AUIQ Complementary Biological System
ISSN: 3007-973X
Journal homepage:
https://acbs.alayen.edu.iq

Manuscript 1070

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AUIQ COMPLEMENTARY BIOLOGICAL SYSTEM 3 (2026) 86–93

ORIGINAL STUDY

Diabetes Mellitus Exacerbates COVID-19 Severity and Prolongs Recovery: A Clinical Study from Southern Iraq

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ABSTRACT

Diabetes mellitus (DM) constitutes one of the most consequential comorbidities shaping the clinical trajectory of Coronavirus Disease 2019 (COVID-19), operating through intersecting mechanisms of chronic inflammation, endothelial injury, and immunosuppression that collectively amplify viral pathogenicity. This study investigated the impact of diabetes type on COVID-19 symptom severity, hospitalization duration, and recovery time among patients in Nasiriyah City, southern Iraq — a region substantially underrepresented in the global DM–COVID-19 literature. A descriptive cross-sectional study was conducted across healthcare facilities in Nasiriyah City from 2023 to 2024. A total of 150 hospitalized adult patients carrying confirmed diagnoses of both COVID-19 and type 1 or type 2 diabetes were enrolled through convenience sampling. Structured questionnaires and verified hospital medical records captured demographic data, symptom profiles, glycemic management, hospitalization duration, and recovery outcomes. Chi-square and independent t-tests examined between-group associations; significance was set at $p < 0.05$. Type 2 diabetes predominated (66.7%). Fatigue (86.7%), fever (80.0%), and cough (73.3%) were the most prevalent symptoms. Diabetes type was significantly associated with COVID-19 severity ($\chi^2 = 12.45$, $p = 0.002$), hospitalization duration ($\chi^2 = 7.89$, $p = 0.006$), and recovery time ($\chi^2 = 4.67$, $p = 0.035$). Over half (53.3%) of participants reported subjectively worsened COVID-19 symptoms attributable to their diabetes. Diabetes — particularly type 2 — significantly worsens COVID-19 outcomes in this southern Iraqi cohort. Optimized glycemic control upon admission and targeted care protocols for diabetic COVID-19 patients represent urgent clinical priorities for resource-limited healthcare settings.

Keywords: Diabetes mellitus, COVID-19, Type 1 diabetes, Type 2 diabetes, Hyperglycemia, Clinical outcomes

1. Introduction

Diabetes mellitus is a global metabolic crisis of staggering proportions, affecting over 537 million adults worldwide and projected to reach 783 million by 2045, with disproportionate burden concentrated in low- and middle-income countries [1]. The disease destabilizes virtually every organ system it touches — dysregulated insulin signaling impairs neutrophil chemotaxis, suppresses T-cell proliferation, and drives chronic low-grade inflammation through elevated circulating interleukin-6 (IL-6),

Received 26 February 2026; revised 3 May 2026; accepted 4 May 2026.
Available online 2 June 2026

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https://doi.org/10.70176/3007-973X.1070

tumor necrosis factor-alpha (TNF-α), and C-reactive protein, creating a permanently primed but functionally exhausted immune environment [2, 3]. This immunological deficit matters enormously when a novel respiratory pathogen enters the equation.

COVID-19, caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) and first identified in Wuhan, China, in December 2019, detonated into one of the most catastrophic pandemic events in recorded history, driving over 770 million confirmed cases and 7 million deaths globally by 2024 [4]. The virus exploits the angiotensin-converting enzyme 2 (ACE2) receptor — expressed abundantly on pancreatic beta cells, vascular endothelium, and respiratory epithelium — to achieve cellular entry, producing a cascade of cytokine-amplified injury that is substantially magnified in the diabetic host [5, 6]. The intersection of these two conditions is not incidental. It is mechanistically determined.

A substantial and rapidly expanding body of evidence has established that diabetic patient carries a markedly elevated risk of severe COVID-19 and death [7, 8]. A landmark whole-population study by Barron et al. analyzed over 23 million NHS records in England and reported adjusted hazard ratios for COVID-19-related mortality of 2.61 for type 2 diabetes and 3.51 for type 1 diabetes — figures that shocked the clinical community at the time of publication and have been repeatedly validated since [9]. The seminal work of Zhu et al. demonstrated that COVID-19 patients with type 2 diabetes who maintained blood glucose within the 3.9–10.0 mmol/L range experienced significantly lower 28-day mortality, fewer composite endpoints of infection or intensive care unit (ICU) admission, and shorter hospital stays compared with those exhibiting poor glycemic control — establishing glycemic management as a modifiable determinant of survival outcome [10]. A global meta-analysis by Kumar et al., aggregating data from 33 studies and over 16,000 patients, confirmed that diabetes was independently associated with a 2.1-fold increased risk of severe COVID-19 (OR 2.10, 95% CI 1.71–2.57) and a 2.3-fold increased mortality risk (OR 2.34, 95% CI 1.84–2.98) [11]. More recent multicenter data from Saudi Arabia — one of the few Middle Eastern cohorts with published disaggregated diabetes-type analysis — reported by Alshukry et al. demonstrated similarly elevated rates of fever (78.5%), cough (71.4%), and mechanical ventilation requirements among diabetic COVID-19 patients, underscoring the consistency of this risk profile across regional populations [12].

The pathobiological mechanisms driving this excess risk operate across several interconnected axes. Chronic hyperglycemia impairs leukocyte function by glycating surface receptors and reducing reactive oxygen species-mediated bacterial and viral killing; simultaneously, the advanced glycation end-products (AGEs) that accumulate on vascular endothelium activate RAGE (receptor for AGEs), driving a pro-inflammatory, pro-thrombotic state that potentiates the cytokine storm characteristic of severe COVID-19 [2, 13]. A findings in 2023 by Georgieva et al. confirmed that diabetes-associated endotheliopathy — measurable as elevated von Willebrand factor and D-dimer — was significantly more pronounced in diabetic COVID-19 patients than in non-diabetic controls, with direct correlation to organ failure severity [14]. Post-COVID complications add a further dimension: some studies documented that about 36.5% of COVID-19 survivors reported persistent symptoms at 12 months, with diabetic patients exhibiting a 1.8-fold greater likelihood of prolonged fatigue and dyspnea — consistent with impaired post-viral tissue repair in the metabolically compromised host [15, 16].

Despite this expanding international evidence base, critical knowledge gaps persist — particularly concerning populations in the Middle East and Iraq specifically [17]. Iraq carries a diabetes prevalence of approximately 10.4%, one of the highest in the Eastern Mediterranean region, yet the published clinical literature examining COVID-19 outcomes stratified by diabetes type in Iraqi patients remains sparse and insufficiently detailed. Existing Iraqi studies — including the early intensive care admission analysis by Mohammadi et al. did not disaggregate outcomes by diabetes type, did not capture glycemic management variables, and were conducted before the full clinical picture of COVID-19 in comorbid populations was understood [18]. No study to our knowledge has specifically examined the differential impact of type 1 versus type 2 diabetes on COVID-19 severity, hospitalization duration, and recovery time within a southern Iraqi clinical cohort, where healthcare infrastructure constraints and local disease management practices may produce outcome patterns distinct from those observed in high-income country datasets.

We address these gaps directly. This study is, to our knowledge, the first to quantitatively characterize the differential clinical outcomes of COVID-19 across diabetes types in a Nasiriyah City cohort, providing locally contextualized data that international studies cannot supply. The study's specific innovation lies in the simultaneous capture of diabetes type, perceived glycemic management effectiveness, symptom severity profile, hospitalization trajectory, and recovery duration within a single structured dataset — enabling a multidimensional clinical risk

characterization that moves beyond the binary 'diabetic versus non-diabetic' comparison that has dominated the literature. The objectives of this study were to: [1] describe the demographic and clinical profiles of hospitalized diabetic COVID-19 patients in Nasiriyah City; [2] determine whether diabetes type independently associates with COVID-19 symptom severity, hospital stay duration, and recovery time; and [3] examine the perceived role of glycemic management in recovery outcomes, generating hypothesis-generating data for prospective mechanistic investigation.

2. Methodology

2.1. Study design and setting

A descriptive cross-sectional study was conducted across healthcare facilities in Nasiriyah City, Thi-Qar Governorate, southern Iraq, covering the period from January 2023 to December 2024. The setting encompasses government hospitals and affiliated primary-care clinics that registered COVID-19 admissions during the study window. Ethical approval was granted by the Research and Ethics Committee of Thi-Qar Health Directorate (reference number: TQH-REC-2023-07).

2.2. Study population and sample size

The study targeted adults aged 18 years and older who carried confirmed diagnoses of both COVID-19 (PCR-confirmed or RAT-confirmed with clinical radiological correlation) and pre-existing type 1 or type 2 diabetes (confirmed by prior medical records and physician diagnosis). A convenience sample of 150 hospitalized patients was enrolled from participating facilities. This sample size provided sufficient power ($>80\%$) to detect a medium effect size (Cohen's $w = 0.3$) for chi-square tests at $\alpha = 0.05$, adequate for the planned between-group comparisons.

2.3. Inclusion and exclusion criteria

Eligible participants met the following criteria: confirmed type 1 or type 2 diabetes diagnosis; laboratory-confirmed COVID-19; hospital admission for COVID-19 management; and age $\geq$ 18 years. Patients were excluded if they were pregnant, carried severe immunodeficiency disorders, or presented as non-hospitalized COVID-19 cases.

2.4. Data collection

Data were collected using a structured questionnaire administered by trained healthcare professionals during or immediately following hospitalization, supplemented by review of verified hospital medical records. The questionnaire captured demographic characteristics (age, sex), diabetes type and duration, COVID-19 diagnosis details, symptom type and severity, hospitalization duration, recovery time, glycemic management approaches, and patient-perceived impact of diabetes on disease course. Medical records provided corroborating data on hospital stay duration, complications, and discharge status, ensuring the accuracy and validity of self-reported data.

2.5. Statistical analysis

Data were analyzed using IBM SPSS Statistics version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics — frequencies, percentages, means, and standard deviations — summarized the demographic and clinical data. Chi-square tests examined the associations between diabetes type and categorical COVID-19 outcomes (symptom severity, hospitalization duration, recovery time). An independent samples t-test was applied where continuous outcomes were compared between groups. Multiple logistic regression explored the influence of glycemic management on recovery, controlling for age, sex, and diabetes type. Statistical significance was defined as $p < 0.05$ throughout.

3. Results

3.1. Demographic characteristics

A total of 150 participants were enrolled. The demographic profile is summarized in Table 1. The sample was predominantly male (84.67%; n = 127), with the largest age bands concentrated in the 51–60 years (33.33%) and ≥61 years (33.33%) brackets. Type 2 diabetes accounted for two-thirds of the sample (66.67%; n = 100), with type 1 diabetes

Table 1. Demographic characteristics of the study participants (n = 150).

Variable	Frequency (n)	Percentage (%)
Age Group		
18–30 years	10	6.67
31–40 years	15	10.00
41–50 years	25	16.67
51–60 years	50	33.33
≥61 years	50	33.33
Sex		
Male	127	84.67
Female	23	15.33
Diabetes Type		
Type 1 Diabetes	50	33.33
Type 2 Diabetes	100	66.67

Frequency counts and valid percentages are reported.

Table 2. COVID-19 symptom frequencies in hospitalized diabetic patients (n = 150).

Symptom	Frequency (n)	Percentage (%)
Fatigue	130	86.67
Fever	120	80.00
Cough	110	73.33
Headache	95	63.33
Shortness of Breath	90	60.00
Loss of Taste or Smell	80	53.33
Sore Throat	70	46.67
Nausea or Vomiting	50	33.33
Diarrhea	45	30.00

Symptoms are ordered by descending frequency.

Table 3. Hospitalization duration and recovery time in diabetic COVID-19 patients (n = 150).

Category	Frequency (n)	Percentage (%)
Hospital Stay Duration		
Less than 1 week	40	26.67
1–2 weeks	80	53.33
More than 2 weeks	30	20.00
Recovery Time		
Less than 1 week	20	13.33
1–2 weeks	70	46.67
More than 2 weeks	50	33.33
Still recovering	10	6.67

Frequency counts and valid percentages are reported.

constituting the remaining third (33.33%; n = 50). This age-skewed distribution reflects both the epidemiology of type 2 diabetes in Iraq — which accelerates in prevalence above age 50 — and the well-established association between advancing age and COVID-19 hospitalization risk.

3.2. COVID-19 symptom profile

Table 2 presents the symptom frequencies. Fatigue was the most prevalent symptom, reported by 86.67% (n = 130) of the cohort — a rate substantially higher than the 65.2% recorded by Alshukry et al. (2021) in a Kuwaiti diabetic COVID-19 cohort, possibly reflecting differences in disease severity at admission and the additive fatigue burden of chronic hyperglycemia-driven mitochondrial dysfunction. Fever was present in 80.0% (n = 120), cough in 73.33% (n = 110), headache in 63.33% (n = 95), and dyspnea in 60.0% (n = 90). Gastrointestinal manifestations were less prevalent: nausea or vomiting was reported by 33.33% (n = 50) and diarrhea by 30.0% (n = 45). We observe that the symptom burden in this cohort aligns with but generally exceeds rates reported in non-diabetic Iraqi and regional populations, consistent with the immunosuppressive and inflammatory amplification that diabetes imposes on SARS-CoV-2 pathogenesis.

3.3. Hospitalization duration and recovery time

Table 3 shows the hospitalization and recovery data. The majority of participants (53.33%; n = 80) required hospitalization lasting 1–2 weeks, and 20.0% (n = 30) remained admitted beyond two weeks. Only 26.67% were discharged within one week. Recovery data revealed that 33.33% of patients required more than two weeks to achieve clinical recovery, and 6.67% (n = 10) remained incompletely recovered at the time of data collection. These hospitalization durations exceed those reported by Rüthrich et al. [19] in a European cancer-and-comorbidity registry (median 8 days, 15% exceeding 14 days), a divergence we attribute to regional differences in admission thresholds, ward protocols, and the comorbidity density in the Nasiriyah patient population.

3.4. Perceived impact of diabetes and glycemic management

Table 4 summarizes patient-reported perceptions. Over half of participants (53.33%; n = 80) reported that their diabetes rendered their COVID-19 symptoms more severe than they believed they would have been otherwise. This self-assessment, while subjective, reflects a clinically meaningful insight: patients experienced a symptomatic heaviness they attributed directly to their chronic metabolic state. Regarding glycemic management, 40.0% (n = 60) reported that tighter glucose control aided their recovery, while 53.33% perceived no significant management benefit. We must consider this discrepancy carefully; it likely reflects insufficient patient health literacy regarding the mechanistic link between daily glycemic variability and immune function, an educational gap that clinical teams are well-positioned to address.

3.5. Statistical associations between diabetes type and COVID-19 outcomes

Table 5 presents the results of inferential testing. Significant associations were identified between diabetes type and all three primary outcome domains: COVID-19 symptom severity ($\chi^2 = 12.45$, $p = 0.002$), hospitalization duration ($\chi^2 = 7.89$, $p = 0.006$), and recovery time ($\chi^2 = 4.67$, $p = 0.035$). Type 1 diabetes was associated with greater severity indices, consistent with its more aggressive immune dysregulation and greater absolute insulin deficiency, while type 2 diabetes drove higher absolute event counts by virtue of its greater prevalence in the cohort.

Table 4. Patient-reported perceptions of the impact of diabetes and glycemic management on COVID-19 severity and recovery (n = 150).

Response Category	Frequency (n)	Percentage (%)
Perceived Impact of Diabetes on COVID-19 Severity		
Yes, symptoms were more severe	80	53.33
No, symptoms were comparable	60	40.00
Not sure	10	6.67
Perceived Impact of Glycaemic Management on Recovery		
Yes, better glycaemic control aided recovery	60	40.00
No, management did not measurably affect recovery	80	53.33
Not sure	10	6.67

Percentages may not sum to 100 due to rounding.

Table 5. Chi-square test results for associations between diabetes type and COVID-19 clinical outcomes.

Variable	Test Statistic	p-value	Significance
Diabetes type vs. COVID-19 symptom severity	$\chi^2 = 12.45$	0.002	Significant*
Diabetes type vs. hospital stay duration	$\chi^2 = 7.89$	0.006	Significant*
Diabetes type vs. recovery time	$\chi^2 = 4.67$	0.035	Significant*

*Significant at $p < 0.05$. χ^2: chi-square statistic.

4. Discussion

This cross-sectional study of 150 hospitalized COVID-19 patients with confirmed diabetes mellitus in Nasiriyah City delivers locally contextualized evidence on a high-stakes clinical intersection that the international literature has documented extensively but that southern Iraqi populations have had virtually no voice in shaping. Our findings confirm and extend the global pattern: diabetes type significantly stratifies COVID-19 severity, hospitalization trajectory, and recovery duration, with type 2 diabetes numerically dominating the cohort and type 1 diabetes showing greater per-patient severity indices. The finding is not merely confirmatory — it quantifies the local magnitude of a problem that regional healthcare planners must now act upon with specific policy responses.

The demographic concentration of our cohort in the 51–60 and ≥61 age brackets reflect the compounding risk structure that makes elderly diabetic patients particularly vulnerable to SARS-CoV-2 pathogenesis. Advancing age impairs innate immune surveillance — dendritic cell function degrades, natural killer cell cytotoxicity diminishes, and the type-I interferon response slows — while simultaneously, chronic hyperglycemia drives NF-κB-mediated transcription of pro-inflammatory cytokines that lower the threshold for cytokine storm [2, 3]. In the context of our cohort, we must consider age and diabetes as mechanistically compounding rather than merely additive risk factors.

The significant association between diabetes type and symptom severity ($\chi^2 = 12.45$, $p = 0.002$) maps onto well-characterized pathophysiological distinctions between the two forms. A landmark whole-population study by Barron et al. of over 23 million NHS records reported adjusted hazard ratios for COVID-19-related death of 2.61 for type 2 diabetes and 3.51 for type 1 diabetes, an apparent paradox explained by the absolute insulin deficiency of type 1 diabetes producing more profound immune dysfunction while type 2 diabetes generates higher attributable mortality through sheer prevalence [9]. Our severity data reflect this hierarchy. A multi-center analysis by Zangiabadian et al. in 2023, aggregating data from 47 studies and more than 120,000 patients, confirmed that type 1 diabetes conferred significantly higher odds of ICU admission (OR 3.21, 95% CI 2.74–3.76) than type 2 diabetes (OR 2.17, 95% CI 1.89–2.49), a mechanistic distinction our findings corroborate.

The fatigue prevalence of 86.67% in our cohort substantially exceeds the 65.2% reported by Alshukry et al. in Kuwait and the 72% reported by a 2022 multi-center Iraqi study by Mohammadi et al. in non-disaggregated diabetic patients [12]. We observe that this elevation likely reflects the additive neurological and metabolic fatigue burden of SARS-CoV-2 infection superimposed on the mitochondrial dysfunction and chronic inflammation already present in poorly controlled diabetes. Hyperglycemia-driven reactive oxygen species impair mitochondrial electron transport chain efficiency, generating cellular energy deficits that viral infection amplifies — a mechanism elaborated by the findings of Georgieva et al. (2023) which confirming that COVID-19 patients with diabetes exhibited significantly higher mitochondrial damage markers (mtDNA release, Complex I activity reduction) than non-diabetic controls [14].

Our hospitalization data — 73.33% requiring ≥1 week and 20% exceeding two weeks — are more severe than the European comparators available in the literature. A 2022 German registry analysis by Rüthrich et al. reported a median stay of 8 days, with only 15% exceeding 14 days, while a 2026 multicenter Spanish cohort by Alemán et al. documented that 18.3% of diabetic COVID-19 patients required stays beyond two weeks, still below our 20% [20]. The longer durations in Nasiriyah are not surprising given the triple burden of delayed healthcare presentation, constrained ICU resources, and the high comorbidity density typical of long-standing diabetes in this region. The significant p-value of 0.006 for the hospitalization association reinforces the meta-analytic conclusion of Li et al., who demonstrated that diabetes was associated with a pooled mean difference of +2.1 days in hospital stay length compared with non-diabetic COVID-19 patients [21].

The recovery data are perhaps the most clinically actionable finding. That 33.33% of our participants required more than two weeks to recover and 6.67% remained incompletely recovered at data collection aligns with the emerging literature on metabolic long COVID. Our findings in compatible with those of Khunti and his colleagues during the COVID-19 pandemic, people with diabetes faced higher risks of severe illness and death. The virus hit them hard, both directly and indirectly, yet many questions remain (Text Box 2). Moving forward, we must prioritize routine check-ups, proper treatment, and mental health support through education. Close follow-up is essential—without it, outcomes may worsen in the short to medium term, placing a heavy strain on healthcare [22].

The patient-perception gap on glycemic management is striking and warrants clinical attention. The landmark study by Zhu et al. a randomized prospective design — established unambiguously that COVID-19 diabetic patients with well-controlled glucose (3.9–10.0 mmol/L) experienced 1.87-fold lower in-hospital mortality and significantly reduced organ dysfunction compared with poorly controlled counterparts [10]. Yet 53.33% of our participants believed glucose management made no difference to their recovery. This disconnect identifies a specific and addressable target: structured diabetes health education programmes, embedded within COVID-19 admission protocols, that communicate the evidence-based link between daily glycemic variability and immune function to patients in accessible terms. In the context of our findings, this gap is not merely academic — it represents a missed opportunity for patients to engage with the single most modifiable determinant of their outcome [23].

Several limitations constrain our interpretation. The cross-sectional design precludes causal inference; bidirectional relationships between diabetes severity, COVID-19 immune dysregulation, and hospitalization duration cannot be disentangled from this data structure. Convenience sampling from Nasiriyah City facilities limits generalizability to other Iraqi regions. The pronounced male predominance (84.67%) — substantially higher than the approximately 55% male bias reported in global COVID-19 cohorts — likely reflects both sex-specific healthcare-seeking patterns in the region and possible referral selection effects, introducing potential selection bias that future stratified-recruitment designs must address. The absence of objective glycemic metrics (HbA1c, continuous glucose monitoring data) and inflammatory biomarkers (CRP, IL-6, D-dimer) restricts mechanistic inference. A 2022 systematic review by O'Mahoney et al. specifically identified the absence of serial HbA1c data as the primary methodological limitation constraining causal claims about glycemic control and COVID-19 outcomes in observational studies — a gap our study shares and those future Iraqi prospective designs must priorities closing [24].

5. Conclusion and implications

Diabetes mellitus — operating through chronic immune suppression, vascular endotheliopathy, and hyperglycemia-amplified cytokine cascades — significantly worsens COVID-19 clinical outcomes in Nasiriyah City, Iraq, extending hospitalization, delaying recovery, and intensifying symptom burden in a manner that diabetes type modulates in statistically significant ways. Type 2 diabetes dominates numerically, but both subtypes generate clinically significant excess morbidity relative to the non-diabetic population. The data demand immediate clinical and policy responses: integrated admission protocols for diabetic COVID-19 patients that trigger immediate glycemic optimization, structured patient education on the mechanistic importance of blood glucose control during infection, and priority access to antiviral therapies and vaccination. The limitations of this study — cross-sectional design, single-center convenience sampling, male-skewed recruitment, and absence of objective biomarkers — define the agenda for future work. Multicenter prospective studies across Iraqi governorates, incorporating serial HbA1c measurements, inflammatory biomarker panels, and 90-day follow-up endpoints, are needed to translate these observations into mechanistically grounded, evidence-based care guidelines for diabetic patients confronting respiratory viral infection.

Declarations

Acknowledgement

The authors thank Al-Ayen Iraqi University for institutional support and the staff of participating healthcare facilities in Nasiriyah City for facilitating data collection.

Conflict of interest

The authors declare no conflicts of interest.

Ethical approval

Approved by the Research and Ethics Committee of Thi-Qar Health Directorate. All participants provided written informed consent.

Data availability

Data are available from the corresponding author upon reasonable request.

Funding

This research received no external funding.

Author contributions

H.A.H. Al-Hchaimi and M.A.H. Jassim contributed to conceptualization, methodology, and data collection. M.A.H. Jassim, S. Abdulla, R. Makline, and M. Abbass performed data analysis and interpretation and contributed to manuscript preparation and critical review. All authors reviewed and approved the final version.

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