



Detection of IgM Antibodies and IgG Anti-Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) during the Transition Period of the Covid-19 Pandemic in Adolescents in Gorontalo City

Irwan,¹ NadirahRasyid Ridha² DeliyanaI. Katili³

¹, Departement Public Health, UniversitasNegeriGorontalo,Gorontalo, Indonesia

²Faculty of Medicine, Hasanuddin University, Makassar, Indonesia

³ Puskesmas Kabila, Bone Bolango,Indonesia

irwan@ung.ac.id

COVID-19 is a disease caused by SARS-CoV-2 infection. Due to the increased spread of COVID-19 in various countries, WHO declared the covid 19 disorder a pandemic. Examination of IgM and IgG antibodies with immunochromatographic principles is considered easier to do than other tests and can be used as an initial suspicion of SARS-CoV-2 infection. This study aims to detect anti-SARS-CoV-2 IgM and IgG antibodies in Gorontalo City adolescents aged 17-25 years.

The type of research used is descriptive research with a cross-sectional research design. The sample was an employee of the Sulawesi River Area Center. As many as 112 Orang were obtained through a simple random sampling technique. Antibody detection was carried out by dripping rich serum on the examination device and interpreted based on the theory and results of previous research.

The results showed that 32% gave reactive IgM and IgG results, and 24% gave reactive IgG results. And there are 106 employees, 44%, who provide non-reactive IgM and IgG results.

Conclusion During the transition period of the Covid-19 pandemic, IgM and IgG were still detected in adolescents aged 17-25 years in Gorontalo City.

Keywords: Adolescents; IgM and IgG; SARS-CoV-2; Immunochromatography.

Background

Coronavirus Disease 2019 (COVID-19) is a disease caused by a new type of virus from the Coronaviridae family, namely Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). COVID-19 was first identified in China in December 2019 as a respiratory system disease with symptoms of pneumonia of unknown cause.^{1,2} Symptoms arising from SARS-CoV-2 infection can manifest mild, moderate, severe, and even not give signs.³ Thus, preventing transmission by always carrying out health protocols is very helpful in reducing the risk of transmission.^{4,5,6}

The rapid increase in the spread of SARS-CoV-2 virus infection occurred in various countries so that on January 30, 2020, WHO designated the COVID-19 outbreak as a World Troubling Public Health Emergency (KKMMD), and on March 11, 2020, COVID-19 was selected as a pandemic situation.^{7,8,9} As of early September 2020, nearly 27 million cases of COVID-19 occurred worldwide, with the number of deaths reaching 900,000 people reporting to WHO.^{10,11}

Indonesia first reported two confirmed cases of COVID-19 on March 2, 2020.^{12,13} On April 10, 2020, all provinces in Indonesia were confirmed to have COVID-

19 patients, with 3512 confirmed cases and 306 deaths.¹⁴ The age of 45 – 54 years is confirmed to be the age range with the highest number of cases. Meanwhile, 55-64-year-olds are guaranteed to have the highest mortality rate for confirmed cases of COVID-19.⁴ Confirmed cases of COVID-19 in Indonesia continue to increase. On September 2, 2020, the number of confirmed COVID-19 cases in Indonesia reached 180,646 cases with 7616 deaths, making Indonesia ranked 23rd as the country with the highest number of COVID-19 cases.^{15,16,17}

On September 2, 2020, WHO reported North Sulawesi as one of the 34 provinces with confirmed COVID-19 cases, ranked third as the province with the highest number of COVID-19 deaths per 1 million population after DKI Jakarta and South Kalimantan.¹⁵

Until now, examination techniques to diagnose SARS-CoV-2 virus infection have only been recommended through molecular examinations such as Reverse Transcription-Polymerase Chain Reaction (RT-PCR).^{18,19} Other examinations, such as the Rapid Diagnostic Test, are also widely known by the public. One of the rapid diagnostic tests often used is the Rapid Diagnostic Test based on antibody detection

using the immunochromatographic method.^{4,20,21,22}The response of immunoglobulin M (IgM) and/or immunoglobulin G (IgG) in the blood will bind to the recombinant antigen of the SARS-CoV-2 virus in the examination device. The presence of IgM indicates a primary infection, while the presence of IgG indicates a secondary infection or a long-standing infection. However, the rapid diagnostic test results cannot be used as a diagnostic standard and can only be used for surveillance purposes and epidemiological research.^{21,22}

Many studies explain the detection of IgM and IgG antibodies against SARS-CoV-2 in health workers. However, there is no research data on detecting anti-SARS-CoV-2 antibodies in-office employees. Thus, this study was made to detect anti-SARS-CoV-2 IgM and IgG antibodies in Adolescents in Gorontalo City using immunochromatographic methods.

Research Method

The type of research that will be carried out is descriptive research using a cross-sectional design. The target population of this study was adolescents with an age category of 17-25 years. The sample of this

study was serum from the blood of adolescents aged 17-25 years. The selection of a piece of adolescents in this age category with consideration of adolescents during the COVID-19 pandemic has a high mobilization and busyness.

Results and Discussion

Detection of anti-SARS-CoV-2 IgM and IgG antibodies against adolescents aged 17-25 years, examination of respondents' blood serum samples was examined using an antibody detection-based Rapid Diagnostic Test kit. The results of the analysis obtained are in the following table:

Table 1. Results of Blood Serum Examination for adolescents aged 17-25 years in Gorontalo City

Work Unit	Interpretation	Total
1	Reactive IgM and IgG	0
	Reactive IgM	0
	Reactive IgG	3
	Non-reactive IgM and IgG	57
2	Reactive IgM and IgG	0
	Reactive IgM	0
	Reactive IgG	0
	Non-reactive IgM and IgG	23

Work Unit	Interpretation	Total
3	Reactive IgM and IgG	0
	Reactive IgM	0
	Reactive IgG	0
	Non-reactive IgM and IgG	4
4	Reactive IgM and IgG	0
	Reactive IgM	0
	Reactive IgG	1
	Non-reactive IgM and IgG	7
5	Reactive IgM and IgG	1
	Reactive IgM	0
	Reactive IgG	0
	Non-reactive IgM and IgG	10
6	Reactive IgM and IgG	1
	Reactive IgM	0
	Reactive IgG	0
	Non-reactive IgM and IgG	5
Total		112

Source: Primary data

Table 2. Serum Examination Results based on Gender for adolescents aged 17-25 years in Gorontalo City

Gender	Interpretation	Total
Male	Reactive IgM and IgG	1
	Reactive IgM	0
	Reactive IgG	4
	Non-reactive IgM and IgG	74
Female	Reactive IgM and IgG	1
	Reactive IgM	0
	Reactive IgG	0
	Non-reactive IgM and IgG	32
Total		112

Source: Primary data

Table 3. Serum Examination Results for adolescents aged 17-25 years in Gorontalo City

Sample	Total	Percentage (%)
Reactive IgM and IgG	2	1,79
Reactive IgM	0	0
Reactive IgG	4	3,57

Sample	Total	Percentage (%)
IgG		
Non-reactive	106	94,64
IgM and IgG		
Total	112	100

Source: Primary data

The examination results on 112 blood serum samples of adolescents aged 17-25 years in Gorontalo City, if categorized by gender, men showed more reactive results, namely as many as five people with details of four people with reactive IgG and one person with reactive IgM and IgG. In the female sex, only one person was found with reactive IgM and IgG results. As for the total number of samples examined, six out of 112 adolescents had reactive results, consisting of four pieces with reactive IgG and two with reactive IgM and IgG results.

Discussion

Research conducted on adolescents aged 17-25 years in Gorontalo City on the detection of IgMIgG anti-Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) antibodies. A blood serum examination was performed on 112 blood serum samples. Using immunochromatography, the serum is dripped on the test strip sample pad.

Antibodies (IgM/IgG) present in blood serum will bind to recombinant antigens in the test strip to form an antigen-antibody complex. The antigen-antibody complex will bind the anti-human antibody to the indicator area of the test strip to produce color on the indicator and be interpreted according to the results obtained.^{21,23}

Antibodies in the body are glycoproteins that will specifically bind to antigens or foreign microorganisms that enter the body.^{24,25} IgM is known to provide a primary immune response as an antibody first formed as an initial response to an infection. Meanwhile, IgG is known for providing a secondary immune response and is an antibody that provides long-term immunity after an illness.^{24,26}

Examination with the immunochromatographic method is more accessible than the COVID-19 test with other methods, so that it can be utilized in various situations. However, in addition to its convenience, there is a drawback where this examination cannot detect an increase in antibody titers. Therefore, WHO does not recommend antibody detection tests with a lateral flow immunoassay system for acute diagnosis or clinical management.^{18,19} Meanwhile, medical personnel more often use examinations with

this method to make a presumptive diagnosis or an early suspicion of SARS-CoV-2 infection that has just occurred if the molecular examination results show negative results. Still, there is a solid epidemiological link to SARS-CoV-2 disease in the person concerned.²²

Based on the blood serum examination of employees of the Sulawesi River I Regional Center, two samples (1.79%) showed reactive IgM and IgG results, four pieces (3.57%) showed reactive IgG results, and the remaining 106 samples (94.64%) showed non-reactive IgM and IgG results. Interpretation of the results in two pieces with reactive IgM and IgG results informs that the infection is suspected of having occurred for more than 14 days and that the immune systems of both samples have been actively producing antibodies in both symptomatic and asymptomatic conditions. Subjects with interpretations of reactive IgM and IgG are required to immediately self-isolate and seek medical treatment according to symptoms if any symptoms are obtained.²¹ Whether the subject has symptoms or is asymptomatic, subjects with blood serum examination results showing reactive IgG are suspected of having been infected for several weeks. There are 4 blood serum examination

samples with reactive IgG results that can provide information: the immune system has produced IgG antibodies against viral recombinant antigens in the examination kit. 106 pieces with non-reactive IgM and IgG results may inform if antibodies are not and or have not been produced and the subject is suspected not to be infected with COVID-19. If IgM and IgG are non-reactive while the subject experiences symptoms such as COVID-19, it is supposed that the symptoms are infections that resemble COVID-19.²¹

If categorized based on the work unit, the results were obtained, namely, in the BWSS-1 work unit, three samples showed reactive IgG. In the results of other sample examinations, one piece showed reactive IgG results, and one showed reactive IgM and IgG results. The interpretation of the examination results can inform that the immune system of the sample with reactive IgG results has formed IgG antibodies. It is suspected that an infection has occurred that lasts for several weeks. Interpretation of examinations with reactive IgM and IgG results can provide information that the sample's immune system has formed IgM and IgG antibodies against recombinant virus antigens in the examination device and is required to self-isolate immediately.²¹

When categorized by gender, one male sample and one sample showed reactive IgM and IgG, and four males showed reactive IgG. Interpretation of examinations with reactive IgM and IgG results can provide information that the sample's immune system has formed IgM and IgG antibodies against recombinant virus antigens in the examination device and is required to self-isolate immediately. Meanwhile, the reactive IgG results reveal that it has formed IgG antibodies and suspected infections that lasted for several weeks.²¹

Research conducted by Imai et al. in February – March 2020 in Japan regarding the clinical evaluation of antibody examination using immunochromatographic methods showed different results depending on the onset of the disease and the presence or absence of symptoms of SARS-CoV-2 infection in confirmed COVID-19 patients. The examination carried out on 35 asymptomatic patients with sampling less than one week after being confirmed with COVID-19 disease with PCR showed that 40% of them had reactive IgM results, and all samples showed non-reactive IgG results. In addition, examinations of three asymptomatic patients with sampling ranging from 1-2 weeks after confirmed

COVID-19 infection showed that 1 person had reactive IgM results and none showed reactive IgG. Meanwhile, the examination of 53 symptomatic patients who were confirmed with COVID-19 with sampling less than one week after the onset of the disease gave 17% (9/53) results showing reactive IgM and reactive IgG as much as 3.8% (2/53). Examination in patients with disease onset 1-2 weeks showed 33.3% (4/12) gave reactive IgM results, and 8.3% of people (1/12) showed reactive IgG results. The examination carried out on confirmed COVID-19 patients with disease onset for more than two weeks showed 100% (9/9) gave reactive IgM results, and 44.4% (4/9) showed reactive IgG results.²⁷

Research conducted by Zhao et al. in January – February 2020 in China regarding the diagnosis value of antibody examination using the ELISA method in COVID-19 confirmed patients showed different sensitivity differences depending on the onset of the disease. On days 1-7 after the start of the illness, IgM sensitivity was 28.7%, IgG sensitivity was 19.1%, and total antibody sensitivity was 38.3%. 8-14 after the onset of the disease showed an increase in the sensitivity values of IgM, IgG, and whole antibodies by 73.3%, 54.1%, and 89.6%. Days 15-39 after the onset of the

disease showed a considerable increase in the sensitivity of IgM, IgG, and total antibodies of 79.8%, 94.3%, and 100%. In another case with diagnosis using RNA examination with samples from the respiratory tract, there is a decrease in sensitivity on days 1-7, 8-14, and days 15-39, namely 66.7%, 54%, and 45.5%. Meanwhile, the combined use of RNA examination and antibody examination showed a better increase in diagnosis sensitivity, namely days 1-7 by 78.7%, days 8-14 by 97%, and days 15-39 by 100%.²⁸

The interpretation of antibody test results depends on several factors, including the duration of infection, clinical morbidity, testing equipment, validation method examination methods, and the results reliability.^{18,29} In the interim guidance published, WHO mentions that the development of the observed antibody response (seroconversion) is more robust in individuals with severe symptoms than individuals with mild or asymptomatic symptoms.¹⁸ This is by a study conducted in China in January 2020 – February 2020, where there was a strong positive correlation between the severity of the disease and the titer of antibodies two weeks after the onset of the disease.²⁸

Conclusion

During the transition period of the Covid-19 pandemic, IgM and IgG were detected in adolescents aged 17-25 years in Gorontalo City. So the chain of transmission of the covid-19 virus is still occurring in the community.

Acknowledgments

The author expresses his gratitude to all parties who have helped in completing this research.

References

1. WHO. (2020). *Novel Coronavirus (2019-nCoV) Situation Report-1*. World Health Organization.
https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200121-sitrep-1-2019-ncov.pdf?sfvrsn=20a99c10_4
2. Adityaningrum, A., & Jusuf, H. (2022). Forecasting Simulation Of Indonesia Covid-19 Confirmed Cases. *Journal Health & Science : Gorontalo Journal Health and Science Community*, 5(3), 10–16.
<https://doi.org/10.35971/gojhes.v5i3.13029>
3. Amalia, L., Irwan, I., & Hiola, F. (2020). Analysis of Clinical Symptoms and Immune Enhancement to Prevent Covid-19 Disease. *Jambura Journal of*

- Health Sciences and Research*, 2(2), 71–76.
<https://doi.org/10.35971/jjhsr.v2i2.6134>
4. Kemenkes. (2020). *Pedoman Pencegahan dan Pengendalian Coronavirus Disease (Covid-19)*. Kemenkes RI. <https://covid19.kemkes.go.id/protokol-covid-19/kmk-no-hk-01-07-menkes-413-2020-ttg-pedoman-pencegahan-dan-pengendalian-covid-19/#.X0bvO-gzbIW>
 5. Zainol Rashid, Z., Othman, S. N., Abdul Samat, M. N., Ali, U. K., & Wong, K. K. (2020). Diagnostic Performance Of Covid-19 Serology Assays. *Malaysian Journal of Pathology*, 42(1), 13–21. <https://pubmed.ncbi.nlm.nih.gov/32342927/>
 6. Nakoe, R., S Lalu, N. A., & Mohamad, Y. A. (2020). Difference in the Effectiveness of Hand-Sanitizer by Washing Hands Using Soap As A Covid-19 Preventive measure. *Jambura Journal of Health Sciences and Research*, 2(2), 65–70. <https://doi.org/10.35971/jjhsr.v2i2.6563>
 7. WHO. (2020). *Coronavirus Disease 2019 (Covid-19) Situation Report - 1*. World Health Organization. https://www.who.int/docs/default-source/searo/indonesia/covid19/who-indonesia-situation-report-1.pdf?sfvrsn=6be5b359_0
 8. WHO. (2020). *Novel Coronavirus (2019-nCoV) Situation Report-11*. World Health Organization. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200131-sitrep-11-ncov.pdf?sfvrsn=de7c0f7_4
 9. Hutagaol, E. K. (2022). Health Policy Analysis: Implementation Of Self-Isolation Policy Covid-19 Patient In Cikarang Community Bekasi Regency. *Journal Health & Science: Gorontalo Journal Health and Science Community*, 6(3), 232–239. <https://doi.org/10.35971/gojhes.v6i3.14005>
 10. WHO. (2020). *Coronavirus Disease (Covid-19) Weekly Epidemiological Update*. World Health Organization. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200907-weekly-epi-update-4.pdf?sfvrsn=f5f607ee_2
 11. WHO. (2020). *Coronavirus Disease 2019 (Covid-19) Situation Report - 51*. World Health Organization.

- <https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200311-sitrep-51-covid-19.pdf>
12. Abudi, R., Mokodompis, Y., & Magulili, A. N. (2020). Stigma Against Positive People Covid-19. *Jambura Journal of Health Sciences and Research*, 2(2), 77–84.
<https://doi.org/10.35971/jjhsr.v2i2.6012>
 13. Abdurrahmat, A. S., Saraswati, D., & Gustaman, R. A. (2022). Model Of The Relationship Of Knowledge And Attitude Towards Covid-19 Prevention Practices During Instructions (Study On Students And Students Of SMA Pondok Pesantren Islamic Association Of 67 Objects In Tasikmalaya City In 2021). *Journal Health & Science : Gorontalo Journal Health and Science Community*, 5(3), 1–9.
<https://doi.org/10.35971/gojhes.v5i3.12477>
 14. *Infografis Covid-19 (10 April 2020) - Berita Terkini _ Gugus Tugas Percepatan Penanganan Covid-19.* (n.d.).
<https://covid19.go.id/p/berita/infografis-covid-19-10-april-2020>
 15. WHO. (2020). *Coronavirus Disease 2019 (Covid-19) Situation Report - 23.* World Health Organization.
https://www.who.int/docs/default-source/searo/indonesia/covid19/external-situation-report-23-02september2020.pdf?sfvrsn=7ed23646_2
 16. *Infografis Covid-19 (2 September 2020) - Berita Terkini _ Gugus Tugas Percepatan Penanganan Covid-19.* (n.d.).
<https://covid19.go.id/p/berita/infografis-covid-19-2-september-2020>
 17. Irwan, I., Nakoe, M. R., & Ganio, F. (2022). The Relationship Between Family Support And Maternal Anxiety Levels With Failure To Provide Basic Immunization As Scheduled During The Covid-19 Pandemic At Sipatana Health Center. *Journal Health & Science : Gorontalo Journal Health and Science Community*, 6(3), 308–322.
<https://doi.org/10.35971/gojhes.v6i3.11609>
 18. WHO. (2020). *Diagnostic Testing for SARS-CoV-2.* World Health Organization.
<https://www.who.int/publications/i/item/diagnostic-testing-for-sars-cov-2>

19. Ahn, D.-G., Shin, H.-J., Kim, M.-H., Lee, S., Kim, H.-S., Myoung, J., Kim, B.-T., & Kim, S.-J. (2020). Current Status of Epidemiology, Diagnosis, Therapeutics, and Vaccines for Novel Coronavirus Disease 2019 (COVID-19). *Journal of Microbiology and Biotechnology*, 30(3), 313–324. <https://doi.org/10.4014/jmb.2003.03011>
20. WHO. (2020). *Clinical Management of Covid-19*. World Health Organization. [https://www.who.int/publications/i/item/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-\(ncov\)-infection-is-suspected](https://www.who.int/publications/i/item/clinical-management-of-severe-acute-respiratory-infection-when-novel-coronavirus-(ncov)-infection-is-suspected)
21. Jacofsky, D., Jacofsky, E. M., & Jacofsky, M. (2020). Understanding Antibody Testing for COVID-19. *The Journal of Arthroplasty*, 35(7), S74–S81. <https://doi.org/10.1016/j.arth.2020.04.055>
22. WHO. (2020). *Saran Penggunaan Tes Immunodiagnostik di Fasyankes (Point of Care) untuk Covid-19*. World Health Organization. [https://www.who.int/docs/default-source/searo/indonesia/covid19/saran-penggunaan-tes-immunodiagnostik-di-fasyankes-\(point-of-care\)-untuk-covid-19.pdf?sfvrsn=a428857b_2](https://www.who.int/docs/default-source/searo/indonesia/covid19/saran-penggunaan-tes-immunodiagnostik-di-fasyankes-(point-of-care)-untuk-covid-19.pdf?sfvrsn=a428857b_2)
23. Choe, J., Kim, J., Kwon, H. H., Hong, H., Jung, C. Y., Jeon, C., Park, E., & Kim, S. (2020). Diagnostic Performance of Immunochromatography Assay For Rapid Detection of IgM and IgG in Coronavirus Disease 2019. *Journal of Medical Virology*, 92(11), 2567–2572. <https://doi.org/10.1002/jmv.26060>
24. Male, D., Peebles, R. S., & Male, V. (2021). *Antibodies*. Immunology. <https://www.clinicalkey.com#!/content/book/3-s2.0-B9780702078446000106>
25. Ladimo, M. P., & Irwan, I. (2020). Middle East Respiratory Syndrome-Corona Virus (MERS-CoV) Stirs Up the Eastern World. *Journal Health & Science : Gorontalo Journal Health and Science Community*, 4(1), 18–28. <https://doi.org/https://doi.org/10.35971/gojhes.v4i1.4666>
26. Wu, J.-L., Tseng, W.-P., Lin, C.-H., Lee, T.-F., Chung, M.-Y., Huang, C.-H., Chen, S.-Y., Hsueh, P.-R., & Chen, S.-C. (2020). Four Point-Of-Care Lateral Flow Immunoassays For Diagnosis of Covid-19 and For Assessing Dynamics of Antibody Responses to SARS-CoV-

2. *Journal of Infection*, 81(3), 435–442.
<https://doi.org/10.1016/j.jinf.2020.06.023>
27. Imai, K., Tabata, S., Ikeda, M., Noguchi, S., Kitagawa, Y., Matuoka, M., Miyoshi, K., Tarumoto, N., Sakai, J., Ito, T., Maesaki, S., Tamura, K., & Maeda, T. (2020). Clinical Evaluation of An Immunochromatographic IgM/IgG Antibody Assay and Chest Computed Tomography For The Diagnosis of Covid-19. *Journal of Clinical Virology*, 128, 104393.
<https://doi.org/10.1016/j.jcv.2020.104393>
28. Zhao, J., Yuan, Q., Wang, H., Liu, W., Liao, X., Su, Y., Wang, X., Yuan, J., Li, T., Li, J., Qian, S., Hong, C., Wang, F., Liu, Y., Wang, Z., He, Q., Li, Z., He, B., Zhang, T., ... Zhang, Z. (2020). Antibody Responses to SARS-CoV-2 in Patients With Novel Coronavirus Disease 2019. *Clinical Infectious Diseases*, 71(16), 2027–2034.
<https://doi.org/10.1093/cid/ciaa344>
29. CDC. (2020). *Coronavirus | Human Coronavirus Types | CDC*. Centers for Disease Control and Prevention (CDC).
<https://www.cdc.gov/coronavirus/types.html>