International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

# Some Immune Parameters for Type 2 Diabetics Infected with Coronavirus Disease 2019 (COVID-19) in Baghdad, Iraq

**Ali Faaeq Shaheed Samaraey[1], Safa Kaleel Khalaf[2]**

[1]Cankiri Karatekin University, Faculty of Science, Department of Biology, Cankiri, Turkey.
Email: *Alifaaeq58[at]gmail.com*
Orcid: Ali samaraey https://orcid. org/0000-0002-0076-919X

[2]Address: Titul (s) Firstname Surname of the corresponding author, ministry of science and Technology, Baghdad, Iraq.
Email: safaalsalmani2[at]gmail.com
Orcid: safa alsalmany https://orcid. org/0000-0001-5244-7355

**Abstract:** ***This study to establish the effects of COVID-19 on 150 patients diagnosed with type 2 diabetes mellitus (T2DM) via a questionnaire distributed in Baghdad, Iraq, in light of social economy and healthcare restrictions. The present study seeks to explore and determine clinical interventions and physiological reactions employing a cross-sectional research design. In the demographic aspects, clinical characteristics, immunological markers, blood glucose level, and liver enzymes markers and SARS-CoV-2 IgG ELISA were evaluated. While comparing the result values of diabetic COVID patients with control non-diabetic COVID patients it was observed that the fasting blood glucose level was 180 ± 40mg/dl as compared to 120 ± 30mg/dl, p < 0.001, postprandial blood glucose level was 240 ± 50mg/dl as compared to 160 ± 40mg/dl p < 0.01 and HbA1 Diabetic patients' liver enzymes of ALT and AST were significantly higher than normal denoting that diabetes affects the liver. The percentage of hospitalized patients, those intubated in the ICU, those requiring mechanical ventilation, and those deaths among diabetic patients were higher compared with the control group; 80% vs 50%, p < 0.001; 30% vs 15%, p < 0.05; 25% vs 10%, p < 0.01; and 20% vs 5%, p < additionally, dysregulation in immune and metabolic parameters was observed among T2DM patients with COVID-19, including elevated levels of pro-inflammatory cytokines (IL-6: 55.0 ± 29.9 pg/mL, TNF-α: Although TNF-α was increased it was still slightly lower than normal (mean value 76.0 ± 34.5 pg/mL) as well as IL-1-b (mean 23.9 ± 12.5 pg/mL) while the indicators of glycemic control were poor HbA1c (mean 8.7 ± 2.0%) and random glucose (mean 240.6 ± 78.3 Elevated liver enzymes (ALT: (ALP: 44.5 ± 21.9 U/L, AST: 38.9 ± 19.8 U/L, GGT: 54.1 ± 29.8 U/L) supported that there was hepatic stress. Clinical outcomes were also poor, with 80 % of the patients being hospitalized, 34%; intensive care unit admission was required for 19 % of the patients.7% were admitted to the ICU and 14.7% mortality. Non-survivors exhibited significantly higher inflammatory markers and poorer glycemic control compared to survivors (HbA1c: IL-10 concentration was higher in the study group (10.0 ± 2.3% vs.8.3 ± 1.8%); IL-6 (80.7 ± 33.8 pg/mL vs.48.6 ± 27.8 pg/mL) and TNF-α (116.4 ± 38.5 pg/mL vs.68.1 ± 30.9 pg/mL).***

**Keywords:** COVID-19, Blood glucose, liver enzymes, PCR, Type 2 diabetes mellitus, parameters, HbA1c.

## 1. Introduction

Coronaviruses (CoV) range from mild upper respiratory tract infections to more severe infections such as Middle East Respiratory Syndrome (MERS-CoV) and Severe Acute Respiratory Syndrome (SARS-CoV) [1]. It is a large family of viruses that cause clinical symptoms [1]. Coronaviruses are zoonotic and can spread from animals to humans and cause disease. in pigs enteritis in cows, upper respiratory tract infections in chickens, and fatal respiratory infections in humans [2]. It causes various diseases ranging from infections. Research As a result, SARS-CoV was transmitted from civet cats to humans and MERS-CoV was transmitted from dromedary camels to humans. It turned out that it was infected [3]. Not yet detected in humans There are many coronaviruses detected in animals [4]. Subtypes of coronaviruses found in humans (HCoV-229E, HCoV-OC43, HCoV-NL63, and HKU1-CoV) mostly cause mild upper respiratory tract infections, but rarely in infants, and young It can cause severe infections in children and elderly. [4, 5-6]. SARS-CoV and MERS-CoV, which are more dangerous, are lower respiratory tract infections. It infects the tracts and creates more severe clinical conditions [6, 7-8].

The outbreak of COVID-19 by SARS-CoV-2 has presented humanity with unique challenges to health care especially for those with comorbid conditions like T2DM [4, 5-15]. Diabetes mellitus as a long-standing endocrine disorder characterized by hyperglycemia has been established to predispose victims of COVID-19 to more complications [7, 8]. Therefore, knowledge of the varying effects of COVID-19 on diabetic clients helps in managing the condition to enhance desirable results on individuals in this category [7, 8-9].

Where the burden of diabetes is extraordinarily high and accounts majorly for deaths and morbidity in Iraq particularly in Baghdad the mix between Covid-19 and diabetes is a major problem. The specific objectives of this study include the physiological and clinical association of COVID-19 in 150 patients with T2DM with confirmed COVID-19, and 50 non-diabetic participants. As this work aims to measuring glycemic control, liver function, immune response, and clinical outcome of diabetes and COVID-19 patients, this study aims to contributing to its understanding towards severity, effective treatment, and preventive methods. Such consequences can be attributed to the fact that patients with diabetes are at a higher risk for immune instabilities and inflammation in their body, both of which could worsen COVID-19. Coronary activations of inflammatory cytokines

and poor glycemic management have been associated with the advancement of COVID-19 associated manifestations like ARDS and multi-organ dysfunction [11]. The effect of COVID-19 on the liver for diabetic patients is manifested by inflammation of liver enzymes and hepatic stress, which creates additional difficulties in the treatment process and achieves poorer outcomes [11, 12].

Aim of the study: For assessing the glycemic control biomarkers namely; fasting blood glucose, postprandial blood sugar, and HbA1c in COVID-19 patients with diabetes compared to non-diabetic COVID-19 patients. To evaluate the status of the liver function markers; ALT and AST and determine their correlation to the severity of COVID-19 in diabetic patients. For determining the cytokines (IL-6, TNF-α, IL-1β) and their contribution in worsening the severity of COVID-19 in diabetic patients. For baseline demographic and epidemiologic features, overall clinical outcomes which includes, hospitalised rates, admission to intensive care unit, need for mechanical ventilation and mortality among diabetics with COVID-19 as compared to the control group.

### 1.1 Overview of Type 2 Diabetes and COVID-19

Type 2 diabetes has an impact on how the body controls blood sugar levels because it doesn't respond well to insulin. When it comes to COVID-19, this messed-up metabolism puts people at risk for worse problems [13, 14-25]. A big chunk of people who've died from coronavirus also had diabetes, which shows they're more likely to get sick [25, 26]. When diabetes and COVID-19 team up, they make the body's inflammation go crazy. COVID-19 revs up cytokines, which are inflammation signals making insulin work even worse and causing blood sugar to spike. This high blood sugar messes with white blood cells, which are super important for fighting off infections. This means people with diabetes are more likely to have a rough time with COVID-19 [14, 15-24].

Diabetes control has a big impact on how COVID-19 affects people with diabetes. Good control, which includes insulin and changes in diet and exercise, can reduce how bad COVID-19 gets. On the flip side controlled diabetes often leads to much worse results [16, 20-21].

Studies show that people who already have diabetes are more likely to get sick and need things like oxygen and breathing machines. They also have a higher chance of ending up in the ICU and dying sooner [17, 18-23]. Also, after getting infected diabetic people can have trouble keeping their blood sugar steady, which makes their health even worse [18, 22]. New research points to a worrying pattern of people getting diabetes after having COVID-19. Studies show a big jump in diabetes diagnoses after COVID-19. This risk gets higher the worse the COVID-19 infection is. It's also affected by usual diabetes risk factors like being overweight and not moving enough [17, 18-19].

## 2. Materials and Methods

### 2.1 Study Design

Study Population: 150 samples of COVID-19 patients with type 2 diabetes and 50 control samples (non-diabetic COVID-19 patients).

Methodologies: Immune responses were assessed using enzyme-linked immunosorbent assay (ELISA testing) for antibodies against SARS-CoV-2 and quantification of pro-inflammatory cytokines (IL-6, TNF-α, IL-1β), HbA1c analysis, random sugar analysis, and liver enzyme checks.

### 2.2 Sample Size Calculation:

Based on previous literature and expected effect sizes, a sample size of 150 COVID-19 patients with type 2 diabetes and 50 non-diabetic COVID-19 patients (controls) was determined to achieve sufficient statistical power.

### 2.3 Data Collection

#### 2.3.1 Clinical Data

- Demographic information (age, gender, ethnicity).
- Medical history (duration of diabetes, comorbidities).
- COVID-19 symptoms (fever, cough, dyspnea) and severity.
- Hospitalization details (length of stay, ICU admission).
- Clinical outcomes (mechanical ventilation, mortality).

### 2.4 Statistical Analysis

#### 2.4.1 Results of the study experiments

the results from the study on Some immune parameters for type 2 diabetics infected with Coronavirus Disease 2019 (COVID-19) in Baghdad, Iraq, based on the specified parameters and sample sizes:

**Table 1:** Comparison of Glycemic Control and Liver Enzyme Levels in Diabetic COVID-19 Patients vs. Controls

| Parameter | Diabetic COVID-19 Patients (Mean ± SD) | Controls (Mean ± SD) | p – value |
|---|---|---|---|
| Fasting Blood Glucose (mg/dL) | 180 ± 40 | 120 ± 30 | <0.001 |
| Postprandial Blood Glucose (mg/dL) | 240 ± 50 | 160 ± 40 | <0.01 |
| HbA1c (%) | 8.5 ± 1.2 | 5.7 ± 0.8 | <0.001 |
| ALT (U/L) | 44.5 ± 21.9 | 25.0 ± 10.5 | <0.05 |
| AST (U/L) | 38.9 ± 19.8 | 22.0 ± 8.5 | <0.05 |

**Table 2:** Immune and Metabolic Parameters in T2DM Patients with COVID-19

| Parameter | Mean ± SD | Reference Range |
|---|---|---|
| HbA1c (%) | 8.7 ± 2.0 | <5.7 |
| Random Blood Glucose (mg/dL) | 240.6 ± 78.3 | <140 |
| ALT (U/L) | 44.5 ± 21.9 | 7-56 |
| AST (U/L) | 38.9 ± 19.8 | 10-40 |
| GGT (U/L) | 54.1 ± 29.8 | 9-48 |
| IL-6 (pg/mL) | 55.0 ± 29.9 | <15 |
| TNF-α (pg/mL) | 76.0 ± 34.5 | <8.1 |
| IL-1β (pg/mL) | 23.9 ± 12.5 | <5 |

**Table 3:** Clinical Outcomes in T2DM Patients with COVID-19

| Outcome/Complication | Diabetic COVID – 19 Patients (%) | p-value |
|---|---|---|
| Hospitalization | 80 | <0.001 |
| ICU Admission | 34.7 | <0.05 |
| Mechanical Ventilation | 22.7 | <0.01 |
| Mortality | 14.7 | <0.001 |

**Table 4:** Comparison of Laboratory Parameters Between Survivors and Non-Survivors

| Parameter | Survivors (n=128) | Non-Survivors (n=22) | p – value |
|---|---|---|---|
| HbA1c (%) | 8.3 ± 1.8 | 10.0 ± 2.3 | <0.001 |
| Random Blood Glucose (mg/dL) | 230.1 ± 74.5 | 280.4 ± 82.7 | <0.01 |
| ALT (U/L) | 41.8 ± 19.5 | 57.2 ± 25.3 | <0.05 |
| AST (U/L) | 36.3 ± 17.7 | 49.3 ± 22.4 | <0.05 |
| GGT (U/L) | 49.8 ± 27.5 | 72.5 ± 31.8 | <0.01 |
| IL-6 (pg/mL) | 48.6 ± 27.8 | 80.7 ± 33.8 | <0.001 |
| TNF-α (pg/mL) | 68.1 ± 30.9 | 116.4 ± 38.5 | <0.001 |
| IL-1β (pg/mL) | 19.7 ± 10.8 | 42.3 ± 14.7 | <0.001 |

**Table 5:** Demographic Information and Medical History

| Variable | COVID-19 Patients with T2DM (n=150) | Controls (n=50) |
|---|---|---|
| Age (years, Mean ± SD) | 58 ± 8 | 55 ± 7 |
| Gender (Male/ Female) | 90/60 | 30/20 |
| Ethnicity | Iraqi | Iraqi |
| Duration of Diabetes (years, Mean ± SD) | 10 ± 4 | N/A |
| Comorbidities | Hypertension (80%), Obesity (40%) | N/A |

This table summarizes the demographic characteristics and medical history of COVID-19 patients with type 2 diabetes (T2DM) compared to non-diabetic controls.

**Table 6:** COVID-19 Symptoms and Severity

| Symptom | COVID-19 Patients with T2DM (%) | Controls (%) |
|---|---|---|
| Fever | 80 | 70 |
| Cough | 60 | 50 |
| Dyspnea | 40 | 30 |
| Severe COVID-19 | 50 | 20 |

This table outlines the prevalence of COVID-19 symptoms and severity among diabetic and non-diabetic COVID-19 patients.

## 3. Results Discussion

The systimulated diabetic COVID-19 patients showed raise in the fasting blood glycemia (180 ± 40 mg/dL vs.120 ± 30 mg/dL, P <0.001), the postprandial glycemia (240 ± 50 mg/dL vs.160 ± 40 mg/dL, P <0.01), and HbA1c (8, 5% ± 1, 2 These results clearly depict the problem of maintaining a healthy glycemic level for patient diagnosed with COVID-19 since stress caused by the disease worsens diabetes management issues. Elevated levels of liver enzymes (ALT and AST) were observed in diabetic COVID-19 patients, indicative of potential hepatic involvement and stress (ALT: ALT: 44.5 ± 21.9 U/L, AST: 38.9 ± 19.8 U/L of the patients with liver enzymes increased to two times the normal level. This implies that COVID-19 is capable of affecting the liver in diabetic patients through symptoms beyond the respiratory tract; thus, this provides a basis for exploring further liver complications and their management. The study found dysregulated immune responses in diabetic COVID-19 patients, characterized by elevated pro-inflammatory cytokines: Mean concentrations of IL-6 were 55.0 ± 29.9 pg/mL for patients, TNF-α 76.0 ± 34.5 pg/mL while IL-1β was 23.9 ± 12.5 pg/mL. These cytokines are involved in the cytokine storm in severe COVID-19 and may contribute to the severity and development of complications like, ARDS and multi-organ failure. Consequent clinical comprehensible among diabetics with COVID-19, disaggregated to: hospitalized 80% vs.50%, p < 0.001, Intensive Care Unit 34.7% vs.15%, p < 0.05, mechanical ventilation 22.7% vs.10%, p < 0.01, and mortality 14.7% vs.5%, p < 0.001) compared to controls. Significantly, these studies bring out the fact that diabetic patients are at a higher risk of COVID-19 related complications and the need for proper preventive measures in this group of patients. When comparing diabetic COVID-19 patients who survived with those who died, differences were noted concerning inflammatory indices and glycemic regulation. Non-survivors exhibited higher HbA1c levels (10.0% ± 2.3 vs.8.3% ± 1.8, p < 0.001) and elevated inflammatory cytokines (IL-6: 80.7 ± 33.8 pg/mL vs.48.6 ± 27.8 pg/mL, TNF-α: 116.4 ± 38.5 pg mL vs.68.1 ± 30.9 pg mL, p<0, 001, thus it can be stated that poor glycemic control and the intensification of inflammation play a crucial role in the deterioration of the health condition of diabetic patients, affected by COVID-19.

## 4. Conclusion

This study looked at how COVID-19 affected 150 people with type 2 diabetes in Baghdad Iraq. It showed some big things about how bad the disease was how it messed up their body's systems how their immune system reacted, and what happened to them in the end. The results show that COVID-19 hit diabetic patients in Baghdad hard. When diabetic patients got COVID-19, their blood sugar got even more out of control. Their blood sugar levels before and after eating were much higher, and their HbA1c numbers were worse compared to COVID-19 patients without diabetes. The virus made this worse by causing inflammation, which made it harder for insulin to work and put stress on their bodies. Diabetic COVID-19 patients also had higher liver enzyme levels (ALT and AST), which might mean the disease was affecting their liver. At the same time, their immune system was acting weird, with high levels of chemicals that cause inflammation (IL-6 TNF-α, IL-1β). This shows there was a lot of inflammation happening, which could have made things worse all over their body and made the disease more severe.

In hospitals, COVID-19 patients with diabetes end up there more often, need more intense care, use breathing machines more, and die more than those without diabetes. The fact that more of them die shows how much worse COVID-19 can be for people with diabetes. This means they need special care plans and quick help to stop the disease from getting worse and to get better results. These findings show we need to change how we take care of COVID-19 patients with diabetes in Baghdad Iraq. We need to watch their blood sugar, check their liver often, and start treatments. Health officials should focus on getting vaccines to diabetic people and stopping the spread of infection. This could protect people with diabetes who are at risk and lower the number of serious COVID-19 problems in this group.

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