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An Analysis of Severe Acure Respiratory Syndrome Coronavirus-2 (Sasrs-COV-2) Antibody Levels Determinant of Society in Gowa Regency

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Abstract

Covid-19 is a disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) Infection. Specific antibody detection can provide information about adaptive immunity against SARS-CoV-2. This study aims to identify and analyze the determinants of SARS-CoV-2 antibody levels based on data from the results of the SARS-CoV-2 Seroprevalence Survey in Indonesia. This study was an analytic observational study with a cross sectional study design. The Total of samples was 851 samples. The sampling technique used purposive sampling with the SARS-CoV-2 Seroprevalence Survey. Data analysis used STATA version 14.0 with chi-square test and multiple logistic regression. There was a difference among the SARS-CoV-2 antibody levels Determinant based on the type of vaccine (p=0.001), vaccine dose (p<0.001) and time interval of last vaccination (p=0.002). The results of the multivariate analysis showed that vaccine dose was the most related variable to SARS-CoV-2 antibody levels (p = 0.004) after removing the variable type of vaccine and time interval of last vaccination. The most related variable is the vaccine dose with the possible type of vaccine and time interval of last vaccination as confounding factor. Vaccination scope for Covid-19 dose 2 and 3 should be further improved and given according to the administration schedule that related to type of vaccine as well as choosing RNA-based vaccine type which given to people in Gowa Regency.

Keywords: SARS-CoV antibody levels, age, Covid-19 infection Profile, Type of vaccine, vaccine dose and time interval of last vaccination

Full length article **Corresponding Author*, e-mail: adrianas20k@student.unhas.ac.id Doi # https://doi.org/10.62877/19-IJCBS-24-25-19-19

1. Introduction

Coronavirus disease 2019 (Covid-19) is an infectious disease caused by new discovered type of coronavirus namely Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The new virus and disease that have been caused were unknown before the plague started in Wuhan, China, in December 2019 [1]. Covid-19 is transmitted from person to person by droplet spread [2]. This virus spreads very quickly to countries around the world. In a short time, it has caused a global pandemic and become a major health problem in the world. The Covid-19 pandemic has destroyed more than 200 countries around the world and continents either developed or developing countries including Indonesia [3]. Based on the report from the Covid-19 Handling Task Force (Satgas), there were additional 1,220 new confirmed cases of Covid-19. Thus in 17 June 2022, the total confirmation of Covid-19 in Indonesia was 6,065,644 cases [4]. However, Gowa Regency is a regency with the second largest number of confirmed cases of Covid-19 in South Sulawesi Province after Makassar City. The total number of confirmed cases of Covid-19 in Gowa Regency in June 22 2022 was 11,277 cases [5]. Due to the rapid transmission of Covid-19 and high level of fatality case, preventive efforts are needed to prevent infection from SARS-CoV-2. Not only implementing health protocol such as wearing mask, washing hands with soap, keeping safe distance, reducing mobility, a strong immune system is also needed so that the body is not easily exposed to this SARS-CoV-2 infection. Immunity can be formed at the individual level either through natural infection with pathogen or through immunization with vaccine [6]. Thus the rapid development and launching of vaccine for SARS-CoV-2 has very big potential to reduce infection-related

morbidity and mortality [7]. This is because most vaccines aim to produce antibody-mediated immune responses [8]. Therefore, to achieve herd immunity, at least 70% of total population needs to be vaccinated because herd immunity is a key concept for epidemic control [9] Regardless of the effectiveness of vaccine that has been reported, the immune response to pathogen is often heterogeneous and diverse among individuals based on age, environment, and health conditions as the baseline. Besides that, according to Zimmermann & Curtis (2019) [10] stated that the immune response in humans to vaccines is influenced by various factors, including intrinsic, perinatal, extrinsic host factors (pre-existing immunity, environment, behavior, nutrition and vaccine factors which include type of vaccine, adjuvant products, doses and factors of giving (schedule, place and time of vaccination). Understanding the immune response to acute respiratory syndrome SARS-CoV-2 is very important to understand the pathogenesis of disease and the use of therapy as well as vaccine development, antivirus and monoclonal antibody [11] and the most important as a basis for making future Covid-19 control policies. Starting from the fact that the high number of Covid-19 cases and the low scope of Covid-19 vaccination in Gowa Regency has attracted the interest of researchers to conduct research to find out the determinant of SARS-CoV-2 antibody levels of society in Gowa Regency.

2. Materials And Method

2.1 Study Design and Location

The type of research used in this study was observational analytic study with a cross sectional study design. The location of this study was in Gowa Regency.

2.2. Sample of the Study

There were 851 samples in this study which consisted of SARS-CoV-2 serology data and questionnaire data. The sampling technique used was purposive sampling with inclusion criteria which is having complete data either serological data or questionnaires.

2.3 Instrument and Procedure

This study was a study that used secondary data from the results of the SARS-CoV-2 Seroprevalence Survey conducted in Gowa Regency in March 2022. The data was in the form of SARS-CoV-2 serological data and questionnaire data that related to the variable abalysis. Giving permission to conduct further analysis of the results of the SARS-CoV-2 Seroprevalence Survey was obtained through a statement letter from the Department of Epidemiology, Faculty of Public Health, Hasanuddin University with number: 13355/UN4.14.7.1/PT.01.00/2022 through ethical approval from the Faculty of Public Health, Hasanuddin University with number Hasanuddin University with number 9087/UN4.14.1/TP.01.02/2022.

2.4 Data Analysis

Data processing and analysis was conducted by using STATA version 14.0. Bivariate analysis used the chi-square test to find out which variables had a significant relation with SARS-CoV-2 antibody levels and multivariate analysis used multiple logistic regression tests with the Forward method to find out which variables were mostly related to SARS-CoV-2 antibody level.

3. Results and Discussion

3.1. Results

Table 1 shows that the proportion of respondents who had the highest reactive antibody in respondents aged <60 years (98.73%), had a profile of Covid-19 infection (100%), respondents who used RNA-based vaccines (100%) and viral vector vaccines (100%), as well as respondents who had been vaccinated Covid-19 for three doses (100%). Likewise, the proportion of respondents with the highest reactive antibody was in respondents who had time interval of last vaccination about <3 months (99.36%). Statistical analysis using the chi-square test shows that the variables significantly that related to SARS-CoV-2 antibody levels including the type of vaccine ($p=0.001$), vaccine dose ($p<0.001$) and the time interval of last vaccination ($p=0.002$). The variables that were not related to SARS-CoV-2 antibody levels were age ($p=0.199$) and Profile of Covid-19 infection ($p=0.328$). Table 2 shows that there are four models in multivariate analysis. After conducting a multivariate analysis, it was found that the most variables related to SARS-CoV-2 antibody levels was vaccine dose ($p<0.001$) after removing the variable type of vaccine and the time interval of last vaccination.

3.2. Discussions

The determinants of variables for SARS-CoV-2 antibody levels analyzed were age, Profile of Covid-19 infection, type of vaccine, vaccine dose and time interval of the last vaccination. From the five variables, it was found that vaccine dose was the most related variable to SARS-CoV-2 antibody levels. This vaccine dose factor should be prioritized in relation to SARS-CoV-2 infection. It was found that the higher the vaccine dose, the higher the proportion of respondents with reactive SARS-CoV-2 antibody where the proportion of respondents with 3 vaccine doses had reactive antibody for 100% (Table 1). The third dose of vaccine or commonly called as booster vaccine was given as an effort to break the chain of Covid-19 transmission to increase the immunity of body against Covid-19 infection. The third dose of vaccine can increase the effectiveness of previous Covid-19 vaccine. As time goes by, the effectiveness of vaccine dose 1 and 2 can be weaker so that protection against viruses can decrease. Then, an additional vaccine is given to rebuild antibody and extend protection [12]. The variable of vaccine dose was only significant after removing the variable type of vaccine and the time interval of last vaccination. It is possible that the two variables are confounding. A significant difference was found in the change of OR score after the variable type of vaccine and the interval time of last vaccination were released (Table 2). Thus, variables that also have relation with SARS-CoV-2 antibody levels including the type of vaccine and the time interval of last vaccination. The immune response are very diverse with different vaccine types and products.[10] In this case, the vaccine dose that can play a role in producing reactive SARS-CoV-2 antibody is also determined by type of vaccine and time interval of last vaccination. This means that to produce reactive SARS-CoV-2 antibody, 3 doses of RNA-based vaccine and vector vaccine should be vaccinated and the time interval of vaccination is < 3 months.

Table 1: The Relation between Research Variables and SARS-CoV-2 Antibody Levels

Research Variables	SARS-CoV-2 Antibody Levels Category		Total (%)	*p value*
	Reactive(%)	Non-Reactive (%)		
	n =12	n=839	n=851	
Age (Years)				
≥60	2 (3.28)	59 (96.72)	61 (100,0)	0.199
<60	10 (1.27)	780 (98.73)	790 (100,0)	
Profile of Covid-19				
Never	12 (1.52)	777 (98.48)	789 (100.0)	0.328
Ever	0 (0.00)	62 (100.0)	62 (100.0)	
Type of Covid=19 Vaacine	4 (7.27)	51 (92.73)	55(100.0)	
No vaccine	8 (1.42)	555 (98.58)	563(100.0)	**0.001**
Inactivated Vacccine	0 (0.00)	10 (100.0)	10(100.0)	
Vector Vaccine	0 (0.00)	223 (100.0)	223(100.0)	
RNA Based - Vaccine				
Dose of Vaccine				
No Vaccine	4(7.27)	51(92.73)	55(100.0)	
One Dose	3(3.53)	82(96.47)	85(100.0)	**<0.001**
Two Doses	5(0.87)	567(99.13)	572(100.0)	
Three Doses	0(0.00)	139(100.0)	139(100.0)	
Time Interval of Last Vaccine				
No Vaccine	4(7.27)	51(92.73)	55(100.0)	**0.002**
>6 Months	4(1.41)	279(98.59)	283(100.0)	
3-6 Months	3(0.84)	354(99.16)	357(100.0)	
<3 Months	1(0.64)	155(99.36)	156(100.0)	

Table 2: Multivariate Analysis Results of Determinants of SARS-CoV-2 Antibody Levels

Research Variables	Model 1		Model 2		Model 3		Model 4	
	p	OR (CI 95%)	*p*	OR (CI 95%)	*p*	OR (CI 95%)	*p*	OR (CI 95%)
Age (< 65 Years Old)	0.734	1.32 (0.26-6.69)						
Type of Vaccine (RNA and Vector Vaccine)	0.325	2.69 (0.37-19.49)	0.323	2.69 (0.37-19.35)				
Vaccine Dose (3 Doses)	0.059	4.80 (0.94-24.50)	0.053	4.99 (0.97-25.55)	0.004	7.32 (1.89-28.24)	<0.001	**3.25 (1.76-6.0)**
Time interval of Last Vaacine (<3 Months)	0.137	0.43 (0.14-1.30)	0.136	0.42 (1.41-1.30)	0.144	0.48 (1.85-1.27)		

There are 10 types of vaccine used in Indonesia such as Sinovac, Astrazeneca, Sinopharm, Moderna, Pfizer, Novavax, Sputnik-V, Janssen, Convidencia and Zivivax [13] and for booster vaccination, vaccines that are used in Indonesia are Moderna, Pfizer, Astrazeneca and Sinopharm [14]. There are two RNA-based vaccines namely Moderna (mRNA-1273) and Pfizer (BNT162b2) [15]. The advantage of mRNA vaccines is that it causes high immunogenicity (the ability of vaccine to stimulate neutralizing antibody appears) [16] compared to inactivated vaccines such as Sinovac.

In line with the finding of Eliakim (2022) shows that the third and fourth dose of Pfizer vaccine in adults aged 60 years or more related to significant increase in IgG antibody titers about 2 weeks after vaccination [17]. Another study also found that sample of receiving seronegative AstraZeneca vaccine had higher Blocking antibody titer for Receptor Binding Domain (RBD) after vaccination compared to the seronegative CoronaVac vaccine [18]. Furthermore, the study by Baden et al (2021) found that the safety of the mRNA-1273 vaccine regimen and platform was reassuring, No unexpected pattern of worries was identified. The mRNA-1273 vaccine also showed no evidence of short-term improvement in respiratory disease after infection. The mRNA-1273 vaccine showed 94.1% efficacy in preventing Covid-19 disease including severe disease [19]. Therefore, the third dose of vaccination (booster) is needed to rebuild antibody and increase the effectiveness of primary vaccine. Thus, the immunity of body against SARS-CoV-2 infection can increase. This study only used data that had complete serology data and questionnaires. Thus, further analysis cannot be carried out on other variables that related to SARS-CoV-2 antibody levels such as Body Mass Index (BMI) and health behavior factors.

4. Conclusions

Based on the results of this study, it can be concluded that the most related variables to SARS-CoV-2 antibody levels are the vaccine dose variable after releasing the variable type of vaccine and the time interval of last vaccination. Thus, it is recommended to choose the type of vaccine based on RNA and vector vaccine as well as it is hoped that the scope of doses 2 and 3 (booster) vaccination will be enhanced more and given based on the correct administration schedule.

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