Original Article

OVERVIEW OF SARS-CoV-2 ANTIBODY TITERS AFTER 2ND VACCINATION AT THE JAYAPURA STATE HEALTH POLYTECHNIC

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Abstract

Introduction and Aim: COVID-19 is a global pandemic caused by a virus. Vaccination prevents covid-19 infection by producing antibodies to protect from infectious diseases. After vaccination, an antibody response will appear; therefore, the development of antibodies can be measured. This study investigated Determine the antibody titers after stage 2 vaccination.

Material and Methods: The type of research is descriptive with laboratory observation design to detect titers of SARS-CoV-2 antibodies. The population in this study was all the Jayapura State Health Polytechnic staff who had been vaccinated in phase 2. Samples were taken using a Random sampling technique of 35 people.

Results: Over the 35 study subjects in the antibody titer measurement, 2 samples had antibody titers below the tool sensitivity value, i.e., < 20 U / ml, and 1 sample had an antibody titer above the tool sensitivity value of > 12,500 U / ml with a mean value of 2533. The percentage of employees who are positive to achieve antibodies at the Jayapura State Health polytechnic after phase 2 vaccination is 94.3%.

Conclusion: An increase in the level of Covid-19 antibodies was found in employees and staff of the Jayapura Ministry of Health Health Polytechnic after stage 2 vaccination

Keywords: Titer Antibody, Sars-Cov-2, Vaccination

INTRODUCTION

COVID-19 is a global pandemic caused by the *severe acute respiratory syndrome coronavirus* 2 (SARS-CoV-2) virus (1). From various public health perspectives, serology examinations are also used to estimate the proportion

of people infected with SARS-CoV-2 so that they can facilitate tracing after contact and are used as a system for individuals vulnerable to COVID-19 (2).

Antibodies to SARS-CoV-2 can form 14 – 21 days after exposure to COVID-19 (1). Specific antibodies, i.e., IgM and IgA, can form earlier before specific antibodies, i.e., IgG, but IgG-specific antibodies can also form along with or before IgM and IgA antibodies (3). Antibodies to SARS-CoV-2 are specifically aimed at fighting some viral proteins, especially nucleocapsid protein (N) or spike protein (S) (4). Proteins N and S comprise most of the target antigens commonly used in serological immunoassay examinations for clinical diagnosis (5). Several studies have shown that antibodies to a receptor-binding domain (RBD) S1 and N proteins correlate with the number of antibody neutralization titers. Antibody neutralization in viruses is the failure of viral infections due to the presence of antibodies that bind to antigens so that the target antigen cannot attach to cell receptors. RBD binding allows SARS-CoV-2 to infect target cells through *the Angiotensin Converting Enzyme* 2 (ACE2) receptor (6).

Interventions must be carried out immediately, not only but also other effective interventions, such as vaccination efforts, to break the chain of disease transmission. Various countries, including Indonesia, have made efforts to develop an ideal vaccine for the prevention of SARS-CoV-2 infection using various platforms, including the mRNA vaccine developed by Pfizer-BioNTech and Moderna, the v axillary vector virus (adenovirus) developed by Astra-Zeneca, Johnson & Johnson, Reithera, and Sputnik, the v action inactivated virus developed by Sinovac, and the v protein subunit axils developed (7).

Vaccination is the process of administering a vaccine into the body in order to produce antibodies that protect against certain infectious diseases (8). Proper and regular vaccination can prevent the occurrence of infections caused by viruses. However, vaccinations that are carried out can also fail. The vaccination program is a control measure to maintain the spread of the virus so that it can be controlled (9). In addition, according to (10), serological examination of antibody titers is one of the effective methods to determine the success of vaccination. The serological test commonly used is the *Enzyme-Linked Immunosorbent Assay* (ELISA) or the *Electrochemiluminescence Immunoassay* (ECLIA) method. After vaccination, an antibody response will appear so that antibodies are formed that can be measured using one of these methods, namely ELISA / ECLIA (11). This study aims to determine the titer of antibodies after phase 2 vaccination to monitor the success of the COVID-19 vaccination program that the Government has carried out.

MATERIALS AND METHODS

Sample Criteria

This type of research is a descriptive study with a laboratory observation design to detect the titer of SARS-CoV-2 antibodies from phase 2 vaccination results in the Jayapura State Health Polytechnic employees and staff. The population in this study was all Jayapura State Health Polytechnic employees and staff who had been vaccinated in phase 2. Random sampling technique with a total of 35 samples. The type of vaccine used by the study subjects was CoronaVac, produced by Sinovac Biotech Ltd in Beijing. With the criteria sample, the subject was willing to follow the study by signing an informed consent, the blood used was not lysis, and the blood volume was sufficient.

Subject's blood sample collection

The first step was to draw blood from 35 study subjects who had previously filled in informed consent. 4ml of venous blood is then taken in a centrifuge to get the serum.

Antibody titer

The serum was obtained in the antibody titer measuring using the Cobas 6000 tool. The examination is carried out with the Elecsys® Anti-SARS-CoV-2 reagent kit. In principle, 20 µL of serum samples were incubated with biotin and *ruthenylated nucleocapsid* (N) antigens sandwich double-antigen complex is made up of antibodies

from the patient. The DAGS complex binds to the solid phase via the interaction of biotin and streptavidin after adding microparticle-coated streptavidin. The reagent mixture is transferred to a measuring cell, where magnetically captured microparticles are captured on the electrode surface. Unbound substances are extracted. The voltage is then used to induce electrochemiluminescence, which is then measured with a photomultiplier. Sars-Cov-2 antibody titers increase signal results (12).

The antibody titer data obtained are presented in a descriptive by calculating the percentage of employees and staff of the Jayapura Ministry of Health Poltekkes. They have antibodies after phase 2 vaccination. A percentage is known using the formula (13):

Percentage of employees and staff who are positive for containing antibodies

$$\%\ \text{Positive antibody} = \frac{\text{Number of samples tested positive}}{\text{Number of all sampels examined}}\ \text{X}\ 100$$

Statistical Analysis

Data analysis using SPSS version 25 used the Man Whitney Test to look at differences in antibody titers by sex and based on a history of covid-19 infection.

RESULTS

The results of the study on the detection of Sars-Cov-2 antibody titers from the phase 2 vaccination of the Jayapura Ministry of Health Poltekkes are as follows

Table 1: Mean levels of antibodies

Number of samples	Mean	Std Deviation	Min-Max
35	2533.4	2811.2	0.00-12500

Of the 35 study subjects who measured antibody titers, 2 samples had antibody titers below the tool sensitivity value, namely < 20 U / ml, and 1 sample had antibody titers above the tool sensitivity value of > 12,500 U / ml with a mean value of 2533.4. A total of 11 samples had antibody titers above the average value, and as many as 24 had antibody titers below the average value.

The percentage of employees and staff who are positive for containing antibodies at the Jayapura Ministry of Health Poltekkes after phase 2 vaccination is calculated using the following formula;

$$\%\ \text{Positive antibody} = \frac{\text{Number of samples tested positive}}{\text{Number of all sampels examined}}\ \text{X}\ 100$$

$$\%\ \text{Positive antibody} = \frac{33}{35}\ \text{X}\ 100$$

$$\%\ \text{Positive antibody} = 94{,}3\ \%$$

So the percentage of employees and staff who are positive for containing antibodies at the Jayapura Ministry of Health's Poltekkes after phase 2 vaccination is 94. 3 %

Table 2: Antibody Levels By Sex

Gender	**N**	**Antibody titers Mean**	**Std. Deviation**	**P value***
Man	12	1735.2	1649.5	0.297
Woman	23	2951.5	3211.5	

*Test Man Whitney P value 0.297>0.05

The study's results in table 4.2 showed that the average antibody level after the 2nd phase of the vaccine in men was 1735.2 lower than that of women with an average antibody level of 2951.5. The results of the Mann-Whitney Test obtained a value of p = 0.297 (P > 0.05), concluding that there was no significant difference in the average titer of antibodies between the male and female sexes.

Table 3: Antibody Levels Based on Covid Infection

Covid history	**N**	**Antibody titers Mean**	**Std. Deviation**	**P value**
Never been Covid	8	4500.9	4159,2	
Never Covid	27	1951.9	2031,6	0.077

*Test Man Whitney P value 0.077>0.05

The study results in table 4.3 showed that the average antibody level after the phase 2 vaccine in people who got covid 19 infection was 4500.9 higher than in people who had never been infected with covid 19 who had an average antibody level of 1951.9. The increase has doubled. The Mann-Whitney test obtained a p-value = 0.077 (P > 0.05), concluding that there was no significant difference in the average titer of antibodies between those who had covid-19 and never had covid-19.

DISCUSSION

The study's results on antibody titers obtained that there are low antibody titers and high ones with a mean value of 2533.4. This difference in antibody titers is due to several factors. According to (14), several factors influence the antibody formation process after COVID-19 vaccination, including age, infection history, and virus mutations. According to research (15), In expansion to behavioral and way of life components, sex components too impact the safe reaction of the have to contamination.

The vaccine used for phase 2 vaccination at the Jayapura Ministry of Health poltekkes uses the Sinovac type vaccine. The Sinovac vaccine is made by a company from China using an inactivated virus as an antigen. Attenuated viral vaccines will not cause but can still produce an immune response (7). The reason for the SARS-CoV-2 immunization is to deliver antibodies that can recognize the virus's S protein. Anti-spike: This counteracting can avoid the interaction of the infection with human cells and offer assistance in dispensing the disease within the early stages. Antibodies vary in terms of their component of activity, mode of organization, and

resistant reaction (14). Vaccines generally contain immunogens that encode antigenic viral peptides and adjuvants that can trigger an immune response (16).

The antibody titer measurement technique uses the ELISA method. ELISA is an immunoassay technique that qualitatively determines the concentration of antibodies in the blood of an individual. This technique uses an electrochemical reaction to generate a chemiluminescent signal measured by an analyzer. The currently available ECLIA test is Elecsys by Roche. The tool measures the total antibodies in the blood. A positive result (showing the nearness of antibodies to SARS-CoV-2) may be a cut-off index of 1, whereas a negative result could be a cut-off file <1 (17).

The results of antibody measurements for employees and staff who were positive for containing antibodies at the Jayapura Ministry of Health's Poltekkes after phase 2 vaccination was 94.3%, meaning that 33 out of 35 people had antibodies after the 2nd stage of vaccination against covid-19. It is imperative to know that an individual with antibodies to covid-19 can be contaminated after immunization or after recuperating from a past disease (reinfected). However, the risk of reinfection is low for at least the first 6 months after infection with the virus that causes covid-19 is diagnosed through laboratory tests. No vaccine is 100% effective. The chance of contamination, extreme sickness, hospitalization, and passing is much lower for inoculated individuals than unvaccinated individuals. When reinfection happens, antibodies play a crucial part in making a difference in anticipating extreme sickness, hospitalization, and passing (18).

Antibodies are products produced by B cells. APC breaks down antigens into littler peptides, at that point communicated to their surface through surface receptors called major histocompatibility complex course II (MHC-II) molecules. The antigen is then presented to several cell types in the host, including B cells, CD4+ T cells, and CD8+ T cells. B cells that separate into plasma cells will deliver antibodies that restrain the passage of viral particles into solid cells. The enactment of aide T cells by APC causes them to distinguish into distinctive subtypes with particular capacities interceded by cytokine discharge and cell-to-cell contact. Th2-differentiated aide T cells assist the humoral reaction development by giving a moment flag to B cells, mostly through IL-4 emission and CD40/CD40L intuitive. A few CD4+ cells, too, ended up follicle partner (Tfh) T cells, which regulate imperative intuition within the germinal center that is imperative for the development of memory B cells and Long-lived high-affinity antibody-producing plasma cells (2, 19).

The study results in table 2 show that the average level of antibodies after the phase 2 vaccine in women is higher than in men. This can be caused because the activation of T cells in women is significantly stronger than in men. The destitute T-cell reaction was contrarily connected with understanding age and was related to more regrettable infection results in male but not in female patients (20). Sex variables that impact a host's resistant reaction to contamination are sex chromosome-related qualities, sex hormones, and microbiome control perspectives of intrinsic and versatile safe reactions. Women have 2 copies of the X chromosome (mother and father), which causes the inactivation of one copy of the gene to ensure proper gene dose. As a result, women have mosaic cells expressing two X-linked alleles, giving them a great advantage in overcoming genetic diseases associated with recessive mutations that occur on the X chromosome. In turn, women have diverse immune responses that may provide a wider range of tools to fight pathogens (15).

Sex hormones are a critical organic figure contributing to sex in carrying out a safe and can influence the seriousness of infections in irresistible and immune system infections. In common, the hormone estrogen capacities as an immunostimulator, enacting intrinsic and versatile resistant reactions in this manner, ladies can clear pathogens more proficiently than men. Though testosterone is immunosuppressive, that will underlie the helplessness and seriousness of higher irresistible illnesses in guys (21). Testosterone is known to operate, bringing down cytokines counting IFN-γ and TNF and expanding administrative cytokines such as IL-10. Progesterone diminishes the control of the generation of proinflammatory cytokines IL-1β and TNF by dendritic cells within the bone marrow in rats. Elevated androgen levels can increment or contribute to contamination due to the translation of transmembrane serine protease 2 (TMPRSS2) interceded androgen receptors that are imperative for the passage of the infection into the have cell. Immune cells contain estrogen receptors, progesterone receptors, and androgen receptors which are ligand-activated translation components. Sex hormones tie to these receptors and trigger a cascade of intracellular signaling to direct quality and protein expression to

impact the advancement, development, actuation, and work of natural and versatile safe cells amid homeostasis and the resistant reaction to contamination (15).

The microbiota or commensal microscopic organisms within the gastrointestinal tract contain a part within the direction of testosterone levels and impact the resistant reaction. An in vivo think about found that the number of microbiome species in male and female mice did not contrast amid the pre-pubescent stage but varied after adolescence. Proposes that hormonal changes amid adolescence drive changes within the microbiome. Furthermore, the microbiome increments androgens to levels that give assurance in mice from sort 1 diabetes. Outlines the synergistic impacts of male hormones and the microbiome (22).

Research by (23) too appeared that there are contrasts in counteracting agent reactions based on sex to SARS-CoV-2 where in patients with mellow conditions, more ladies compared to men who deliver antibodies to S1 parts of protein S. This part of protein S contains *a receptor binding domain* (RBD) is an important region for the introduction of receptors and the entry of viral cells. Thus the antibodies that recognize them will have the ability to neutralize them. Studies conducted on experimental animals have also shown similar results: female animals develop stronger innate and adaptive immune responses to infectious diseases. In male and female rats with SARS, male rats had a mortality rate of 90%, while female mice had a mortality rate of 20% (15, 24).

The results of the study in table 3 show that the average antibody level after the 2nd phase of the vaccine in people who are getting covid 19 infection is 4500.9 U / ml higher than in people who have never been infected with covid 19 who have an average antibody level of 1951.9 U / ml. Nevertheless, statistically, there is no meaningful difference between the average titer of antibodies infected with covid-19 and never been infected with covid-19. The increase has doubled. This is in line with research conducted by (25) appearing that the titer of anti-SARS-CoV-2 antibodies within the test of already contaminated members had a normal titer of 569 and the test of already uninfected members had a normal titer of 118 with ($P<0.001$).

CONCLUSION

An increase in the level of Covid-19 antibodies was found in employees and staff of the Jayapura Ministry of Health Health Polytechnic after stage 2 vaccination.

SUGGESTION

1. Subsequent vaccines or boosters are still needed to maintain antibody titers in the body.
2. More research is needed regarding antibody titers derived from several types of vaccines.
3. More research is needed on how long antibody will last in individuals after infection and vaccines.
4. It is necessary to conduct further research using a larger number of samples

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CONFLICT OF INTEREST

The author (s) have no conflict of interest to declare.

STATEMENT OF ETHICS

All procedures involving research subjects in the form of humans are by the standards of the Health Research Ethics Committee of the Ministry of Health of Jayapura (No.015/KEPK-J/IV/2022).

AUTHORS CONTRIBUTIONS

Conceptualization: ITS and RH. Methodology: ITS and RH. Data curation: ITS. Formal analysis: ITS and RH. Supervision: ITS. Validation: ITS and RH. Writing original draft: ITS. Writing, review and editing: ITS, AHW, A and DR. All the authors have critically reviewed and approved the final draft and are responsible for the accuracy and integrity of the content and similarity index of the manuscript.

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