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Seroprevalence SARS-CoV-2 among the academic population of Universitas Gadjah Mada Yogyakarta

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ABSTRACT

Background: Many academicians in Yogyakarta, Indonesia, face the increased potential for Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2) transmission in academic populations. Seroprevalence data can represent the number of infections showing the proportion of people exposed and those potentially immune to the virus and provide evidence for public health policymakers. The seroprevalence of SARS-CoV-2 in the academic population of Universitas Gadjah Mada (UGM) remains unknown, raising concerns about the immune status among the academic population. A cross-sectional study was conducted to estimate the seroprevalence rate of SARS-COV-2 infection in the UGM academic population.

Methods: We conducted a descriptive study of 406 subjects of the UGM academic population. In the cross-sectional analysis of data collected, we performed serological testing for SARS-COV-2 infection for random academicians willing to participate voluntarily. Subjects were categorized as high and low-risk based on SARS-CoV-2 exposure and work history. Data normality was tested with Kolmogorov-Smirnov test. Proportion differences were analyzed with chi-squared tests with a significance set as $P<0.05$.

Result: 406 subjects were included in this study, with most of the subjects (55.91%) being female. The majority of the subjects were students (82.27%). Most of the subjects were categorized as high-risk (51.72%). Eight subjects (1.97%) had reactive antibody testing. The prevalence of SARS-COV-2 infection was higher in the high-risk group than in the low-risk group (3.57% vs. 0.48%; $p=0.01$). The high-risk subjects had 7.5 times more incidence of reactive antibody results than low-risk subjects based on the prevalence ratio.

Conclusion: The seroprevalence of SARS-COV-2 immunity in the general academic population of the Universitas Gadjah Mada is 1.97%. These low proportions reflect that more strategies are needed to protect the high-risk group against SARS-CoV-2 exposure.

Keywords: COVID-19, SARS-CoV-2, seroprevalence, academic population.
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INTRODUCTION

Severe Acute Respiratory Syndrome-Coronavirus-2 (SARS-CoV-2), which causes Corona Virus Disease-19 (COVID-19), has become a pandemic in almost the entire global population and continues to be a major health problem worldwide today. The World Health Organization (WHO) noted that currently, more than 3 million cases have been confirmed from around the world, with more than 200 thousand people (> 7%) dying in 213 infected countries. Within the first few months of the outbreak, according to the Ministry of Health in Indonesia, on May 5th, 2020, 12.438 cases were reported. Case fatality rate back then was around 7.2%. The addition of confirmed cases is still in the range of 300-400 cases per day and still does not show a declining graph trend.[1] However, the accuracy of the COVID-19 case figures is still viewed with skepticism by some researchers. This doubt is because the diagnostic scope of using polymerase chain reaction (PCR) as a diagnostic tool for COVID-19 is limited, so many potential cases, especially mild and asymptomatic, continue to go undiagnosed.[2]

The serological examination is important to help diagnose this disease. Besides, mapping positive serological examination results in the middle population or seropositive population will provide an overview of the prevalence of individuals with a history of infection with SARS-COV-2 who have antibodies in the middle population. This examination is useful in providing an overview of the cumulative incidence of the disease in this population. Also, it can provide potential information about the true number of infections, enabling more robust estimates of cases and case fatality rates and establishing more accurate epidemiological model parameters to evaluate the possible impact of a specific intervention to guide public health decision-making.[3,4]

Health policymakers in the United

Kingdom (UK) and other countries have made it mandatory to collect seroprevalence data, which is useful in showing the proportion of the population exposed to and potentially immune to the virus.[5] This can also show whether the coverage is different from the population accessed by PCR testing. These sets of data form the basis for determining the amount of herd immunity mitigation required by calculating the baseline reproductive rate (R0), which is currently believed to be around 2.2 for SARS-CoV-2. Based on these estimates, herd immunity calculations show that at least 60% of the population needs to have protective immunity, either from natural infection or vaccination.[6]

As one of the so-called 'student cities' in Indonesia with a large number of academicians and a wide diversity of students, Yogyakarta City has the potential for increased COVID-19 transmission in the academic population. The seroprevalence of COVID-19 in Yogyakarta, especially in Universitas Gadjah Mada, the largest university in the province, is still unknown, and this gap raises concerns about the accuracy of the current epidemiological data. The heterogeneity of the academic population could represent this province. Therefore, we aimed to conduct a cross-sectional study to estimate the seroprevalence rate of SARS-COV-2 infection in the academic population of Universitas Gadjah Mada, Yogyakarta, Indonesia.

METHODS

Design and setting of the study

This study was a descriptive, cross-sectional study designed to estimate the seroprevalence rate of SARS-COV-2 infection in the academic population of Universitas Gadjah Mada in Yogyakarta, Indonesia. The study was carried out in August to December, 2020. Subjects were random academicians who willingly chose to participate voluntarily. The inclusion criteria for this study were academicians who were willing to become respondents. Lysed serum samples were excluded from this study. Respondents who were willing to participate and signed the informed consent form were included in the research.

Study population

Subjects were categorized as high and low-risk. High-risk subjects are academicians who have a history of exposure or medical personnel in the hospital (doctors, residents, and clerkship students), while the low-risk subjects are academicians who study or work in other than the medical-related areas.

Data collected from the population in this study included: age, sex, symptoms related to COVID-19, comorbidities, previous antibody testing, and previous PCR results. All of these data were self-reported by subjects using an electronic form.

SARS-CoV-2 antibody testing

Serological testing was done in a cross-sectional manner for SARS-CoV-2 total immunoglobulin G and M (IgG / IgM) detected by Electrochemiluminescence methods using Cobas® Roche E411 at the Clinical Pathology Laboratory, FKKMK, Universitas Gadjah Mada and Clinical Laboratory, Dr. Sardjito Hospital. The tests were conducted for academicians with high and low risk of exposure to COVID-19 infection by taking serum samples. The reactive result was defined as higher than the cut-off index 1.

Statistical analysis

We performed the descriptive statistical analysis and used Kolmogorov-Smirnov tests to test the data normality. Proportion differences were analyzed using chi-squared tests. Statistical analysis was performed with MedCalc® Statistical Software version 19.6. Data is then presented in tables. According to the distribution, continuous data are presented with mean, standard deviation (SD), or median (minimum-maximum).

RESULTS

A total of 406 subjects were included in the study. Most subjects are female (55.91%) (Table 1).

The subjects were then grouped according to their academic status. The academic status was 21 (5.17%) lecturers, 334 (82.27%) students, and 51 (12.56%) educational staff (Table 2).

Subjects were classified based on exposure and working area. Most of the subjects (51.72%) were categorized as high risk (Table 3).

This study found respiratory disease the most common comorbidity (19.46%). It was followed by several other comorbidities, including hypertension (18.72%), cancer (16.26%), heart disease (14.78%), kidney disease (14.04%), lupus (13.55%), and diabetes mellitus (13.05%). Hypertension and cancer were the most common comorbidities in the high-risk group, with 32.65% for each one. Subjects in the low-risk group had fewer comorbidities than the high-risk group (Table 4). As many as 212 subjects (52.22%) had their antibodies tested before the study, and 166 subjects (40.89%) had undergone PCR swabs before this study. There were ten subjects (4.65%) who had reactive results from the previous antibody testing, while seven subjects (3.76%) had a positive results from the previous PCR swab tests (Table 4).

There were eight subjects (1.97%) who had reactive results from the serology testing. As much as 3.57% of the high-risk subjects had reactive antibody test results, while only 0.48% of low-risk subjects had reactive antibody test results (p=0.01). The results of the proportions difference test showed a significant difference in reactive results in high-risk subjects. Based on the calculation, a Prevalence Ratio (PR) of 7.5 was obtained, so it could be interpreted that subjects with high risk had 7.5 times more incidence of reactive antibody results than subjects with low risk (Table 5).

DISCUSSION

Currently, the definitive diagnosis of COVID-19 is based on a viral nucleic acid amplification test from nasopharyngeal swab samples.[7] There are several limitations to this diagnostic test, including the limitations of the scope of the test, especially in Indonesia. In Yogyakarta, only three laboratories have PCR available, and there are limited molecular rapid testing facilities. This condition makes handling COVID-19 more difficult. The latest data from last year, as of December 23rd, 2020, showed that there were 9,683 confirmed cases of COVID-19, and the number of daily cases had reached 186 new cases. The increase in cases is getting higher after the public holidays, which

Table 1. Subject characteristics.

Variable	Value
Sex, n (%)	
Males	179 (44.08%)
Females	227 (55.91%)
Age (year), median (min-max)	30 (19-68)
Academic status	
Lecturer	21 (5.17%)
Student	334 (82.27%)
Supporting staff	51 (12.56%)

Min-max, minimum-maximum

Table 2. Subjects' academic status.

Academic status	n	%	95%CI
Lecturer	21	5.17	3.41-7.78
Student	334	82.27	78.25-85.67
Educational staff	51	12.56	9.68-16.14
Total	406	100	

CI, confidence interval

Table 3. Risk category.

Risk grade	n	%	95% CI
Low risk	210	51.72	46.87-56.55
High risk	196	48.27	43.45-53.13
Total	406	100	

CI, confidence interval

Table 4. Subject characteristics and their risk category.

	Low-Risk (n=210)	High-Risk (n=196)
Age, median (min-max)	24 (19 – 68)	31 (21 – 68)
Male, n (%)	86 (40.95%)	93 (47.45%)
Academic Status, n (%)		
Lecturer	16 (7.62%)	5 (2.55%)
Student	146 (69.52%)	188 (95.91%)
Education staff	48 (22.86%)	3 (1.53%)
Comorbidities		
Lupus	1 (0.48%)	54 (27.55%)
Diabetes Mellitus	2 (0.95%)	51 (26.02%)
Cancer	2 (0.95%)	64 (32.65%)
Hypertension	12 (5.71%)	64 (32.65%)
Kidney Disease	1 (0.48%)	56 (28.57%)
Heart Disease	4 (1.9%)	56 (28.57%)
Respiratory Disease	18 (8.57%)	61 (31.12%)
Previous reactive antibody test	3 (2.44%)	7 (7.61%)
Previous positive PCR test	2 (3.57%)	5 (3.85%)

PCR, polymerase chain reaction

Table 5. Seroprevalence of SARS CoV-2.

	n	Seroprevalence (%)	95% CI (%)	*p*
Low risk	209	0.48	0.08 -2.66	0.01
High risk	196	3.57	1.74-7.19	
Total	406	1.97	1.00-3.84	

CI, confidence interval; SARS CoV-2, Severe Acute Respiratory Syndrome-Coronavirus-2

saw the higher mobilization of the people around the country.[8]

Although antibody testing is not a standard diagnosis, for particular aims, it is used as an initial screening for patients with suspected COVID-19. Unlike some countries implementing a strict nationwide lockdown, Indonesia has implemented a region-based big-scale social restriction.[9,10] Restrictions by limiting the movement of large masses and travel between cities are very effective in reducing the rate of infection.[10,11] The government requires PCR or antibody results before people travel, both domestically and internationally. Antibody testing is an option for travelers because the results are less time-consuming than PCR swab results, which take up to 72 hours.[12]

The results of this study are in line with several previous studies, which showed a relatively low seroprevalence in the population (<5%).[13,14] One study in Taiwan had a much lower seroprevalence with 0.05% due to the government's stricter control measures.[15] Seroprevalence itself can be interpreted as the program's success because it indirectly measures the level of infection in the population.[9] Several studies showed differences in seroprevalence according to setting and population groups.[15-19] Seroprevalence testing in the epidemiological view has an important role as a fast and accurate tool in determining the effectiveness of health policies.[17]

The antibody response to the SARS COV-2 virus remains unclear. The onset of seroconversion in several studies has shown inconsistent results. Previous studies have shown an increase in IgM levels three days after symptoms.[20] Another study showed a longer onset of nine days before any symptoms.[21] The national policy mandates antibody screening within at least three days before travel and 3-5 days afterward.[22]

This research is the first study in Indonesia to determine the seroprevalence of COVID-19 in the academic population. The national policy requires online virtual classroom learning to prevent face-to-face interaction between community members at the university level. However, there are exceptions for the community with a

profession as a doctor who often may need to have face-to-face contact with their patients. The risk of infection increases with the frequency of having contact with their patients. In this study, high-risk subjects have a higher seroprevalence than low-risk subjects (3.6% vs. 0.5%). Another study showed a high seroprevalence, and one study even found a rate of 27% among medical workers in New York, which was increasing in symptomatic patients.[23,24] One study in China, the first epicenter of COVID-19, showed that 17.14% of healthcare workers exposed to only four patients with COVID-19 were seropositive. Doctors have a higher chance of seroconversion among the healthcare workers in these at-risk groups.[25]

National large-scale vaccination plans have legitimacy based on these seroprevalence data. Vaccination will increase the antibody titer and increase herd immunity prevalence.[26] A low seroprevalence rate indicates that the subject population is still low in antibody and immunity. It is also known that the proportion of immune individuals contributes to herd immunity.[27,28] Mandatory vaccination is necessary to increase herd immunity.[9] Nowadays, scientists worldwide are trying to find a suitable vaccine for COVID-19. As of July 2nd, 2020, the worldwide SARS-CoV-2 vaccine landscape included 158 vaccine candidates, of which 135 were in preclinical or exploratory stages of development.[29] Several platforms are used to search for effective vaccine candidates, such as Live Attenuated, Inactivated, Vaccine sub-unit, Viral vector-based, and Genomic Vaccines. Overall, vaccines are intended to enhance the measurable antibody response in the target populations.[29,30]

This study has several limitations, such as the generalizability of this study being limited to our academic community population because of the relatively small sample size. This study also did not measure the proportion of neutralizing antibodies. Further research is needed to know the impact of vaccination programs on increasing the seroprevalence in the general population. The results of this study can be used as the basis to evaluate vaccination programs currently being implemented.

CONCLUSION

From this cross-sectional descriptive study, the seroprevalence of SARS-COV-2 immunity in the general academic population of the Universitas Gadjah Mada is higher than in the high-risk group (3.57%), which consists of medical staff, residents, and clerkship students. Additional strategies are needed to protect the high-risk group against COVID-19 exposure.

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CONFLICT OF INTEREST

There is no competing interest regarding the manuscript.

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ETHICS APPROVAL

The study was approved by the Medical and Health Research Ethics Committee (MHREC), Faculty of Medicine, Public Health and Nursing Universitas Gadjah Mada, with the ref. Number KE/FK/1108/EC/2020.

CONSENT FOR PUBLICATION

Electronic informed consent was obtained from all subjects before they participated in the study.

AUTHORS CONTRIBUTION

Conceptualization and methodology, OS, USI, AZA; data collection, ATW, AZA; analysis and writing, OS, USI, ATW, FA, AHD, AZA; review, OS, USI, TR. All authors have read and agreed to publish the manuscript.

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