Acta. Chim. Asiana., 2026, 9(1), 803 –807 803
e-ISSN/p-ISSN 2550-0503/2550-049x
Available online at: www.aca.unram.ac.id

RESEARCH PAPER

New-onset diabetes after covid-19: mechanisms, metabolic implications, and clinical insights

*Baneen Sarhan Al-Bderi[a], Abtisam Faris Al-Shukry[a], Emad Abbas Jaffar Al-Mulla[a]**

[a] *College of Health and Medical Techniques, Al-Furat Al-Awsat Technical University, 54001 An-Najaf, Iraq*

Email: almullaemad@atu.edu.iq.

DOI: https://doi.org/10.29303/aca.v9i1.248

Article info:

Received 15/05/2025

Revised 13/01/2026

Accepted 12/04/2026

Available online 31/05/2026

Abstract: COVID-19 primarily affects the lungs, the impact of COVID-19 is not limited to the lungs only, but rather extends to affect other organs and body systems resulting in other complications that continue during the period of infection or beyond that. New onset diabetes and hyperglycemia is one of the complications of this virus. This study aims to investigate some biomarkers (HbA1c, triglycerides and cholesterol) in group of patients with post covid-19 syndrome and patient with post covid-19 hyperglycemia. Blood samples were withdrawn from 100 (50 controls including 25 males and 25 females and 50 patients including 25 males and 25 females) to investigate HbA1c, triglycerides and cholesterol levels. The result of the present study show that HbA1c significantly increased in PCS males (p.value=0.04) and in PCS females (p.value=0.05) in comparison with control males and control females respectively. The results also show that triglycerides have a significant elevation in PCS males (p.value=0.00) and PCS females(p.value=0.04) in comparison with control males and control females respectively. In the other hand cholesterol was non-significant in both groups. Correlation studies also included and show that there is no significant correlation between HbA1c and other measured parameters. Correlation studies also show that Triglycerides had a strong positive correlation with cholesterol in both PCS groups. Post COVID-19 hyperglycemia is a public health problem in concern and affect the body's biochemical markers such as HbA1c and triglycerides reflecting their importance in monitoring the overall health in this group of patients.

Keywords: COVID 19 , Diabetes , Metabolic, Mechanisms , Implications , Clinical Insights ,Corona Viruse , 2 (ACE2) recepto, COBAS system , COBAS system , SARS-CoV-2.

Citation: Al-Mulla, E., Al-Bederi, B. S., & Al-Shukry, A. F. . New-onset diabetes after covid-19: mechanisms, metabolic implications, and clinical insights. *Acta Chimica Asiana*, *9*(1), 803–807. https://doi.org/10.29303/aca.v9i1.248

INTRODUCTION

The first cases of infection with the new Corona virus were was in late December, starting from Wuhan, Hubei Province, China. COVID-19 infection rapidly spreads and causes high mortality rate worldwide [1]. Severe Acute Respiratory Syndrome CoronaVirus-2 (SARS-CoV-2) is the causative agent that causes COVID-19 [2]. A class of viruses known as coronaviruses consists of enclosed, single-stranded, positive-sense RNA viruses that can infect a variety of hosts [3]. Three prominent human coronaviruses include SARS-CoV-1 (The Severe Acute Respiratory Syndrome Coronavirus) in 2002, MERS-CoV (The Middle East Respiratory Syndrome Coronavirus) in 2012, and SARS-CoV-2 (The Current Pandemic's Causative Agent) in 2019 [4]. SARS-CoV-2's spike protein attaches to the receptor unique to each cell which is an angiotensin-converting enzyme 2 (ACE2) receptor that is membrane-bound, facilitating the virus's entry into the host cell [5]. SARS-CoV-2 primarily infect the lower respiratory system causing pneumonia with different severity. However, ACE2 receptor also found in other organ such as the heart, kidney, pancreas, intestinal, and bladder

reflecting the ability of SARS-CoV-2 to cause extrapulmonary disorders [6].

It was found that patient after infection with SARS-COV2 may suffer from elevated levels of their blood glucose even if they were healthy before the infection [7]. Following COVID-19 infection, new-onset diabetes has been observed and In different forms depending on the patient's condition before infection. For example, people who were healthy before infection developed acute hyperglycemia that lasted from weeks to months, and others acquired diabetes as a result of infection with the virus. As for infected people who were previously suffering from diabetes, it appeared in the form of diabetic ketoacidosis [8-10].

The virus that causes COVID-19 is capable of infecting the pancreas, thus affecting its function as an insulin-secreting endocrine gland, causing an imbalance in the amount of insulin secreted, which increases the likelihood of developing diabetes during and after infection [7] In patients with COVID-19, SARS-CoV-2 can affect human pancreatic islets in two different ways. The direct toxic way in which SARS-CoV-2 causes direct injury/localization to pancreatic β-cells throughout ACE2 receptors that expressed by these cells and causes a series of inflammatory damaging events that might cause the emergence of new hyperglycemia. The indirect way is an immune mediated that includes inflammatory-mediated dysfunction of human pancreatic islets which lead to inflammatory new hyperglycemia [11].

MATERIALS AND METHODS

From October 2024 to February 2025, this study was conducted at AL-Diwaniya Educational Hospital. The study consists of 100 participants in all, split into two groups: group A: patients with post covid-19 syndrome without pre-existing diabetes before covid-19 infection (n=50, 25% male and 25% female) and group B: control who had never had appositive COVID-19 test (n=50, 25% male and 25% female).

Sample collection

5 ml of venous blood were collected from patients and healthy individuals under fasted conditions by sterile disposable syringe. The blood sample were transferred to EDTA tubes for HbA1c analysis and coagulate gel tubes for other parameters. To separate plasma, the EDTA tubes were spun for 10 minutes at 2500 rpm, and to separate serum, the coagulate gel tubes were centrifuged for 5 minutes at 4000 rpm. At that point the sera and plasma were stored at (-20℃) until analysis.

METHODS

The plasma HbA1c assay used COBAS system and the Kit company (Cobas c 111, Germany). Triglycerides and cholesterol measurements used spectrophotometric methods and the kits company (BioLabo, France) and (LABORA, Spain) respectively.

Data analysis

For analyzing data, Version 18 of the statistics package for social sciences (SPSS) program was used, and the results are displayed as the mean and standard deviation. To ascertain the differences between two groups, a two-way ANOVA was performed. The connection between the variables was ascertained using Pearson chi square. P.Value is considered statistically significant when it is less than 0.05.

RESULTS AND DISCUSSION

Some metabolic parameters in post covid-19 syndrome patients and control

This study aim is to find out if there were any significant differences in some metabolic parameter between post covid-19 patients and control group. Our results show that post covid-19 syndrome male had a significant elevation in HbA1c level (p.v <0.5) in comparison with control male (mean of PCS male = 5.58±0.94 VS mean of control male = 5.12±0.54). the results also show that post covid-19 syndrome female had a significant elevation in HbA1c level (p.v <0.5) in comparison with control female (mean of PCS female = 5.48± 1.06 VS mean of control female = 4.99±0.65). This is may be duo to many mechanisms that explain the changes that occurs including direct lytic effects and indirect action of SARS-COV2 during the acute phase of infection which lead to insulin insufficiency as a result of disruption of insulin-producing beta cells leading to imbalances in glycemic control and eventually some non-diabetic patients with COVID-19 will develop diabetes. Several studies comparable or agree for our study done by Gandikota et al (2023) [12]. Al Jubury et al., found that found significant differences in HbA1c levels [13]. Our results also show that post COVID-19 syndrome male had an extreme significant elevation in triglycerides level (p.v <0.5) in comparison with control male (mean of PCS male = 216.84±77.19 VS mean of control male = 134.28±36.44). the results also show that post COVID-19 syndrome female had a significant elevation in triglycerides level (p.v <0.5) in comparison with control female (mean of PCS

female = 142.88± 77.97 VS mean of control female = 109.0±22.49). The increase in triglycerides level during the active phase of COVID-19 infection and subsequently may be directly caused by the effect of the infection itself in which the immune responses that involve immune cell activation, including macrophages and these cells synthesize and secrete TG in response to blood HDL and ApoA1 levels causing high blood TG levels or indirectly by treatments admitted to those patients during infection such as tocilizumab or propofol (lipid containing), which have both previously been reported to cause high blood TG levels or by behavioural factors at play throughout the recuperation phase, such diet indulgence after taste returns or the joy of survival, or decreased physical activity as a result of post-viral sluggishness and ongoing loss of exercise ability [14-16]. Several studies comparable or agree for our study done [17] and Almulla et al (2025) that found significant increases in blood triglycerides level after COVID-19 infection [18]. In the other hand, the result in show that cholesterol had no significant differences (p.value > 0.05) between post COVID-19 male and control male (mean of PCS male =190.0±50.04 VS mean of control male =165.12±41.07) and between female as well (p.value>0.05) when compared (mean of PCS female = 185.32± 48.75 VS mean in control female = 170.0±40.39)

Table 1: The mean and standard deviation of HbA1c, triglycerides and cholesterol in post COVID-19 syndrome patients and control groups

VARIABLES	GROUPS	MEAN ±SD	P-VALUE
HBA1C	PCS male	5.58±0.94	0.04
	Control male	5.12±0.54	
	PCS female	5.48± 1.06	0.05
	Control female	4.99±0.65	
TRIGLYCERIDES	PCS male	216.84±77.19	0.00
	Control male	134.28±36.44	
	PCS female	142.88± 77.97	0.04
	Control female	109.0±22.49	
CHOLESTEROL	PCS male	190.0±50.04	0.06
	Control male	165.12±41.07	
	PCS female	185.32± 48.75	0.23
	Control female	170.0±40.39	

PCS: post COVID-19 syndrome; SD, standard deviation.

Next, we investigated the correlation between parameters. Our results show that neither triglycerides nor cholesterol correlated with HbA1c in both male and female with post covid-19 syndrome as shown in Table 3.

Table 3: Correlation of HbA1c with triglycerides and cholesterol.

	Sex		Cholesterol	Triglycerides
HbA1c	**Male**	**r**	0.080	0.062
		P	0.583	0.670
	Female	**r**	0.163	0.057
		P	0.257	0.692

*Correlation is significant at 0.05(2-tailed) and at 0.01(2-tailed).

In Table 4, statistically there is significant positive correlation in post covid-19 male between triglycerides and cholesterol (p.value =0.02), r= 0.32 show that positive correlation occurs between triglycerides and cholesterol. In post covid-19 females, strong positive correlation occurs between triglycerides and cholesterol with p.value=0.00 and r =0.39. No significant correlation occurs between

triglycerides and HbA1c in both males and females with post covid-19 syndrome.

Table 4: Correlation of triglycerides with HbA1c and cholesterol.

	Sex		HbA1c	Cholesterol
Triglycerides	**PCS Male**	**r**	0.06	0.32*
		P	0.67	0.02
	PCS Female	**r**	0.05	0.39**
		P	0.69	0.00

*Correlation is significant at 0.05(2-tailed) and at 0.01(2-tailed).

The results in Table 5 show there is significant positive correlation in post covid-19 male between cholesterol and triglycerides (p.value =0.02), r= 0.32 show that positive correlation occurs between triglycerides and cholesterol. In post covid-19 females, strong positive correlation occurs between and cholesterol triglycerides with p.value=0.00 and r =0.39. the study done by Roccaforte et al (2021) found that triglycerides and cholesterol are both high after recovery suggesting the positive correlation between them. No significant correlation occurs between cholesterol and HbA1c in both males and females with post covid-19 syndrome [19].

Table 5: Correlation of cholesterol with HbA1c and triglycerides.

	Sex		HbA1c	Triglycerides
Cholesterol	**PCS Male**	**r**	0.08	0.32*
		P	0.58	0.02
	PCS Female	**r**	0.16	0.39**
		P	0.25	0.00

*Correlation is significant at 0.05(2-tailed) and at 0.01(2-tailed).

CONCLUSION

We conclude that new onset diabetes after covid-19 infection is a novel health issue. The elevated levels of HbA1c reflect its importance as a predictor for chronic hyperglycemia and its usefulness in monitoring the glycemic control in post covid-19 patients with chronic hyperglycemia or those who develop post covid-19 diabetes.

REFERENCES

[1] Yang, L., et al., *COVID-19: immunopathogenesis and Immunotherapeutics.* Signal transduction and targeted therapy, 2020. **5**(1): p. 128.

[2] Jin, Y., et al., *Virology, epidemiology, pathogenesis, and control of COVID-19.* Viruses, 2020. **12**(4): p. 372.

[3] Mohamadian, M., et al., *COVID-19: Virology, biology and novel laboratory diagnosis.* The journal of gene medicine, 2021. **23**(2): p. e3303.

[4] Goyal, R., et al., *Comparative highlights on MERS-CoV, SARS-CoV-1, SARS-CoV-2, and NEO-CoV.* EXCLI journal, 2022. **21**: p. 1245.

[5] Alshawi, A. and A.F. Al-Shukry, *Increases Aspartate Aminotransferase Activity Negatively Correlated with D-Dimer in Early Diagnosed SARS-CoV-2 Patients.* Pharmacophore, 2021. **12**(5-2021): p. 85-91.

[6] Perrotta, F., et al., *Severe respiratory SARS-CoV2 infection: Does ACE2 receptor matter?* Respiratory medicine, 2020. **168**: p. 105996.

[7] Metwally, A.A., et al., *COVID-19–induced new-onset diabetes: trends and technologies.* Diabetes, 2021. **70**(12): p. 2733-2744.

[8] Chee, Y.J., S.J.H. Ng, and E. Yeoh, *Diabetic ketoacidosis precipitated by Covid-19 in a patient with newly diagnosed diabetes mellitus.* Diabetes research and clinical practice, 2020. **164**: p. 108166.

[9] Fadini, G.P., et al., *Newly-diagnosed diabetes and admission hyperglycemia predict COVID-19 severity by aggravating respiratory deterioration.* Diabetes research and clinical practice, 2020. **168**: p. 108374.

[10] Rubino, F., et al., *New-onset diabetes in Covid-19.* New England Journal of Medicine, 2020. **383**(8): p. 789-790.

[11] Ben Nasr, M., et al., *Indirect and direct effects of SARS-CoV-2 on human pancreatic islets.* Diabetes, 2022. **71**(7): p. 1579-1590.

[12] Gandikota, S., K.S. Sudha, and M.L. Naramalli, *Study of HbA1c levels in non-diabetic individuals recovered from Covid-19.* Journal of Family Medicine and Primary Care, 2023. **12**(11): p. 2727-2732.
[13] Al-Jubury, K., et al., *D-dimer and HbA1c levels findings in COVID-19 Iraqi patients.* Brazilian Journal of Biology, 2023. **84**: p. e266823.
[14] Ebrahimi, K.H. and J.S. McCullagh, *A lipidomic view of SARS-CoV-2.* Bioscience Reports, 2021. **41**(8): p. BSR20210953.
[15] Fijen, L.M., et al., *Severe acquired hypertriglyceridemia following COVID-19.* BMJ Case Reports CP, 2021. **14**(11): p. e246698.
[16] Durrington, P., *Blood lipids after COVID-19 infection.* The Lancet Diabetes & Endocrinology, 2023. **11**(2): p. 68-69.
[17] Xu, E., Y. Xie, and Z. Al-Aly, *Risks and burdens of incident dyslipidaemia in long COVID: a cohort study.* The Lancet Diabetes & Endocrinology, 2023. **11**(2): p. 120-128.
[18] Almulla, A.F., et al., *Elevated Atherogenicity in Long COVID: A Systematic Review and Meta-Analysis.* medRxiv, 2025: p. 2025.01. 06.25320068.
[19] Roccaforte, V., et al., *Altered lipid profile in patients with COVID-19 infection.* Journal of Laboratory and Precision Medicine, 2021. **6**.