Unveiling the Dynamics of the Omicron Variant: Prevalence, Risk Factors, and Vaccination Efficacy during the Third Wave of Covid-19 in Indonesia's Gowa Regency

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Abstract: *Introduction*: In February-March 2022, the B.1.1.529 (Omicron) variant of SARS-CoV-2 became the cause of the third wave of COVID-19 in Indonesia. However, data on the prevalence of the effects of the third wave of the COVID-19 pandemic are still limited, especially in regencies/cities in Indonesia. Gowa Regency is one of the most affected areas by COVID-19 in South Sulawesi.

Objective: Ascertaining risk factors associated with infection and evaluating the effectiveness of vaccination programs in Gowa Regency.

Methods: In March 2022, venous blood specimens were taken from 859 randomly selected samples in Gowa Regency to determine the presence of antibodies to SARS-CoV-2 by examining chemiluminescent microparticle immunoassay (CMIA) specimens. Information on demographics, previous infection history, symptoms, comorbid diseases, and vacancy status was collected through interviews. Data analysis was conducted using descriptive, bivariate tests with chi-square and One-way ANOVA, and multivariate tests using logistic regression.

Results: The overall prevalence of anti-SARS-CoV-2-IgG was 98.7%. The results showed that the prevalence of SARS-CoV-2 antibodies was not significantly different in terms of sex (P=0.306), age group (P=0.190), education (P=0.749), and occupation (P=0.685), history of COVID-19 symptoms (P=0.108), history of confirmation of COVID-19 (P=0.352), and history of comorbid diseases (P=0.477). However, this study showed that the prevalence of SARS-CoV-2 antibodies differed significantly among the fully vaccinated and incomplete groups (P <0.001).

Conclusion: There was a significant difference between the antibody status of respondents who had been fully vaccinated (at least two doses) and respondents who had not completed the vaccination.

Keywords: Seroprevalence, SARS-Cov-2, COVID-19, Vaccination.

INTRODUCTION

The Coronavirus Disease 2019 (COVID-19) pandemic is a major global crisis for humanity, that has spread worldwide rapidly, causing many casualties and economic losses [1]. Globally, as of February 28, 2022, the total confirmed cases of COVID-19 reached 445,113,336 cases with 6,022,339 deaths. In Indonesia, the total number of confirmed cases of COVID-19 have reached 5,748,752 cases, with 1 50,172 deaths due to COVID-19 infection [2]. During February-March 2022, Indonesia faced the third wave of the COVID-19 pandemic with the attack of the B.1.1.529 (Omicron) variant of SARS-CoV-2, which caused an increase in COVID-19 cases nationwide [3]. South Sulawesi Province is the most affected area, with 110,803 confirmed cases as of February 7, 2022, with a death rate of 2,247. Gowa Regency is the second highest district after Makassar City, with 8,738 cases.

The surveillance method carried out in Indonesia is not able to capture all cases of infection caused by the limitation of diagnostic tools broadly. The spectrum of diseases with fairly wide manifestations, especially the omicron variant without symptoms or mild symptoms that may not be examined so that the infection status of the case is unreported. This results in a higher probability of more infected patients in the field than reported cases [4, 5]. At the same time, the COVID-19 vaccination program in Indonesia is running, with coverage of the complete vaccination (2 doses) in South Sulawesi when the study took place still reaching 61.21% and Gowa Regency only reaching 53.76%. Looking at these data, it is crucial to conduct a seroprevalence study to estimate the actual prevalence of COVID-19 infection in communities in the Gowa Regency.

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Research on seroprevalence has been conducted in many countries [6-9]. Some studies focus on specific groups such as health workers [10-12], blood donors, or dialysis patients [13-16]. When this survey was conducted, similar seroprevalence studies were also shown in Indonesia but had never been performed in South Sulawesi, Gowa Regency [17-19]. This seroprevalence study aims to evaluate the effects of the post-third wave of COVID-19 in Indonesia and see the effectiveness of the ongoing vaccination program. In addition, having detailed data at the community level, such as districts, can help local governments provide more targeted public health responses during the pandemic [4, 17].

METHODS

Eight hundred fifty-nine people in Gowa Regency were recruited on March 6-20, 2022, to participate in this cross-sectional study. The inclusion criteria used are residents of Gowa Regency who are domiciled for at least six months calculated until the survey is conducted, not in an isolation-quarantine period, and willing to participate in this research by filling out a consent form.

This survey was designed to estimate the seroprevalence of SARS-CoV-2 in the Gowa District. The minimum sample size required is calculated using the following formula:

[DEFF*Np(1-p)]/ [(d2/Z1-α/2*(N-1)+p*(1-p)].

Where

N = population size more than 1,000,000

p = prevalence of community antibodies has reached (0.5).

d = precision (0.5)

Desain effect (DEFF) = 2 for multi-stage random sampling.

Z1-α/2 = 1.96

The assumption is that the estimated prevalence of community antibodies has reached (50% or 0.5). Desiain effect (DEFF) = 2 for multi-stage random sampling. With the desired estimated confidence increase of 1-α/2 = 95% (Z1-α/2 = 1.96) and a margin of error of 2%, a minimum sample number of 768 was obtained to avoid a loss to follow-up the sample. It was increased to 859 respondents. The sample was selected through a sampling cluster in 2 stages: 1) random village selection using probability proportional to size (PSS) and 2) random selection of households and respondents in each selected village.

The blood specimen is taken through a vein and examined by the Chemiluminescent Microparticle Immunoassay (CMIA) method using the Architect tool to measure antibody titer levels in the specimen. Demographic data, previous infection history, symptoms, comorbid diseases, and vacancy status were collected through interviews using structured questionnaires. All respondents signed informed consent before blood specimen collection and questionnaire filling. This study has also received approval from the Faculty of Public Health Ethics Committee, Hasanuddin University, with number: 9087/UN4.14.1/TP.01.02/2022.

The sociodemographics seen in this study include gender, age, education, and occupation. In addition, there are also variables such as a history of COVID-19 symptoms, a history of comorbid diseases, and vaccination status. Data analysis using the chi-squared test, one-way ANOVA, and logistic regression using the Stata 14 application. Results are considered significant at $p<0.05$.

RESULTS

The prevalence of anti-SARS-CoV-2-IgG in the Gowa Regency was 98.7% (848/859). The demographic prevalence of anti-SARS-CoV-2-IgG is shown in Table **1**. The results showed that the majority of SARS-CoV-2 antibodies did not differ significantly in terms of sex (*P*= 0.306), age group (*P*=0.190), education (0.749), and occupation (0.685). Having a history of COVID-19 symptoms and a history of having been confirmed with COVID-19 at least six months earlier statistically did not have a significant relationship with anti-SARS-CoV-2 status with p values (*P*= 0.108) and (*P*= 0.352), respectively. The same was found in the comorbid history variable (*P*= 00.477). However, this study showed that the p prevalence of SARS-CoV-2 antibodies differed significantly among the fully vaccinated and incomplete groups (*P*<0.001). The multivariate analysis's findings revealed that the factor most responsible for the rise in SARS-CoV-2 antibody levels in the Gowa Regency residents was their COVID-19 vaccination status (Table **2**).

This information can also be seen in more detail in Figure **1**, which compares antibody titer levels based

Table 1: Sociodemographic Characteristics of Respondents with SARS-CoV-2 Antibody Status

Variable	Total	Reactive (%)	non-reactive (%)	p-value
Seroprevalance	859 (100)	848 (98.7)	11 (1.28)	
Sex				
Male	415 (48.3)	408 (98.3)	7 (1.7)	0.306
Female	444 (51.7)	440 (98.7)	4 (0.9)	
Age Group (year)				
1-11	45 (5.2)	43 (95.5)	2 (4.4)	0.190
12-18	45 (5.2)	44 (97.8)	1 (2.2)	
19-29	144 (16.8)	141 (97.9)	3 (2.0)	
30-59	564 (65.7)	560 (99.2)	4 (0.7)	
60+	61 (7.1)	60 (98.3)	1 (1.6)	
Education				
Higher education (junior high school and below)	509 (59.2)	503 (98.8)	6 (1.2)	0.749
Higher education (senior high school and above)	350 (40.7)	345 (98.6)	5 (1.4)	
Employment				
Working	495 (57.6)	488 (98.6)	7 (1.4)	0.685
Not Working	364 (42.4)	360 (98.9)	4 (1.1)	
History of COVID-19 Symptoms				
Yes	441 (51.3)	438 (99.3)	3 (0.7)	0.108
No	418 (48.7)	410 (98.1)	8 (1.2)	
Diagnose of COVID-19				
Yes	62 (7.2)	62 (100)	0 (0)	0.352
No	797 (92.8)	786 (98.7)	11 (1.3)	
History of comorbid disease				
Yes	98 (11.4)	96 (97.9)	2 (2.1)	0.477
No	761 (88.6)	752 (98.8)	9 (1.2)	
COVID-19 vaccination status				
Complete	718 (83.6)	713 (99.3)	5 (0.7)	<0.001*
Not Complete	141 (16.4)	135 (95.7)	6 (4.3)	

Table 2: Multivariate Analysis SARS-CoV-2 Antibody Status

Variable	p-value	COR (95% CI)	AdjOR (95% CI)
Age group	0,325	1,672 (1,008-2,774)	1,281 (0,782-2,099)
History of COVID-19 Symptoms	0,115	2.848 (0.750-10.811)	2,944 (0,767-11,289)
COVID-19 vaccination status	0,019	6.337 (1.907-21.063)	5,473 (1,523-19,658)

on the dose of vacation. The antibody titer of those vaccinated with the third dose was 12,445 titer of 3,244 (374-9,186), and significant statistically; it shows a difference between these groups (*P* <0.001).

DISCUSSION

The seroprevalence findings in Gowa Regency in March 2022 were relatively high, reaching 98.7%,

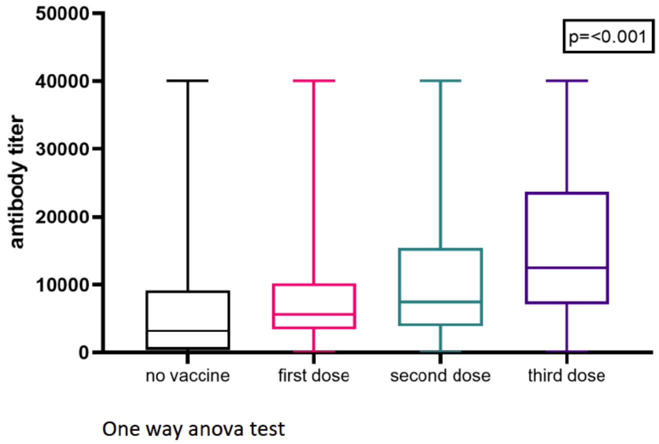

Figure 1: Comparison of antibody titers based on vaccine dose.

indicating that most of the population already had SARS-CoV-2 antibodies after the third wave of COVID-19 in Indonesia. This is similar to several countries in Africa and Asia, which experienced an increase in seroprevalence after the high COVID-19 wave The results of this study showed that the proportion of SARS-CoV-2 antibodies in all age groups was very high, with the percentage of respondents aged >30 years having a higher proportion than in younger age groups [20, 21]. These results are in line with some studies that have been done previously [7, 18] by sex, there were no significant differences between the male and female groups, as in another study [22, 23].

The respondents with a history of COVID-19 symptoms had the same high percentage of antibodies as respondents with no previous symptoms; the same thing happened between the group who had been confirmed with COVID-19 and those who had never been confirmed with COVID-19. This indicates that there is a considerable difference between the results of this serosurvey and the cumulative reports of cases that have been reported in public; this is due to the inadequate number of tests and the nature of infection with COVID-19 variant B.1.1.529 (Omicron) which is primarily asymptomatic or only mild [24].

This study showed a significant difference between the antibody status of respondents who had been fully vaccinated (at least two doses) and those who had not. This study's results align with studies showing that COVID-19 vaccination stimulates the immune system to produce neutralizing antibodies against SARS-CoV-2 [25-27]. The COVID-19 vaccine is considered effective in forming an immune response against the SARS-CoV-2 virus because most COVID-19 vaccines are designed to elicit an immune response that neutralizes antibodies to the SARS-CoV-2spike protein [21, 28, 29].

Understanding the magnitude of the response to vaccination during the SARS-CoV-2 pandemic is critical to the eventual mitigation of the disease. Vaccination efforts are an effective COVID-19 control and control strategy so that the pandemic shifts towards endemicity [30, 31]. The Indonesian government has conducted an intensive vaccination program against SARS-CoV-2 during the COVID-19 pandemic. Herd immunity against COVID-19 should be achieved by exempting people through vaccination, not by exposing them to disease-causing pathogens. An effective vaccine can reduce the risk of severe symptoms if infected with the COVID-19 virus.

The results of this study confirm the importance of COVID-19 vaccination in determining the SARS-CoV-2 antibody response. Therefore, to form SARS-CoV-2 antibodies, it is recommended that people be vaccinated against COVID-19 so that herd immunity can be developed. Thus, it is hoped that the spread of COVID-19 can end.

CONCLUSION

This study's findings reveal a remarkably high prevalence of anti-SARS-CoV-2 antibodies in the Gowa Regency, reaching 98.7%. This underscores the extensive impact of the Omicron variant during the third wave of COVID-19 in the region. The results highlight the need for continued vigilance and strategic responses to combat future pandemic waves effectively, emphasizing the importance of understanding risk factors associated with infection.

Additionally, the significant difference in antibody status between fully vaccinated individuals and those with incomplete vaccination underscores the critical role of comprehensive vaccination programs in building herd immunity.

These findings contribute to the growing body of evidence on the effectiveness of COVID-19 vaccination in stimulating immune responses and mitigating the impact of the virus, particularly in the face of emerging variants. As we move forward, it is crucial to maintain and expand vaccination efforts while considering the local context and community-level data to tailor public health responses and ultimately bring an end to the spread of COVID-19 in the region.

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CONFLICT OF INTEREST STATEMENT

There are no conflicts of interest.

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