Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i17.2585

RENAL FUNCTION, LIVER FUNCTION, AND LIPID PROFILE STATE IN SUBJECTS AFTER HEALING FROM COVID-19 INFECTION

Israa H. Ibrahim[1*], Mena Y. Abd[2], Murtadha Matai Al-Fatlawi[3]

[1*]College of Nursing, University of Warith Al-Anbiyaa, Iraq, College of Dentistry, University of Kerbala, Iraq, email: Israa.ha@uowa.edu.iq, ORCID ID: 0000-0002-3649-1070
[2]College of Nursing, University of Warith Al-Anbiyaa, Iraq, College of Medicine, University of Kerbala, Iraq, Email: mena@uowa.edu.iq, ORCID ID: 0009-0003-6346-9375
[3]College of Administration and Economics, University of Warith Al-Anbiyaa, Iraq, Email: Murtadhd.mu@uowa.edu.iq, ORCID ID:

***Corresponding Author:** Israa H. Ibrahim
*College of Nursing, University of Warith Al-Anbiyaa, Iraq, College of Dentistry, University of Kerbala, Iraq, email: Israa.ha@uowa.edu.iq, ORCID ID: 0000-0002-3649-1070

Abstract:
Background: Coronavirus belongs to the Coronaviridae family, Nidovirales order. Coronaviruses are separated into four genera and β- COVs only infect mammals. Human COVs consist of α- COVs (229E and NL63), β- COVs (OC43 and HKU1), the Middle East respiratory syndrome-related coronavirus (MERS-COV), and SARS-COV.

Aim of Study: to evaluate the effect of infection with coronavirus on liver and renal function and also the effect on lipid profile according to the duration after healing.

Materials and Methods: the persons were divided according to the duration after healing to ≤3, ≤6, >6 months, and the human samples were taken from a private laboratory for renal function, liver function, and lipid profile.

Results: the results show a significant increase in S.ALT, S.AST, and S.TSB in some groups and there were no significant differences in other parameters.

In conclusion there was no effect of COVID-19 on the function of the kidney as well as lipid profile but may have a reversible effect on liver function and the needs for more long-term studies are very important.

Keywords: Coronavirus, COVID-19, liver function

Introduction:

Coronavirus belongs to the Coronaviridae family, Nidovirales order. Coronaviruses are separated into four genera as follows: α-, β-, γ-, and δ- COV. α- and β- COVs only infect mammals, but γ- and δ- COVs mostly infect birds. Human COVs consist of α- COVs (229E and NL63), β- COVs (OC43 and

HKU1), the Middle East respiratory syndrome-related coronavirus (MERS-COV), and SARS-COV (Zhu *et al*., 2019).

The genomic and phylogenic analysis showed that the COV causing COVID-19 is a β- COV in the identical subgenus as the SARS virus, but the virus that was recognized as a COV had >95% homology with the bat COV and >70%resemblance with the SARS-COV (Xinhua, 2020).

The analogous between COV and SARS-COV is the structure of the receptor-binding gene region thus they utilize the same receptor for entrance into the respiratory cells which that angiotensin-converting enzyme 2 (ACE2) (Zhou *et al.*, 2020).

Coronaviruses are large, enveloped, single-stranded RNA viruses found in humans and other mammals, such as dogs, cats, chickens, cattle, pigs, and birds. The first coronavirus that caused severe disease was severe acute respiratory syndrome (SARS), which was thought to originate in Foshan, China, and resulted in the 2002-2003 SARS-COV pandemic (Zhong *et al*., 2003).

The second was the coronavirus-caused Middle East respiratory syndrome (MERS), which originated in the Arabian Peninsula in 2012 (Zaki *et al.*, 2012).

Coronaviruses do not only cause respiratory diseases, but also can cause gastrointestinal, and neurological diseases. The most common coronaviruses in clinical practice are 229E, OC43, NL63, and HKU, which typically cause common cold symptoms in immunocompetent individuals. SARS-CoV-2 is the third coronavirus that has caused severe disease in humans to spread globally in the past two decades (Zhu *et al*., 2019).

Aim of Study:
To evaluate the effect of infection with coronavirus on renal function, liver function, and the state of lipid profile according to the duration after healing.

Materials and Methods:
Blood samples were taken in the private clinical laboratory (Al-Jawadeen Laboratory) for people with previously infected with coronavirus and recovered for one year or less, their ages ranged from (20-45 years). The study included a questionnaire for demographic study which contain gender, age, type of supplement taken before infection, during infection, and after infection, and if found any chronic diseases. The number of samples taken was 64 samples (22 males and 42 females). The persons were divided into three groups according to time of infection (less than 3 months ago, less than 6 months ago, and more than 6 months ago).

The parameters tested using blood were renal function test, liver function test, and lipid profile by using an automated device. Also, microalbuminuria in urine was tested by using strips. Cystatin C was measured using the ELISA technique.

Statistical Analysis: Statistical analyses were performed by using Microsoft Office Excel 2019. The results are represented as Number, %, and mean ± S.D. The analyses of variances were made by using One Way ANOVA.

Results:
The results of a recent study revealed that Table 1 (Demographic study) show that the persons who had nutrition supplement before infection were 91% while the percentage of persons who had nutrition supplement during infection was 44% and after infection there was 88%. The percent of persons who have chronic disease was 25% compared with the others who do not have (75%).

Table 1 : Demographic Study

Parameters	No.	%
Gender : male female	 22 42	 34% 66%
supplement before infection	Yes = 58 No = 6	91% 9%
supplement during infection	Yes =28 No = 36	44% 56%
supplement after infection	Yes = 8 No = 56	88% 12%
Duration from infection to the data of collection of samples: ≤ 3 months ≤ 6 months >6 months	 12 26 26	 19% 40.50% 40.5%
chronic diseases	Yes= 16 No= 48	25% 75%

Table 2 shows the comparison among groups (in the renal function) that are divided according to time of infection (less than 3 months ago, less than 6 months ago, and more than 6 months ago). The result reveals no significant differences among the three groups, especially Cystatin C levels. While in Table 3 the comparison in liver function shows a significant increase in S.ALT in the ≤6 months group and >6 months group in comparison with ≤3 months group. S.AST show a significant increase in the ≤6 months group in comparison with ≤3 months group and show a significant increase in the>6 months group in comparison with ≤6 months. Also, there was an increase in S.TSB in the ≤6 months group in comparison with ≤3 months group and in the>6 months group in comparison with ≤6 months group.

Table 2: Comparison among groups divided according to the duration after healing to ≤3, ≤6, >6 months in the renal function

duration after healing of infection	≤3 months	≤6 months	>6 months
No. of persons	12	26	26
parameters			
S. Urea mg/dl	28.348±4.936	30.149±5.740	29.813±9.868
S. Uric Acid	4.648±1.187	4.968±1.038	5.262±1.745
S. glucose	114.762±27.198	117.006±36.788	128.724±41.246
Microalbuminuria	16.667±10.328	26.923±33.263	14.5±8.317
S. Cystatin C	0.3±0.053	0.468±0.394	0.506±0.585

The results are represented as Mean ± S.D., *P* value ≤ 0.05.
[a] The results show significant differences at *P* ≤ 0.05 in comparison with the first group.
[b] The results show significant differences at *P* ≤ 0.05 in comparison with the second group.

Table 3: Comparison among groups divided according to the duration after healing to ≤3, ≤6, >6 months in the liver function

duration after healing of infection	≤3 months	≤6 months	>6 months
No. of persons	12	26	26
parameters			
S. ALT	14.793±5.225	46.904±22.601[a]	34.987±16.725[a]
S.AST	16.34±4.289	29.239±13.494[a]	19.089±7.164[b]
S. ALP	69.505±19.129	99.613±78.250	71.896±24.377
S. TSB	0.467±0.121	0.762±0.214[a]	0.477±0.142[b]

The results are represented as Mean ± S.D., *P* value ≤ 0.05.
[a] The results show significant differences at *P* ≤ 0.05 in comparison with the first group.
[b] The results show significant differences at *P* ≤ 0.05 in comparison with the second group.

In Table 4 the comparison among groups divided according to the duration after healing to ≤3, ≤6, >6 months in the lipids profile shows no significant differences among these groups.

Table 4: Comparison among groups divided according to the duration after healing to ≤3, ≤6, >6 months in the lipids profile

duration after healing of infection	≤3 months	≤6 months	>6 months
No. of persons	12	26	26
parameters			
Cholesterol mg/dl	226.263±43.330	200.674±43.859	217.696±43.092
Triglyceride mg/dl	144.713±67.736	158.492±85.808	226.139±156.319
S. HDL mg/dl	48.538±10.695	43.907±7.170	46.599±7.948
S. LDL mg/dl	148.833±33.367	124.846±36.572	125.846±47.571
S. VLDL	28.95±13.538	31.577±17.096	45.162±31.242

The results are represented as Mean ± S.D., P value ≤ 0.05.
[a] The results show significant differences at $P \leq 0.05$ in comparison with the first group.
[b] The results show significant differences at $P \leq 0.05$ in comparison with the second group.

Discussion:

table 1 show that the largest percentage of persons administrate nutrition supplement before the infection to avoid the effect of the virus and to support immunity and this state may make the virus has no virulence effects on those persons

Table 2 for the effect of coronavirus on renal function shows no significant effect and this result agrees with other research that show there was no effect of the virus on renal function with the exclusive reason (Marchioricoronavirus *et al.*, 2021). While another study shows a significant correlation between renal insufficiency and infection with COVID-19 (Noori Ali *et al.*, 2021).

We notice in Table 3 that there was a significant increase in S.ALT in groups ≤6 months and >6 months after healing in comparison with group ≤3 months, also we show a significant increase in S.AST in the ≤6 months group in comparison with ≤3 months group and a significant increase in the>6 months group in comparison with the ≤6 months group. The same table for the S.TSB test shows a significant increase in the ≤6 months group in comparison with ≤3 months group and a significant increase in the>6 months group in comparison with the ≤6 months group. These results may reveal impairment in the liver function of the subjects after healing from COVID-19. And for these three tests, the concentration after more than 6 months of healing is lower than the concentration after less than 6 months of healing and this may indicate reversible damage to the liver occurs temporarily after infection.

These results were compatible with a study on hospitalized patients in China during infected with COVID-19 referred that most patients have hepatic injuries according to abnormal liver function and they mention that the cause for these abnormalities may be because of medications they administrated during the period of hospitalization (Cai et al., 2020)

Another research case report that shows COVID-19 may cause liver damage (Grzywa-Celińska *et al.*, 2021), and another study shows that abnormalities in the liver function test were very common among patients infected with COVID-19 (Abdelrahman *et al.*, 2021).

The elevation in the concentration of enzymes most noted in S.ALT (Elghannam *et al.*, 2022) and the damage to the liver after infection with COVID-19 may be temporary and return to normal function at the end of the 12-month follow-up (Liao *et al.*, 2022). These agree with other studies that show the abnormal liver function test may persist after admission and disappear after one year of discharge and long-term monitoring is necessary (Zhu *et al.*, 2022).

Table 4 shows the results of the lipid profile for three groups of subjects that reveal no significant changes in these tests for the three groups.

Other research shows that hypolipidemia may develop in COVID-19 patients and there was a negative correlation between the levels of lipids and the severity of viral infection (Almas *et al*., 2022). Also, research during infection reveals that the level of lipid profile correlate with the severity of the disease, and it is a useful indicator for the severity of COVID-19 infection (Changaripour *et al*., 2022).

Conclusion:

Coronavirus or COVID-19 has no effect on renal function, and lipide profile after healing at least for a short-term time. But COVID-19 may cause reversible damage to the liver and this return to normal after 6 months of healing. Thus, we recommended a long-term study of the effect of COVID-19 on the human body.

References:

1. Abdullah Ali Mohammed, Mahmood Nazar Mustafa, Sura A. Abdulsattar, Ahmed Salam Al-zaidi. (2021) COVID 19: Evaluate of Liver and Renal Function Tests in Iraqi Patients. *Medico-legal Update*, Vol. 21, No. 1.
2. Herget-Rosenthal S, Bokenkamp A, Hofmann W (2007) How to estimate GFR-serum creatinine, serum cystatin C or equations? *Clin Biochem* 40:153–161. https:// doi. org/ 10. 1016/j. Clin Biochem. 2006. 10. 014.
3. Xinhua. China's CDC detects a large number of new coronaviruses in the South China seafood market in Wuhan. Available from: URL: https://www.xinhuanet.com/2020-01/27/c_1125504355.htm. Accessed, February 20, 2020.)
4. Zaki AM, van Boheemen S, Bestebroer TM, Osterhaus AD, Fouchier RA. (2012) Isolation of a novel coronavirus from a man with pneumonia in Saudi Arabia. *N Engl J Med*.; 367(19):1814-1820
5. Zhong NS, Zheng BJ, Li YM, et al. (2003) Epidemiology and cause of severe acute respiratory syndrome (SARS) in Guangdong, People's Republic of China. *Lancet*, 362(9393):1353-1358.
6. Zhou P, Yang XL, Wang XG, Hu B, Zhang L, Zhang W, et al. (2020) A pneumonia outbreak associated with a new coronavirus of probable bat origin. *Nature*, 579(7798): 270–3
7. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. (2020) China Novel Coronavirus Investigating and Research Team. A Novel Coronavirus from Patients with Pneumonia in China. *N Engl J Med*, 382(8): 727–33.
8. Marchiori JS, de Oliveira MAS, Bezerra IMP. (2021) COVID-19 and its relationship with kidney diseases: a scoping review. *J Hum Growth Dev.* 31(3):533-548. DOI:10.36311/jihad.v31.12782.
9. Noori Ali, Roaa; Fadhil Alasadi, Yusor; Isam Jameel, Zahraa (2021) Estimation some Kidney function parameters among COVID-19 Patients in Kerbala province. *Archivos Venezolanos de Farmacología y Terapéutica*, vol. 40, núm. 7, Sociedad Venezolana de Farmacología Clínica y Terapéutica, República Bolivariana de Venezuela Disponible en: https://www.redalyc.org/articulo.oa?id=55971545014
10. Grzywa-Celińska, A., Emeryk-Maksymiuk, J., Szewczyk, K., Krusiński, A., Celiński, R., Milanowski, J. (2021). Acute liver injury in the course of COVID-19. *Ann Agric Environ Med.*, 28(4), 729-732. https://doi.org/10.26444/aaem/142232
11. Elghannam, M. T., Hassanien, M. H., Ameen, Y. A., ELattar, G. M., ELRay, A. A., Turky, E. A., & ELTalkawy, M. D. (2022). COVID-19 and liver diseases. *Egyptian Liver Journal*, *12*(1), 1-9. https://doi.org/10.1186/s43066-022-00202-2.

12. Abdelrahman, M. M., Younis, M. A., Mahmoud, M. G., & Shafik, N. S. (2021). Liver function test abnormalities in COVID-19 patients and factors affecting them – a retrospective study. *Clinical and Experimental Hepatology*, *7*(3), 297-304. https://doi.org/10.5114/ceh.2021.109225.
13. Cai, Q., Huang, D., Yu, H., Zhu, Z., Xia, Z., Su, Y., Li, Z., Zhou, G., Gou, J., Qu, J., Sun, Y., Liu, Y., He, Q., Chen, J., Liu, L., & Xu, L. (2020). COVID-19: Abnormal liver function tests. *Journal of hepatology*, *73*(3), 566–574. https://doi.org/10.1016/j.jhep.2020.04.006.
14. Liao, X., Li, D., Ma, Z., Zhang, L., Zheng, B., Li, Z., Li, G., Liu, L., & Zhang, Z. (2022). 12-Month Post-Discharge Liver Function Test Abnormalities Among Patients With COVID-19: A Single-Center Prospective Cohort Study. *Frontiers in Cellular and Infection Microbiology*, *12*. https://doi.org/10.3389/fcimb.2022.864933.
15. Zhu X, Wang J, Du J, Chen S, Chen S, Li J, Shen B. (2022) Changes in Serum Liver Function for Patients with COVID-19: A 1-Year Follow-Up Study. *Infect Drug Resist*. 15:1857-1870 https://doi.org/10.2147/IDR.S356181.
16. Almas, T., Malik, J., Alsubai, A. K., Ehtesham, M., Laique, T., Ishaq, U., Mehmood, A., Jawad Zaidi, S. M., Hadeed, S., Huang, H., & Oruk, M. (2022). Effect of COVID-19 on lipid profile parameters and its correlation with acute phase reactants: A single-center retrospective analysis. *Annals of Medicine and Surgery*, *78*, 103856. https://doi.org/10.1016/j.amsu.2022.103856
17. Changaripour, S., Sarvazad, H., Barghi, M., Sajadi, E., Sadeghian, M. H., & Roozbahani, N. E. (2022). Lipid profile changes in patients with COVID-19 referred to medical centers in Kermanshah, Iran; a case–control study. *Journal of International Medical Research*. https://doi.org/10.1177/03000605221078699