Natural Resources for Human Health
eISSN: 2583-1194

Original Research

Received 24 July 2026
Revised 28 Aug 2026
Accepted 12 Sep 2026

Natural Resources for Human Health 2026, Vol. 6 (22s): 368–376

KEYWORDS:
COVID-19, diabetes, vaccine, pandemic, review.

The Impact of COVID-19 on Type 2 Diabetic Individuals: A Review of Current Evidences

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ABSTRACT: Background: The coronavirus disease 2019 (COVID-19) pandemic has significantly affected global healthcare systems, with individuals living with chronic diseases, particularly type 2 diabetes mellitus (T2DM), experiencing disproportionately severe clinical outcomes. Smoking may further increase the risk of COVID-19-related complications among patients with T2DM.

Objective: This review aimed to evaluate the impact of COVID-19 infection on individuals with T2DM, with particular emphasis on the additional risks associated with smoking, including disease severity, hospitalization, intensive care unit (ICU) admission, and mortality. Methods: A literature review was conducted to examine relevant scientific evidence published between 2020 and 2021 concerning the impact of COVID-19 on individuals with type 2 diabetes mellitus. The selected studies were examined in two categories: (1) the clinical impact of COVID-19 on individuals with T2DM and (2) the additional effects of smoking among individuals with diabetes infected with COVID-19. Findings were synthesized to identify major risk factors and adverse clinical outcomes.

Results: The reviewed studies indicated that individuals with T2DM were more likely to require hospitalization following COVID-19 infection than individuals without diabetes. The reviewed studies suggested that individuals with type 2 diabetes mellitus were at increased risk of severe COVID-19 outcomes, including hospitalization, intensive care unit admission, and mortality. Smoking and obesity were identified as potential additional risk factors; however, the magnitude of their independent contributions remains uncertain because of differences in study populations, clinical outcomes, and adjustment for confounding variables. Additional factors, including underlying comorbidities, racial and ethnic disparities, socioeconomic conditions, and limited access to quality healthcare, were identified as potential contributors to increased disease severity.

Conclusion: Type 2 diabetes mellitus is associated with an increased risk of severe COVID-19 outcomes, which may be further exacerbated by smoking and other coexisting risk factors. These findings emphasize the importance of targeted preventive strategies, smoking cessation interventions, optimal glycemic management, and equitable access to healthcare services to reduce COVID-19-related complications among vulnerable populations.

1. INTRODUCTION

The COVID-19 pandemic continues to disproportionately affect individuals and communities across the globe, especially those with underlying medical conditions, such as the immunocompromised and those with hypertension, cardiovascular diseases, and diabetes. So far, the pandemic has claimed the lives of 6,230,357 people out of 509,531,232 reported cases globally (as of April 28, 2022) [1]. Like other chronic conditions, COVID-19 has severe prognoses and therapeutic implications for diabetic individuals [2]. A few months into the pandemic, studies showed that more than a quarter of people who went to hospitals with severe COVID-19 infections were diabetic. High blood sugar weakens the immune system, and the problems become more complicated if one has a heart or lung disease or is a smoker [3]. For instance, when people with diabetes contract COVID-19, their risk for complications like diabetic ketoacidosis or sepsis significantly increases. COVID-19 has greatly affected

hospitalization, mortality, and the economic burden related to diabetes, especially in low-income communities. This is primarily because individuals with diabetes have an increased risk of developing complications when they contract the COVID-19 virus [4]. This is unfortunate for diabetic individuals who contract the COVID-19 virus. Available data show that even those who have not contracted the virus have still been affected by the lockdowns, such as having difficulties obtaining required medication, and some people with diabetes report varying levels of anxiety and depression [5].

This paper presents a review of current evidence regarding the impact of COVID-19 on individuals with type 2 diabetes in Saudi Arabia and the Middle East. Although there are various vaccines available in different parts of the world, new variants that are more resistant to these vaccines have made it difficult to protect people from the virus. The risk is still high for diabetics and other individuals with underlying medical conditions [6].

1.1 LITERATURE SEARCH STRATEGY

A literature review was conducted to investigate the impact of COVID-19 on individuals with type 2 diabetes mellitus (T2DM), with particular emphasis on the additional risks potentially associated with smoking. The literature search was conducted using several electronic databases, including PubMed/MEDLINE, Scopus, ScienceDirect, and Web of Science, with the final search performed on July 20, 2021. The eligibility period was restricted to studies published up to this date, while any subsequently published references were used solely to provide contextual information and were not considered part of the eligible study population. The search terms included combinations of "COVID-19," "SARS-CoV-2," "type 2 diabetes mellitus," "diabetes," and "smoking." The search initially covered international studies and was subsequently refined to identify relevant evidence from Saudi Arabia and the Middle East. The identified literature was organized into two categories: (1) studies investigating COVID-19-related clinical outcomes among individuals with T2DM and (2) studies examining the potential additional effects of smoking among individuals with diabetes infected with SARS-CoV-2.

1.2 INCLUSION AND EXCLUSION CRITERIA

Studies were considered eligible for inclusion if they were published between January 2020 and July 20, 2021, and examined the impact of COVID-19 on individuals with type 2 diabetes mellitus (T2DM). Consideration was given to studies investigating disease severity, hospitalization, intensive care unit (ICU) admission, mortality, and the potential additional risks associated with smoking. Relevant studies from Saudi Arabia, the Middle East, and other international settings were considered. Publications that did not address the relationship between COVID-19 and diabetes or were unrelated to the objectives of the review were considered outside the scope of this review.

1.3 STUDY SELECTION PROCESS

Following the literature search, potentially relevant publications were examined for their relevance to the review objectives. The full texts of relevant articles were assessed to identify studies addressing COVID-19-related clinical outcomes among individuals with type 2 diabetes mellitus, including those investigating smoking as an additional potential risk factor. The selected literature included studies with different methodological approaches, particularly retrospective observational studies. The findings were subsequently organized and synthesized narratively according to the main objectives of the review.

A majority of the selected studies were retrospective studies that collected clinical information on patients, such as symptoms, demographics, serological tests, and anthropometrics, among others. They also collected information on diagnosis, admissions, intensive care, intubation, and the final outcome (whether patients recovered and discharged or died).

1.4 CHARACTERISTICS OF THE STUDY POPULATIONS

The reviewed literature included populations with different clinical and demographic characteristics. Several studies examined hospitalized patients with confirmed COVID-19, comparing individuals with diabetes and those without diabetes. Other studies investigated patients with diabetes and additional comorbidities, including obesity, hypertension, and cardiovascular disease. The review also considered evidence involving individuals with diabetes who smoked, including a hospital-based study conducted in Iraq involving 284 patients categorized according to diabetes and smoking status. Studies from Saudi Arabia and other international settings were considered to provide a broader understanding of COVID-19-related clinical outcomes and diabetes management during the pandemic. Differences in patient characteristics, comorbidities, and healthcare settings were considered important when interpreting the findings. Studies found that the number of type 2 diabetes patients that were hospitalized with COVID-19 was more than twice that of individuals hospitalized for COVID-19 who were not diabetic [7].

The death rates were also significantly higher in the group with diabetes mellitus than those without diabetes. Generally, COVID-19 patients with type 2 diabetes had worse clinical symptoms compared to those without type 2 diabetes, which was consistent across a majority of the studies [8]. Moreover, these findings agree with previous results from a pooled analysis that type 2 diabetes is associated with severe outcomes of COVID-19. Interestingly, one study found that type 2 diabetes is not associated with mortality after adjusting for sex, age, and body mass index (BMI) [7]. This indicates that type 2 diabetes contributes to severe outcomes among COVID-19 patients, especially when combined with other factors like age and BMI, but not on its own.

1.5 INTERPRETATION OF ADJUSTED AND UNADJUSTED RISK ESTIMATES

An important consideration when interpreting the reviewed findings is whether the reported associations were adjusted for potential confounding variables. Unadjusted estimates may reflect the combined influence of diabetes and other patient characteristics, including age, obesity, hypertension, and cardiovascular disease. Adjusted estimates attempt to account for selected confounding factors and may therefore differ from unadjusted findings. The reviewed literature included studies with varying approaches to statistical adjustment, making direct comparisons of reported associations challenging. Consequently, the observed relationships between type 2 diabetes mellitus and adverse COVID-19 outcomes should be interpreted in the context of each study's design, patient population, and adjustment methods rather than as evidence of a direct causal effect. Contrary to many findings, Giorgino and colleagues found that individuals with type 2 diabetes are no more likely to contract a COVID-19 infection than other people. The reviewed literature suggests that individuals with type 2 diabetes mellitus may experience more severe clinical outcomes following SARS-CoV-2 infection, particularly when additional risk factors such as obesity are present. However, the reported magnitude of these associations varies across studies depending on patient characteristics, study design, outcome definitions, and adjustment for potential confounding factors. Therefore, the magnitude of the reported associations should be interpreted cautiously, considering differences in study populations, clinical outcomes, and statistical adjustment for potential confounding factors. The media and the internet have been a source of information (and misinformation) for communities worldwide. People with diabetes and people living with other underlying health conditions are wary of going to hospitals, which comes from being told that they are at a higher risk. This has been countering efforts by care providers to convince people with diabetes to seek much-needed care.

Furthermore, this situation results in delays of functioning treatment of their diseases and complications inherent to their health conditions. In many cases, it has resulted in many people with diabetes reporting to the emergency rooms of care facilities when it is too late. In these cases, they have to be hospitalized or put under intensive care [4].

In the case of other health issues that require a doctor's attention, individuals with type 2 diabetes have been found to resort to alternative means of care, such as sending others to obtain over-the-counter medications. These include painkillers because they are afraid of contracting the COVID-19 virus if they visit healthcare facilities, especially those who are aware that they have an increased risk of becoming infected. This is also true in other parts of the world. For instance, a study done in Serbia found that even after the easing of lockdowns, less than half of the diabetic population participating in the study were willing to go to the hospital, even for issues that would be difficult to diagnose through telemedicine [9].

The prevalence of type 2 diabetes is high among hospitalized COVID-19 patients in Riyadh, Saudi Arabia. Although type 2 diabetes patients have a higher mortality rate than non-diabetic patients, other factors play a significant role in these rates. These factors include old age, smoking, congestive heart failure, β-blocker use, elevated creatinine, the presence of bilateral lung infiltrates, and severe vitamin D deficiency, which appear to be more significant predictors of mortality [2]. Having two or more of these factors in one patient significantly increases the chances of mortality and severe outcomes. In addition, COVID-19 patients with hyperglycemia are more likely to require intensive care [10].

On its own, type 2 diabetes places a strain on healthcare services and the economy, primarily through decreased work productivity, increased chance of mortality, and the likelihood of early retirement. All these eventually add a burden to a nation's economy [8]. This situation has become even more complicated in the era of COVID-19, especially since diabetic individuals have an increased risk of contracting the virus. When they become infected, they are more likely to spend more time and resources on medication or even have severe outcomes like requiring intensive care, needing oxygen support, or dying [9]. The combination of type 2 diabetes and COVID-19 comes with unprecedented social, economic, and health burdens for individuals, families, economies, and healthcare systems. The effect on employment and careers cannot be understated, especially since the

start of lockdowns and partial lockdowns, travel restrictions, and other measures aimed at curbing the spread of the disease, which have had huge impacts on economies across the globe [12]

During the pandemic, there has been an increase in severe hypoglycemia among type 2 diabetes patients in South and East Europe, the Middle East, and Africa [6]. This is consistent with other reports. The findings indicated that irregularity of glucose monitoring and lack of physician consultations might be main causes. Hypoglycemia management is critical to successfully treating patients with diabetes and should be carefully monitored, particularly in elderly people [13]. The use of novel ultra-long-acting basal insulin should be recommended in guidelines as they provide glycemic control with low hypoglycemic risk in patients with type 1 or type 2 diabetes. In addition, studies and reported data showed patients with COVID-19 with or without diabetes are often show hyperglycemia after hospital admission, which can be attributed to a direct virus-induced decrease in insulin secretion and an increase in insulin resistance resulting from the COVID-19 virus [6].

Since individuals with type 2 diabetes are more susceptible to COVID-19 and have a high risk of severe outcomes, they are required to take extra precautions to stay safe. This has caused them unique challenges, such as a lack of exercise, weight gain, mental stress, poor quality of sleep, and glycemic control. The World Health Organization (WHO) recommends that governments and healthcare authorities contain the spread of the COVID-19 virus by implementing social distancing restrictions and closing public spaces [3], including recreational parks and gyms. Furthermore, people are advised to stay inside their homes and not go outside unless necessary.

Exercise is an integral part of diabetes prevention and management plans. Studies done showed that lifestyle interventions, such as physical activity and diet-induced weight loss, reduce the risk of progression from impaired glucose tolerance to type 2 diabetes by 58% [8]. The WHO recognizes this and encourages people with diabetes to stay physically active and exercise within their home compounds in their "Stay Physically Active During Quarantine" initiative. Nevertheless, this is not practical for most [12].

Alhusseini and Alqahtani did a study on the impacts of COVID-19 on eating habits among the Saudi Arabian population. They observed a slight increase in the proportion of respondents who bought groceries three or more times per week before COVID-19 (35.9%) compare to 38.9% during the COVID-19 period. In the same period, anxiety about food hygiene outside increased (from 17.3% before the pandemic to 72.9% after it began). Regarding food quality, increasing in carbohydrates consumption by 21%, fat increased by 13%, and fruit consumption increased by 7%, respectively [13].

The COVID-19 pandemic has caused anxiety and stress regarding a shortage of food in the future, resulting in people purchasing packaged and long-life food instead of fresh food. This impacts the quality of the food consumed and has led to weight gain and increased intake of oxidants. Although some good eating habits have increased, such as consuming home-cooked meals, the quality and the quantity of the food became worse during the pandemic [13]

The mandatory lockdowns have limited access to healthy foods such as vegetables and fresh fruits. This has resulted in people with type 2 diabetes consuming processed foods that are preferred for their longer shelf life. These foods typically come with high amounts of carbohydrates, fats, and calories and are not recommended for people with diabetes. These foods increase the risk of weight gain and cardiovascular, respiratory, and thrombotic complications [15]. These complications are particularly concerning for individuals with type 2 diabetes as they are compounding factors [16].

The presence of obesity and diabetes poses additional detrimental effects on the functioning capabilities of the lungs, which lead to a decrease in forced expiratory and vital volumes capacity [12]. Studies showed that pulmonary lipo-fibroblasts in the presence of adipocytes plays a role in COVID-19 pathogenic response. Moreover, the increased expression of Angiotensin-converting enzyme 2 receptors can turn adipocytes into reservoirs for the virusis. Additionally, the transdifferentiation of lipofibroblasts into myofibroblasts will lead to pulmonary fibrosis. Consequently, the presence of fibrosis leads to severe complications of COVID-19 infection among diabetic obese populations [12].

The COVID-19 pandemic has also caused a recurrent issue of increased mental stress and changing sleeping habits among people with diabetes. Anxiety comes from the increased risk of contracting the virus, being locked down in one location without freedom of movement and not being able to be with one's family or loved ones due to restrictions. These conditions were reported to cause mental stress in 80% of participants who participated in a 2020 study [3]. 12.5% of the participants reported that they worried about the implication of COVID-19 in their lives to the extent that they could not sleep. These findings are consistent with studies done in other parts of the world.

A study conducted in China found that COVID-19 had moderate to severe effects on mental health among 53.8% of the participants. COVID-19 exacerbated the stress and sleep disturbance that diabetics and individuals living with other chronic and lifestyle diseases go through on a daily basis [16]. For instance, studies have found that erratic sleeping patterns and shorter sleep durations are linked to being overweight, obesity, and cardiovascular problems. A significant number of people with diabetes have at least one of these conditions. Individuals with type 2 diabetes report higher rates of insomnia, use of sleep medication, and sleeping during the day, which disrupt their typical sleeping patterns [12].

In some cases, the lockdown restrictions have resulted in diabetic individuals having inadequate vitamin D levels as they spend most time indoors with minimal exposure to sunlight. Vitamin D deficiency can lead to increased the risk of mortality and morbidity in cases of COVID-19 infection [4]. Supplementing vitamin D is thought to decrease the risk of infection, and it has been suggested as a cure for infected patients. Vitamin D has numerous mechanisms by which it reduces the risks of microbial infections and death, which can be devided into three main categories: physical barriers, adaptive, and natural immunity [12].

1.6 DIABETIC SMOKERS

Few studies have looked at the impact of COVID-19 on diabetic individuals who smoke, and available data are from cross-sectional observational studies. A study by Mohhamed Abbas and colleagues found that patients with more than one comorbidity, especially diabetes and smoking, showed more severe–critical cases than people with diabetes who do not smoke and healthy patients. They sought to compare the adverse risks of smoking versus diabetes comorbidities and the outcome in COVID-19 patients. The study examined a total of 284 patients admitted to a Bagdad hospital between June 7 and July 26, 2020, who had confirmed cases of COVID-19. These patients were grouped with regards to present comorbidities (72 healthy patients), smoking (71), diabetes (71), and both smoking and diabetes (70) [16]. As expected, the group with healthy (COVID-19) patients showed minimal symptoms compared to smokers, diabetics, and diabetic smokers. This study found that patients with two or more comorbidities were more prevalent in older age groups. Smokers were found to show high temperatures and high blood cell counts. Diabetic patients showed more symptoms, including sore throat, headache, and lymphocytopenia, and it took longer for their health to improve [16]. The impact of smoking and diabetes on COVID-19 patients is significantly higher than in patients without comorbidities. Patients with more than one comorbidity primarily present in a critical situation and require a respiratory care unit. Patients without comorbidity mostly present at a mild stage. The duration taken for the disease to subside is significantly longer for patients who have diabetes and also smoke [16]. Body temperature, respiratory rate, diastolic blood pressure, pulse rate, and other symptoms are higher in diabetic smokers. The mortality rate was higher among COVID-19 patients who were smokers (4.2%) and those with diabetes (7.04%), with the highest mortality rate observed among patients who both smoked and had diabetes (10%) [16]. It is a difficult task to obtain data on COVID-19 hospitalizations in the Middle East and the Gulf Cooperation Council (GCC) countries. However, a few studies managed to collect comprehensive data on the clinical characteristics and outcomes of COVID-19 patients with type 2 diabetes admitted to care facilities across the Kingdom of Saudi Arabia (KSA). Understanding the impact of type 2 diabetes at the population and community levels is essential in assessing its impact in the community. The effect of this disease in the time of the COVID-19 pandemic can be quantified in terms of pre-mature mortality, quality of life, economic impact, morbidity, and impacts on healthcare [10]. Type 2 diabetes has been a burden for healthcare communities across the globe for decades, but it has become an even more significant burden since the onset of the COVID-19 pandemic. Consequently, both at the local and global levels, healthcare systems and the diabetic population have been significantly impacted by this pandemic [15]. Mitigation restrictions aimed at curbing the spread may have imposed a bad reflections on the diabetes population. These reflections faced by this vulnerable population will enable healthcare professionals, healthcare providers, and policymakers to create targeted action plans that are practical [13]. The COVID-19 pandemic has caused undeniable and dramatic challenges in the global healthcare landscape, particularly in some sections of the population in some rather disproportionate ways. While individuals with diabetes and obesity require optimal care when they contract the virus, they often have sub-optimal care, and the situation is likely to persist following movement restrictions and lockdowns [13]. The availability of vaccines is good news for the most vulnerable populations and a step in the right direction. However, the advent of new variants of the COVID-19 virus that keep spreading across the globe could mean that progress will be even slower for a while. In this situation, there is a need to share meaningful clinical experiences across the different countries among specialists and healthcare professionals in general [10].

This is even more important now during the COVID-19 era than before. For instance, it will help to prevent increased severe hypoglycemia episodes. More importantly, it will help identify risk factors for unfavorable outcomes of the infection, as some

patients have no symptoms,. The medical response has to adapt quickly to the evolving COVID-19 landscape, especially with new variants, and the need for timely advice and sharing of best practices is at its highest. The implementation of critical learning will need to be swift to improve disease control and prevent acute and chronic complications in patients [18].

Since type 2 diabetes and obesity are often associated and are accompanied by other cardiometabolic risk factors, there is a need for a comprehensive approach in caring for patients with COVID-19 and those conditions to reduce their cardio-metabolic risk [18]. This is indeed highlighted by reports calling for congruence between the treatment approach and the significant cardio-metabolic potential of COVID-19. A recent study found that BMI is positively associated with a combined outcome of tracheal intubation and/or death within seven days of admission among patients with COVID-19 and diabetes [6]. This places particular emphasis on targeting patients with both diabetes and obesity, thereby increasing their monitoring, priority in testing, and treatment to control comorbidities [18]. As such, these findings cement the idea that individuals with diabetes and obesity should be prioritized for COVID-19 vaccination programs [6].

Convincing individuals with underlying conditions like diabetes, hypertension, and cardiovascular diseases to visit clinics and hospitals in the era of COVID-19 has become a challenge since they are generally afraid of contracting the COVID-19 infection. Generally, patients with diabetes and obesity who have not been infected should continue to be treated according to global and local guidelines, with frequent blood glucose monitoring and reminders of the value of healthy eating, exercise, and vitamin/mineral supplementation [8]. For instance, the decision to give vitamin D was made very early in Israel, even before strong evidence was available to support its use in the management of COVID-19 infections. Potential mechanisms by which vitamin D may reduce the risk of COVID-19 include lowering viral replication rates, the induction of antimicrobial peptides, and the regulation of inflammatory responses [13].

Because of the poor prognosis of COVID-19 in patients with hyperglycemia, it is important to control hyperglycemic excursions during the early phase of COVID-19 infection. This is particularly important among vulnerable populations, such as the immunocompromised, those with malnutrition, those with terminal illnesses, and those with gestational diabetes. Patients with type 1 diabetes should also be reminded of the risk of diabetic ketoacidosis should they experience excessive hyperglycemia. In contrast, a recent study conducted in Italy shows that patients with type 1 diabetes using flash glucose monitoring during lockdown experienced significantly fewer hypoglycemic events and time below range. At the same time, no changes were observed in time in range or time above range. These changes in glycemic control were associated with increased access to food (particularly sweets) during the lockdown [6].

1.7 LIMITATIONS OF THE REVIEW

This review has several limitations. First, the included literature was published during the early stages of the COVID-19 pandemic (2020–2021), when knowledge of SARS-CoV-2 infection and its clinical consequences was still evolving. Consequently, the findings may not fully reflect the clinical outcomes observed during later phases of the pandemic. Furthermore, differences in study designs, patient characteristics, and healthcare settings may limit the generalizability of the findings. These limitations should be considered when interpreting the association between type 2 diabetes mellitus, smoking, and adverse COVID-19 outcomes.

Additionally, the emergence of new SARS-CoV-2 variants and the increasing availability of COVID-19 vaccines may have influenced disease severity, hospitalization rates, and mortality during subsequent phases of the pandemic. Since most studies included in this review were conducted before widespread vaccination, their findings may not accurately represent the clinical outcomes observed in vaccinated populations or among individuals infected with later viral variants. Therefore, caution is required when generalizing these findings to subsequent stages of the COVID-19 pandemic.

Furthermore, changes in COVID-19 treatment strategies and healthcare practices throughout the pandemic may have influenced clinical outcomes among patients with type 2 diabetes mellitus. During the early stages of the pandemic, treatment options were limited, and clinical management protocols were continuously evolving. Differences in healthcare infrastructure, hospital resources, intensive care unit capacity, and access to specialized medical services across countries and healthcare institutions may also have contributed to variations in hospitalization rates, disease severity, and mortality. Therefore, these factors should be considered when interpreting and comparing findings from different studies. Another important limitation is the potential influence of confounding factors on the reported associations between type 2 diabetes mellitus, smoking, and adverse COVID-19 outcomes. Factors such as advanced age, obesity, hypertension, cardiovascular disease, and other pre-

existing medical conditions may independently contribute to disease severity and mortality. Furthermore, differences in the adjustment for these variables across observational studies may influence the reported risk estimates. Therefore, the observed associations should not be interpreted as evidence of direct causation. Further well-designed prospective studies with appropriate adjustment for potential confounders are needed to clarify the independent and combined effects of diabetes and smoking on COVID-19 outcomes.

2. CONCLUSION

The combination of type 2 diabetes and COVID-19 has made a significant section of the population susceptible to severe health outcomes. These severe outcomes may be further exacerbated by coexisting risk factors, including obesity, smoking, and cardiovascular disease, as well as limited access to appropriate healthcare service. This study has established that COVID-19 has disproportionately affected individuals with type 2 diabetes. People with diabetes have an increased risk of severe infection and have a poor prognosis when they become infected. They are more than two times as likely to develop severe symptoms that require intensive care compared to non-diabetics. Smoking may represent an additional risk factor for adverse COVID-19 outcomes among individuals with type 2 diabetes mellitus. However, the available evidence does not establish a consistent magnitude of increased risk specifically attributable to smoking, and the findings should be interpreted cautiously because of potential confounding factors and differences in study populations and clinical outcomes. After contracting the disease, the mortality rate for diabetics is also significantly higher than among non-diabetics. There is an increased risk of developing severe symptoms and complications among COVID-19 patients who have diabetes or other comorbidities like smoking, obesity, hypertension, cancer, and chronic respiratory infections or have underlying cardiovascular conditions. People with diabetes who have managed to stay safe and have not contracted the COVID-19 virus still experience adverse effects but in logistical aspects. Lockdown and movement restrictions have affected them in numerous ways, such as limiting access to fresh vegetables and fruits, limiting access to medication and technology to help them manage diabetes, and keeping them away from their loved ones. This has resulted in increased mental stress, anxiety, and depression among some people with diabetes.

ACKNOWLEDGEMENTS

The authors extend their appreciation to Umm Al-Qura University, Saudi Arabia, for funding this research work through grant number 26UQU4310007GSSR08.

FUNDING

This research was funded by Umm Al-Qura University, Saudi Arabia, through grant number 26UQU4310007GSSR08.

AUTHOR CONTRIBUTIONS

A M A: study conception and design, data collection, analysis and interpretation of results, manuscript drafting, critical revision, and approval of the final manuscript.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ETHICS STATEMENT

Ethical approval was not required for this study.

DATA AVAILABILITY STATEMENT

Data Availability Statement

The data supporting this review were obtained from publicly available sources, including ClinicalTrials.gov (https://clinicaltrials.gov/). Clinical trial information is freely accessible through the ClinicalTrials.gov database. No new primary data were collected during this study.

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