. More stable and slowed down rhythm might lead to better glycemic control, but lifestyle changes cloud not provide a long-term effect.
(Navis et al., 2021)	Design : Case control study Sample : 269 patients with T1DM Variable : Patients were identified Freestyle Libre (FSL) or Dexcom G6 sensor users Instrument : Sensor data from Libreview and Dexcom clarity following periods pre-lockdown, early lockdown, and mid-lockdown Analysis : Chi-square	Glycemic control in patients with T1DM improved during the pandemic	Blood glucose control during the lockdown period is improved in people with diabetes equipped with sensor glucose
(Khare & Jindal, 2021)	Design : Cohort study Sample : 307 patient with diabetes Variable : Patient who had attended the endocrine OPD before lockdown due to COVID-19 and had HbA1c reporting in recent past Instrument : Questionnaire Analysis : Chi-square	Glycemic control got deranged during lockdown period	Significant increase of mean HbA1c in immediate post lockdown period which may significantly increase the annual incidence of complications relates to diabetes
(Khare & jindal, 2020)	Design : Cohort study Sample : 143 patient with T2DM Variable : Patients who had attended endocrine OPD in the last 3 months and had good glycemic control in the past without any chronic complications Instrument : Questionnaire Analysis : Chi-square	Glycemic control got deranged during the 3-week lockdown period	Lifestyle changes, psychological stress, difficulty in getting medication and medical advice were identified as possible factors for derangement of glycemic control
(Olickal et al., 2020)	Design : Cross-sectional study Sample : 350 PWD Variable : Registered for care at diabetes clinic of a tertiary care center Instrument : Telephonic interviews : physician consultations, access to diabetes medications and blood sugar test, use of telemedicine services, out of pocket expenditure and psychological morbidity Analysis : Chi-square	Majority of PWDs (People With Diabetes) had a poor glycemic control during lockdown period and most of them did not consult a physician	The awareness about telemedicine services very low and Out Of Pocket Expenditures (OOPE) on diabetes care was very high
(Alshareef et al., 2020)	Design : Cross-sectional study Sample : 394 participant Variable : Patient who had attended National Guard primary care center Instrument : Survey included question on demographic data, type of diabetes, medication used, comorbidities, medication compliance, and daily habits before and after the lockdown Analysis : Chi-square	The patient's levels of compliance with medications and healthy lifestyle habits were significantly reduced after the lockdown	Health-care need to encourage diabetes patients to adhere to healthy lifestyle habit and use telemedicine during the lockdown in order to ensure optimal blood glucose control

The COVID-19 Pandemic Increased Blood Glucose Management

a. Use CGM (Continuous Glucose Monitoring)

In the strict lockdown conditions imposed during the COVID-19 pandemic, type 1 DM patients who have a history of being prone to hypoglycemia and using CGM technology have managed to control glycemic well. (Predieri et al., 2020). CGM technology is considered to be able to help prevent the occurrence of hypoglycemia in clients because CGM has a feature that allows patients to receive an alarm in the form of a signal that will warn the patient if blood glucose levels increase or decrease below normal levels, which are adjusted based on the settings prepared by the health care provider (Lin et al., 2020). When patients use CGM technology, health workers can easily access and find out data on fluctuations in the patient's glucose levels. Patients who receive a signal that blood glucose begins to fall below the normal range can immediately initiate self-prevention of hypoglycemia.

b. Use telemedicine

The COVID-19 pandemic has become the reason for the widespread use of telemedicine technology for DM patients who have high risk, especially in patients with type 1 DM. (Aragona et al., 2020). Patients and health workers who use telemedicine can streamline services in monitoring, evaluation, and education. Using telemedicine will help patients who find it difficult to come to health services so that they can report their symptoms and can receive advice and direction regarding their illness (Lubis, 2021). DM sufferers who experience limited access during the lockdown period can easily get consultation and advice from medical personnel. Insulin doses, complaints and disease progression, prevention of complications, especially in type 1 DM patients who are very susceptible to hypoglycemia should be monitored regularly, and telemedicine is the most appropriate and safe option during the COVID-19 pandemic.

c. Improved quality of life

Type 1 DM patients at the beginning of the lockdown have more time to focus on timing insulin injections and food composition (Navis et al., 2021). Based on the results of the study, people are more likely to adopt a healthy diet during the COVID-19 pandemic. People are encouraged to improve their diet, such as eating a complete composition, increasing consumption of fruits and vegetables, meeting fluid needs, limiting consumption of fat, sugar, and salt, and improving food hygiene. (Afifah, dictation in Tampatty et al., 2020). During the COVID-19 pandemic, this can be maximized by taking advantage of the lockdown and social restrictions policies because more and more time is available for self-management and DM management.

The COVID-19 Pandemic Decreased Blood Glucose Management

a. Increased psychological stress

Most type 2 DM patients reported increased psychological stress and decreased sleep quality during the COVID-19 pandemic (khare & jindal, 2020). The COVID-19 pandemic period can affect the psychological condition of various scopes, including the academic scope for students who experience learning limitations, the work scope for people who have lost income, and the family scope created by the aggregation of academic and work pressures. (Muslim, 2020). The entire community has directly experienced the impact of the COVID-19 pandemic, which includes feeling limited in their activities, decreasing economic turnover, workers' concerns about layoffs and online learning models that make students feel bored and bored. This leads to an increase in psychological stress and leads to a decrease in blood glucose management.

b. Difficulty accessing health service

Type 2 DM patients in India find it difficult to participate in online-based alternative health care programs (Olickal et al., 2020). Health services for patients with chronic diseases such as DM during the COVID-19 pandemic must find alternative methods so that acute worsening and complications that can threaten life do not occur. (WHO, 2020). Alternative health services that are considered the most appropriate in a crisis situation like this are telemedicine technology and the use of health applications. However, there can be several obstacles such as internet network difficulties for patients in rural areas, not having a smartphone in underprivileged patients, and the inability to operate a smartphone which often occurs in elderly DM patients. This can prevent DM patients from getting health consultations during the COVID-19 pandemic.

c. Not monitoring blood glucose

The main reason for type 2 DM patients in India not to monitor blood glucose levels is the unavailability of glucose strips during the COVID-19 pandemic (Verma et al., 2020). In the early phases of the lockdown, the supply of medicines was continuously affected. Transportation of supplies for insulin and glucose strips is constrained, making it difficult to ensure a sustainable supply of pharmacotherapy (Tao et al., 2020). The unavailability of glucose strips prevents DM patients from checking their blood glucose levels. Whereas DM patients are recommended to routinely check blood glucose levels even though there are no symptoms of hypoglycemia or hyperglycemia. By routinely checking blood glucose, patients can adjust the dose of oral glycemic drugs and insulin doses to be used.

d. Decreased physical activity and dietary compliance

The results of the study on type 2 DM patients in Turkey showed an increase in body weight during the lockdown period (Önmez et al., 2020). There was a change in eating patterns during the COVID-19 pandemic caused by the increase in food portions, the frequency of snacks, the frequency of cooking at home, as well as the frequency of vegetables and fruit. (Noviasty & Susanti, 2020). During the COVID-19 pandemic, people experienced an increase in the desire for carbohydrate-rich snacks because they were influenced by psychological pressure while staying at home. In addition, feeling bored from spending hours at home during quarantine has resulted in a drastic increase in the frequency of eating. This is exacerbated by the decrease in physical activity during the pandemic so that weight gain and the diet pattern of DM patients become messy.

CONCLUSIONS

The COVID-19 pandemic has both positive and negative effects on blood glucose management in DM patients. Things that affect the improvement of blood glucose management in DM patients include the use of CGM technology, the use of telemedicine, and improving the quality of life. While the things that affect the decrease in blood glucose management in DM patients include psychological pressure, patient difficulties in accessing health services, not monitoring blood glucose, decreased physical activity, and failure to maintain a diet pattern. DM patients should be given comprehensive education to improve proper blood glucose management during the COVID-19 pandemic. Further research is needed to assess the readiness of DM patients in preparing for blood glucose control in a state of social restriction so that the decrease in blood glucose management and the increased risk of morbidity and mortality of DM patients can be prevented.

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