



Research Article

The impact of IgG and IgM levels on clinical symptoms of people who have recovered from SARS-Cov-2

Enass Waad Al-hadidi and Mahmoud Abduljabbar Altobji[✉]

Department. of Biology, College of Science, University of Mosul, Mosul, Iraq

✉ Corresponding Author: Enass.scp23@student.uomosul.edu.iq

Received: Aug 9, 2022/ Revised: Sept 1, 2022/ Accepted: Sept 23, 2022

Abstract

The factors that influence SARS-CoV-2 antibody development are currently unknown. This study aims to detect these factors in COVID-19 patients who have recovered. ELISA was used to measure IgG and IgM levels in 188 serum samples. The results showed that 94.03% of patients had IgG and 5.22% had IgM. IgG concentrations peaked at 6 months after infection, while IgM concentrations peaked at 8 months after infection. This study revealed that the fever, joint, and muscle discomfort had the greatest percentages of 75% and 27.9%, respectively, with a significant association with IgG. There is a correlation between IgM and conjunctivitis at $P < 0.01$. IgG and IgM levels correlate with age (15-35years). The varied levels of IgG and IgM have a distinct and visible effect on the overall clinical symptoms, with or without a correlation. The understanding of several biological and serological factors in patients who have recovered may be useful in this effort.

Keywords COVID-19, anti-SARS-CoV-2 IgG, IgM

Introduction

Despite the emergence of new strains, coronavirus remains a menace to the world (Dawood, 2022). Thousands of people died as a result of the damage, and many more experienced physiological alterations (Guan et al., 2020). Furthermore, some of the restored individuals experienced long-term problems (Abou-Ismaïl et al., 2020).

The clinical manifestations of COVID-19 infection range from asymptomatic carriers to acute respiratory distress syndrome and numerous organ failures. Immune function may be crucial in SARS-CoV-2 infection. Antibodies are essential components of the immune response to viral infections. Serological testing has far-reaching consequences for epidemiological studies, therapies, and vaccine development (Kumar et al., 2021).

Several serological techniques have been developed to detect IgG and IgM against viral proteins, however, these tests face the same issues of delayed positive host immune function and

cross-reactivity to other coronaviruses. The lack of a standard laboratory diagnosis algorithm might thus significantly impede the design of epidemiological surveys and therapeutic trials (Hu et al., 2021; Oztruk et al., 2020).

Coagulopathy, which manifests as venous and arterial thromboembolism, leads to complications with poor results (Amir et al., 2020). The severity of the condition is connected to the number of neutrophils, lymphocyte qualification, lymphocyte proportion, and platelet count. Individuals infected with COVID-19 now have a greatly higher chance of getting a stroke (Tang et al., 2020; Gorbalenya et al., 2020).

The purpose of this study was to detect the IgG and IgM levels in the serum of recovering people from COVID-19 using ELISA. The influence of antibody levels on the pathological symptoms associated with these people was neutralized.

Materials and Methods

From October 2020 to March 2021, 92 blood samples were obtained for this study. After 4 months, 67 of these persons recovered from COVID-19, and 25 blood samples served as controls. The participants ranged in age from 17 to 75 years old. Patients' data and clinical symptoms that occurred throughout the infection and the concomitant diseases and therapy were also recorded. The IgG and IgM levels were detected using ELISA (American Accu-Bind Company).

SPSS version 25 was used to perform statistical analysis on the results. The standard mean, standard error, and standard deviation were all calculated using (Descriptive analysis). Pearson test two details were used to derive significant correlations at $P < 0.01$ and $P < 0.05$.

Results and discussion

The ELISA approach was utilized to identify the presence of IgG and IgM in SARS-COV-2 samples, with a total of 67 samples diagnosed. The test was performed on 25 samples of control who did not show any symptoms of illness, and 63 of them provided a positive result for IgG 94.03%. IgM was detected in 37 persons 55.22%, compared to 22 in control samples 88%.

The people were separated into groups based on clinical signs, as shown in [Table 1](#).

Table 1. Clinical signs of the people under study and their percentages

Clinical symptoms	Total No.	No. of Infections	%
Fever	48	36	75
Muscle and joint pain	48	35	72.91
Loss of sense of smell and taste	48	32	66.7
Headache	48	26	54.16
Sore throat	48	20	41.7
Dry cough	48	18	37.5
Diarrhea	48	16	33.33
Hard breathing	48	13	27.08
Vomiting	48	4	8.33
Conjunctivitis	48	2	4.16

Clinical indications develop in persons during the outset of COVID-19 infection. Forty-eight participants were selected from those with a high content of IgG. The most relevant clinical symptoms were found four months after infection. In general, 75% of people had a fever, 72.91% had muscular and joint pain, 66.7% had a loss of smell and taste, headache 54.16%, sore throat 41.7%, dry cough 37.5%, diarrhea 33.33%, hard breathing 27.08%, and vomiting 8.33%.

A study conducted on 100 persons in North Carolina, encompassing both sexes, recorded that the intensity of clinical symptoms ranged from mild to severe, with overall fatigue appearing to be the highest at 89%, headache at 77%, fever at 74%, and muscle pain 73% ([Markman et al., 2021](#)). This differs from the results obtained from this study. Another study was conducted on 62,000 verified COVID-19 cases. Clinical signs included fever at 87%, pneumonia at 82%, cough at 73%, and shortness of breath at 48% ([Minh et al., 2019](#)). This is consistent with the findings of this investigation. Another study was undertaken in China, and the most common clinical signs were fever 83.3%, cough 60.3%, and fatigue 38.0% ([Fu et al., 2020](#)).

According to several studies, the most common clinical signs of COVID-19 are fever, cough, and exhaustion, with congestion, runny nose, sore throat, and diarrhea being uncommon ([Chen et. al, 2020](#); [Li et al., 2020](#)).

Another study, which included 3062 individuals from China, looked at the clinical characteristics of COVID-19 patients. The following are the most common symptoms: fever 80.4%, weariness 46%, cough 63.1%, phlegm 41.8%, muscle pain 33%, lack of appetite 38.8%, chest tightness (35.7%), and difficulty breathing 35% ([Zhu et al., 2020](#)).

The average IgG concentration for the SARS-COV-2 virus for the three study periods and according to clinical symptoms is provided in [Table 2](#). The highest level for the first period was 39.22U/ml for diarrhea and 39.66U/ml for vomiting. In the second session, those who vomited had the greatest rate of IgG 47.07 U/ml. Those suffering from conjunctivitis had the highest level in the third period 41.03 U/ml.

There is a significant correlation between fever and headache cases at $P < 0.01$. Furthermore, at $P < 0.05$, there was a significant correlation between the loss of smell and taste, as well as heavy breathing in the third period. There was also a significant association between muscle and joint pain and IgG level at $P < 0.05$ in the third period.

According to the clinical symptoms, the IgM level declined across the three periods. The highest level of IgM was seen in the first period among individuals with conjunctivitis at 19.52 U/ml. In the second phase, those with conjunctivitis had the highest levels of IgM 19.15 U/ml. In the third phase, those suffering from sore throat had the highest IgM level 17.43 U/ml, [Table 3](#).

At $P < 0.01$, there was a significant correlation between conjunctivitis cases and IgM levels in the first period. There was a significant correlation between headache instances and IgM level in the first period at $P < 0.05$, and the cases of muscle and joint pain with IgM level in the second period at

Table 2. IgG level for the three periods according to clinical symptoms. *: P > 0.05, ** P < 0.05

*** P < 0.01

Clinical symptoms	IgG Concentration Rate (IU/ml)		
	IgG 4 M ±Std Error	IgG 6 M ± Std Error	IgG 8 M ± Std Error
Fever	34.23± 1.91*	43.43± .780*	38.85 ± 1.48*
Muscle and joint pain	33.4± 1.92*	43.51 ± .740*	39.19±1.29**
Loss of sense of smell and taste	34.26± 1.83*	44.05 ± 0.80*	39.12±1.34**
Headache	33.7 ± 2.13*	43.56 ± .920*	38.93 ± 1.66*
Sore throat	32.74± 1.90*	44.23 ± 0.79*	39.22 ± 1.27*
dry cough	36.83± 5.71*	44.36 ± 5.71*	39.88 ± 5.71*
Diarrhea	39.66±2.37***	46.2 ± 1.2***	40.47 ± 2.2*
hard breathing	35.55 ± 2.53*	45.18 ± 1.38*	40.8 ± 1.60*
Vomiting	39.22 ± 7.85*	47.07 ± 1.42*	40.11 ± 6.56*
Conjunctivitis	42.4± .590*	43.01 ± 3.25*	41.03 ± .270*

P< 0.05. There were additional correlations found between the various clinical symptoms at P< 0.01, 0.05, Table 3.

Table 3. IgM level for the three periods according to clinical symptoms. *: P > 0.05, ** P < 0.05

*** P < 0.01

Clinical symptoms	IgG Concentration Rate (IU/ml)		
	IgG 4 M ±Std Error	IgG 6 M ±Std Error	IgG 8 M ±Std Error
Fever	34.23 ± 1.91*	43.43± .780*	38.85 ± 1.48*
Muscle and joint pain	33.4± 1.92*	43.51 ± .740**	39.19 ± 1.29*
Loss of sense of smell and taste	34.26 ± 1.83*	44.05 ± 0.80*	39.12 ± 1.34*
Headache	33.7 ± 2.13**	43.56 ± .920*	38.93 ± 1.66*
Sore throat	32.74 ± 1.90*	44.23 ± 0.79*	39.22 ± 1.27*
dry cough	36.83 ± 5.71*	44.36 ± 5.71*	39.88 ± 5.71*
Diarrhea	39.66 ± 2.37*	46.2 ± 1.2*	40.47 ± 2.2*
hard breathing	35.55 ± 2.53*	45.18 ± 1.38*	40.8 ± 1.60*
vomiting	39.22 ± 7.85*	47.07 ± 1.42*	40.11 ± 6.56*
Conjunctivitis	42.4± .590***	43.01 ± 3.25*	41.03 ± .270*

An American study of 113 persons recovering from COVID-19 revealed correlations between high levels of antibodies against SARS-CoV-2 and the following clinical symptoms: fever, decreased appetite, abdominal pain, and diarrhea. Low antibody titers have been correlated to body aches, headaches, nausea, vomiting, chills and hard breathing, chest tightness, sore throat, loss of taste, and a runny or stuffy nose (Amjadi et al., 2021).

Another study, with 6098 individuals in northeastern Italy, recorded that overall weakness, runny nose, and headache were the most prevalent symptoms (Stefanelli et al., 2021). Due to the vast number of samples, this result differs from ours. IgG positive was substantially related to loss of smell and loss of taste. Other symptoms, such as a sore throat, a headache, a runny nose, photophobia, and conjunctivitis, were not linked to IgG levels (Stefanelli et al., 2021).

A study in Denmark comprised 350 people who had previously tested positive for RT-PCR. Fatigue, chest pain, loss of appetite, fever, shortness of breath, nausea, cough, diarrhea, and stomach pain were all positively and substantially correlated with IgG levels. Lack of symptoms, nasal congestion, pharyngeal pain, headache, muscle, and joint aches, and loss of smell and taste were not connected with low IgG levels (Hansen et al., 2021). IgM levels were found to be positively and significantly related to fever, hard breathing, general weariness, stomach pain, muscular pain, and cough. The absence of symptoms, nasal congestion, pharyngeal pain, headache, chest pain, nausea, vomiting, diarrhea, loss of smell, and taste were all associated with lower IgM levels. This emphasizes the relationship between clinical symptoms and the immunological response (Hansen et al., 2021).

In humans, the antibody response to coronavirus infection correlates with illness severity. Coronaviruses linked to moderate disease (for example, HCoV-229E, HCoV-NL63, and HCoV-HKU1) produce temporary amounts of antibodies. Those that cause more severe diseases, such as SARS-CoV and MERS-CoV, elicit stronger and longer-lasting antibody responses (Sariol and Perlman, 2020). Because the clinical spectrum of SARS-CoV-2 infection spans from asymptomatic to lethal, induced antibody responses are variable (Klein et al., 2020).

Conclusions

The varied levels of IgG and IgM have a distinct and visible effect on the overall clinical symptoms, with or without a correlation. This research probably discovered connections between antibodies for different periods of Coronavirus infection after recovery.

Conflict of Interest

The author hereby declares no conflict of interest

Consent for publication

The author declares that the work has consent for publication

Ethical Considerations

The study was approved by the institutional ethical committee

Funding support

The author declares that they have no funding support for this study

References

- Abou-Ismaïl, M. Y., Diamond, A., Kapoor, S., Arafah, Y., and Nayak, L. (2020). The hypercoagulable state in COVID-19: Incidence, pathophysiology, and management. *Thrombosis Research*, 194(6), 101–115. <https://doi.org/10.1016/j.thromres.2020.06.029>
- Amir, E., Fatemeh, J., Neda, P., and Ali, A. (2020). Prevalence of Underlying Diseases in Hospitalized Patients with COVID-19: a Systematic Review and Meta-Analysis. *Archives of Academic Emergency Medicine*, 8(1), e35–e35.
- Amjadi, M. F., O'Connell, S. E., Armbrust, T., Mergaert, A. M., Narpala, S. R., Halfmann, P. J. et al. (2021). Fever, Diarrhea, and Severe Disease Correlate with High Persistent Antibody Levels against SARS-CoV-2. *medRxiv*.
- Chen, W., Lan, Y., Yuan, X., Deng, X., Li, Y., Cai, X. et al. (2020). Detectable 2019-nCoV viral RNA in blood is a strong indicator for the further clinical severity. *Emerging Microbes and Infections*, 9(1), 469–473. <https://doi.org/10.1080/22221751.2020.1732837>
- Dawood, A. (2022). Influence of SARS-CoV-2 Variants' Spike Glycoprotein and RNA-Dependent RNA polymerase (Nsp12) Mutations on Remdesivir Docking Residues. *Medical Immunology Russia*, 2022; 24(3), 617–628. <https://doi.org/10.15789/1563-0625-IOS-2486>.
- Fu, L., Wang, B., Yuan, T., Chen, X., Ao, Y., Fitzpatrick, T. et al. (2020). Clinical characteristics of coronavirus disease 2019 (COVID-19) in China: A systematic review and meta-analysis. *Journal of Infection*, 80(6), 656–665. <https://doi.org/10.1016/j.jinf.2020.03.041>.
- Gorbalenya, A. E., Baker, S. C., Baric, R. S., de Groot, R. J., Drosten, C., Gulyaeva, A. A. et al. (2020). The species severe acute respiratory syndrome-related coronavirus: classifying 2019-nCoV and naming it SARS-CoV-2. *Nature Microbiology*, 5(4), 536–544. <https://doi.org/10.1038/s41564-020-0695-z>.
- Guan, W., Ni, Z., Hu, Y., Liang, W., Ou, C., He, J. et al. (2020). Clinical Characteristics of Coronavirus Disease 2019 in China. *New England Journal of Medicine*, 382(18), 1708–1720. <https://doi.org/10.1056/nejmoa2002032>.
- Hansen, B., Jarlhelt, I., Pérez-Alós, L., Hummelshøj L., Loftager, M., Rosbjerg, A. et al. (2021). SARS-CoV-2 Antibody Responses Are Correlated to Disease Severity in COVID-19 Convalescent Individuals. *The Journal of Immunology*, 206(1), 109–117. <https://doi.org/10.4049/jimmunol.2000898>.
- Hu, Z., Li, J., Yang, C., Chen, F., Wang, Z., Lei, P. et al. (2021). Elevated SARS-CoV-2-Specific IgM Levels Indicate Clinically Unfavorable Outcomes in Patients with COVID-19: A Retrospective Cohort Study. *International Journal of Gynecology Medicine*, 2021 Dec 29; 14:10429–10438. <https://doi.org/10.2147/IJGM.S322971>.
- Klein, S. L., Pekosz, A., Park, H. S., Ursin, R. L., Shapiro, J. R., Benner, S. E. et al. (2020). Sex, age, and hospitalization drive antibody responses in a COVID-19 convalescent plasma donor population. *The Journal of clinical investigation*, 130(11), 6141–6150.
- Kumar, P.K., Banerjee, M., Bajpayee, A. et al. (2021). SARS-CoV-2 IgG Antibody and its Clinical Correlates in Convalescent Plasma Donors: An Indian Experience. *Indian Journal of Clinical Biochemistry*, <https://doi.org/10.1007/s12291-021-01012-w>.
- Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y. et al. (2020). Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *New England Journal of Medicine*, 382(13), 1199–1207.
- Markmann, A. J., Giallourou, N., Bhowmik, D. R., Hou, Y. J., Lerner, A., Martinez, D. R. et al. (2021). Sex disparities and neutralizing-antibody durability to SARS-CoV-2 infection in convalescent individuals. *MSphere*, 6(4), e00275-21.
- Minh, L. H. N., Abozaid, A. A. F., Ha, N. X., Le Quang, L., G, A. G., Tiwari, R. et al. (2021). Clinical and laboratory factors associated with coronavirus disease 2019 (Covid-19): A systematic review and meta-analysis. *Reviews in Medical Virology*, 31(6), 1–15. <https://doi.org/10.1002/rmv.2288>.
- Ozturk, T., Howell, C., Benameur, K., Ramonell, R.P., Cashman, K. et al. (2020). Cross-sectional IgM and IgG profiles in SARS-CoV-2 infection. *medRxiv*, 2020 May 14:2020.05.10.20097535. <https://doi.org/10.1101/2020.05.10.20097535>.
- Sariol, A., and Perlman, S. (2020). Lessons for COVID-19 Immunity from Other Coronavirus Infections. *Immunity*, 53(2), 248–263. <https://doi.org/10.1016/j.immuni.2020.07.005>.
- Stefanelli, P., Bella, A., Fedele, G., Pancheri, S., Leone, P., Vacca, P. et al. (2021). Prevalence of SARS-CoV-2 IgG antibodies in an area of northeastern Italy with a high incidence of COVID-19 cases: a population-based study. *Clinical Microbiology and Infection*, 27(4), 633.e1–633.e7. <https://doi.org/10.1016/j.cmi.2020.11.013>.
- Tang, N., Li, D., Wang, X., and Sun, Z. (2020). Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. *Journal of Thrombosis and Haemostasis*, 18(4), 844–847. <https://doi.org/10.1111/jth.14768>.
- Zhu, J., Ji, P., Pang, J., Zhong, Z., Li, H., He, C. et al. (2020). Clinical characteristics of 3062 COVID-19 patients: a meta-analysis. *Journal of medical virology*, 92(10), 1902–1914.

How to cite this article

Al-hadidi, E. W., Altobji, M. A. (2022). The Impact of IgG and IgM levels on clinical symptoms of people who have recovered from SARS-Cov-2. *Science Archives*, Vol. 3(3), 211-214. <https://doi.org/10.47587/SA.2022.3310>

This work is licensed under a [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/)



Publisher's Note: MD International Publishing stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.