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Original Article

EVALUATION COMPARISON BETWEEN SINOVAC AND PFIZER VACCINE AMONG INDONESIAN CHILDREN AND TEENAGER UNDER 18 YEARS OLD

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ABSTRACT

Objective: To evaluate the comparison between the Sinovac vaccine and Pfizer vaccine for children and teenagers under 18 y in Indonesia and other factors that influence it.

Methods: The type of this research is observational with a cross-sectional design using convenience sampling for all children and teenager in Indonesia who has received the full dose of Sinovac and Pfizer vaccine.

Results: It was found that the efficacy for Sinovac and Pfizer vaccines was 99.5% and 99.75%, respectively. Other factors that influence the side effects and efficacy of vaccines are gender, age, and BMI, with a p-value of each variable<0.05.

Conclusion: There is a correlation between the type of vaccine, gender, age, and BMI with the efficacy and side effects of vaccination.

Keywords: Sinovac, Pfizer, Indonesian children and teenager under 18 y old

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INTRODUCTION

The coronavirus disease 2019 (COVID-19), which emerged at the end of 2019 has become a public health threat around the world. The primary destination of infection for SARS-CoV-2 acute respiratory syndrome is the lower respiratory tract [1]. Recorded in the Analysis of Covid-19 Indonesia Data on the Development of Covid-19 Cases Indonesia, among the 765,350 confirmed cases of COVID-19 in the update of October 10, 2021, the percentage of patients confirmed positive for covid with an age range of 13-15 y is 1.83% while for the age range of 16-18 y by 2.24%. Very far with patients with an age range over 18 y with a percentage of 13–29,66% [2].

Reported in August 2020 Estimates of pediatric hospitalizations for COVID-19 in the US are 15.8% of 100,000 in children aged 0-4 y and 9.2% of 100,000 in those aged 5-17 y. Although this fig. is quite far from Covid inpatients over the age of 17, a vaccination program is also needed for children and teenagers under 18 y of age [3]. The Indonesian government provides a choice between two types of Covid-19 vaccines that have passed clinical trials for children in Indonesia, Sinovac, which can be used for ages 3 to 17, and Pfizer for ages 12 to 17 [4].

Pfizer-BioNTech COVID-19 vaccine (BNT162b2) is a lipid nanoparticle modified mRNA vaccine created with a nucleoside encoding the SARS-CoV-2 prefusion spike glycoprotein, the virus that causes coronavirus disease (COVID-19) [5]. While the Sinovac CoronaVac vaccine is an inactivated whole-virion SARS-CoV-2 vaccine that was developed by Sinovac Biotech Ltd., Beijing, China [6, 7]. In Brazil, Indonesia, and Turkey, three randomized, placebo-controlled phase 3 clinical trials were conducted [8]. Pfizer Vaccine has a 95% effectiveness rate against COVID-19 [9, 10]. In phase III clinical trials, Sinovac indicated the efficacy of 50%, 65%, 78%, and 91% in different nations. The Brazilian population had the lowest efficacy, with a mean efficacy of 50.38% [8, 10].

Sinovac vaccine for health workers and public service providers covered one million people in an observational study, and until recently, mild Adverse Event Following Immunization (AEFI) incidents such as soreness, pain at the injection site, redness, fever, nausea, and changes in appetite was reported [11]. The Official Report On Pharmacovigilance Programs in Chile reported on Consolidated Regional And Global Information On Adverse Events Following Immunization (AEFI) Against COVID-19 And Other Updates. In the case of the Pfizer-BioNTech vaccine, Between the 16th and the 23rd of April, 156 AEFI were examined, with women accounting for 74% of the total. AEFI examined during this period were classed as non-serious 99.4% of the time and mild in all but one case. Pain at the injection site accounted for 20% of reported occurrences, followed by a 10% fever and an 8% headache. A single severe instance was documented, with an anaphylactic response [12].

Although data related to efficacy and side effects regarding the Sinovac and Pfizer vaccine already exist. Further clinical research is warranted on evaluation comparison between Sinovac and Pfizer vaccine among Indonesian, especially for children and teenager under 18 y old.

Covid-19

In late December 2019, several people were diagnosed with pneumonia of unknown etiology. The assumption for the source comes from a wholesale market, and large animals in Wuhan, Hubei province, China [13]. China has announced that the type of pneumonia is novel coronavirus (2019-nCoV) pneumonia [14]. Novel coronavirus pneumonia is a new type of pneumonia that affects humans and is caused by a new coronavirus. The World Health Organization (WHO) has stated the coronavirus disease outbreak in 2019. (COVID-19) [15]. Covid 19 (SARS-CoV-2) is a new type of coronavirus that is the source of the 2019 Coronavirus Pandemic disease. The coronavirus acute respiratory syndrome (SARS-CoV-2) is the origin of the 2019 Coronavirus disease (COVID-19). The World Health Organization (WHO) has declared Covid-19 a pandemic on March 11, 2020 [16]. Coronaviruses are classified as alpha (α-CoV), beta (β-CoV), gamma (γ-CoV), and delta (δ-CoV) coronaviruses and belong to the Coronaviridae family. The alpha and beta coronaviruses can infect mammals, and human viruses are genetically related to the β-CoV genus. The β-CoVs are further classified into four lineages (A, B, C, and D) SARS-CoV and SARS-CoV-2 are classified as lineage B, which has about 200 published virus sequences, while MERS-CoV is classified as lineage C, which has 500 viral sequences [17]. The HCV-229E and HCV-NL63 are Alphacoronavirus family, while the HCoV-OC43, HCV-HKU1, and SARS-CoV are Betacoronaviruses. SARS-CoV-2 protein is securely entrenched in the β-genus lineage of bat coronaviruses, according to

phylogenetic analyses [18]. SARS-CoV-2 has a whole-genome that is 80 percent identical to SARS-CoV-2 is 96 percent identical to BatCoV-RaTG13, a bat coronavirus [19]. The spike protein sequences of SARS-CoV-2 and SARS-CoV are nearly identical (76–78%). The RBD alone has a resemblance of 73–76%, while the RBM has a similarity of 50–53%. The human MERS-CoV, on the other hand, is related to the Tylonycteris bat coronavirus HKU4, has a lower sequence similarity (54%), and recognizes DPP4 as a receptor. The probability of binding to the same receptor angiotensin-converting enzyme 2 (ACE2) in the host cell is explained by the sequence similarity between SARS-CoV-2 and SARS-CoV spike proteins [18]. Coronavirus has one of the largest genomes of any RNA virus, with a genomic size of 27 to 32 kb. The major method of virus entry into host cells is receptor-mediated endocytosis. For viral infection, SARS-CoV-2 requires ACE2, a cell-surface receptor found in the kidney, blood vessels, heart, and, most crucially, AT2 alveolar respiratory tract epithelial cells in the lungs [20]. The N-terminal and C-terminal domains of the spike protein, which is crucial for viral entry, are present in almost all coronaviruses, and two major subunits, S1 and S2, are present in almost all coronaviruses [21].

Acute liver, heart, and renal injury, as well as secondary infection and inflammatory reaction, are all probable COVID-19 consequences. Because there is no protective immunity to the virus, it can evade the innate immune response. The initial line of antiviral defense is the innate immune-sensing mechanism, which is a crucial part of virus immunity. Pattern recognition receptors (PRRs) are involved in this pathway, and when they are activated, they cause the release of cytokines (the most important of which are type I/III IFN). SARS-CoV-2, on the other hand, has acquired several strategies to prevent IFN-I production and signaling. As a result of viral growth, SARS-CoV-2 primary infected tissue is characterized by cell death and viral shedding. The recruitment of immune cells, the formation of immunological complexes, and the resulting organ damage follow. SARS-CoV-2 infection can stimulate both innate and adaptive immunity. The initial line of antiviral defense is the innate immune-sensing mechanism, which is a crucial part of virus immunity. Pattern recognition receptors (PRRs) are involved in this pathway, and when they are activated, they cause the release of cytokines (the most important of which are type I/III IFN). SARS-CoVs, on the other hand, has acquired several strategies to prevent IFN-I production and signaling. As a result of viral growth, SARS-CoV-2 primary infected tissue is characterized by cell death and viral shedding. The recruitment of immune cells, the formation of immunological complexes, and the resulting organ damage follow. SARS-CoV-2 infection can stimulate both innate and adaptive immunity. This indicated that, in addition to immune cell recruitment, mononuclear cell infection could trigger a huge inflammatory response in the latter stages of the disease. This uncontrolled inflammatory immune response can damage tissue both locally and systemically [16].

Pediatric hospitalizations in the United States are expected to be 15.8 per 100,000 in children aged 0-4 y old and 9.2 per 100,000 in children aged 5-17 y old until August 29, 2020, according to estimates. Even though the burden of COVID-19 hospitalization is lower in children than in adults, it is comparable to the burden of pre-vaccine-era hospitalizations from other viruses that are now prevented with vaccines. Approximately one-third of children hospitalized with a SARS-CoV-2-positive polymerase chain reaction were admitted to the intensive care unit, as did 80 percent of those with the multisystem inflammatory syndrome in children (MIS-C). Furthermore, COVID-19 pediatric mortality is rapidly reaching the previous four seasons' average of 110-188 influenza-related child deaths every season (2016-2020) [3].

Symptoms

Several coronaviruses infect humans' respiratory tracts, causing everything from coughs and colds to more serious diseases. The symptoms are normally minor and come gradually, and some infected people may not display any symptoms at all and yet feel fine [22]. However, in individuals with comorbidities, including obesity, type 2 diabetes, and cardiovascular disease, the clinical state can quickly advance to severe pneumonia and, eventually, mortality [23]. In mild cases, recovery time looks to be around two weeks, whereas in severe cases, recovery time appears to be three to six weeks [24].

From January 23 to February 15, 2020, a retrospective examination of the clinical features of COVID-19 children compared to adults from the two study centers was performed on patients in Jinan and Rizhao, Shandong Province. Mild clinical symptoms in children with fever and dry cough were the most common, and other symptoms were uncommon, according to the data. Dry cough and phlegm, on the other hand, are not the most prevalent. When compared to adults, children have more symptoms. This is because children's inflammatory responses to lung injury are smaller than adults, resulting in milder clinical symptoms [25].

Vaccine

The COVID-19 epidemic has resulted in a significant increase in mortality and has thrown the country into recession. Although the virus's spread can be slowed by physical separation, face coverings, testing, and tracing, and possibly therapy, the risks, and disruptions to the economy and social life may persist until effective vaccines are given to a large portion of the world's population to prevent serious illness and disease and achieve herd immunity to transmit the virus [26]. The development of COVID-19 vaccines has progressed at an unparalleled rate. In phase 3 clinical studies, some COVID-19 vaccines, such as mRNA-1273, BNT162b2, and AZD1222, were proven to exhibit protective efficacy intramuscular COVID-19 vaccines have been authorized for use as of July 2021. Adenovirus-vectored COVID-19 vaccine (Ad5-nCoV; produced by the Beijing Institute of Biotechnology, Beijing, China, and CanSino Biologics, Tianjin, China) protects against wild-type SARS-CoV-2 replication in the upper respiratory tract, according to previous animal studies. Mucosal immunity, as opposed to traditional parenteral immunity, can activate mucosal and systemic immune defenses, preventing infections from entering the mucosal surface [27].

There are 289 investigational COVID-19 vaccines under development as of 3 February 2021, 66 of which are in various stages of clinical testing, including 20 in phase 3. Only five of the 66 vaccines developed by AstraZeneca in partnership with the University of Oxford, BioNTech in collaboration with Pfizer, Gamaleya, Moderna, and Sinopharm in collaboration with the Beijing Institute have been approved by a strict regulatory authority (based on WHO standards). Some of the firms developing these vaccines have acquired clearance or authorization for emergency use from various regulatory agencies in China, India, Kazakhstan, and Russia. WHO has received documentation for emergency use registries or prequalification, but it is currently being reviewed. Although not all inventors have reported findings, certain vaccines have shown significant levels of efficacy (i.e., more than 70%) in clinical studies. The majority of approved vaccines have been demonstrated to give effective protection against COVID-19 hospitalization and mortality [26].

Vaccinating children against COVID-19 may have indirect benefits similar to those seen with other vaccines. Children experience severe symptoms and are just as likely to be infected as adults, according to data from a study of close contacts infected with SARS-CoV-2 patients (7% rate in both). According to certain research, the number of titular viruses in children's respiratory tracts is higher than in adults. A major contact tracing investigation of COVID-19 cases undertaken in South Korea while schools were closed supports the idea that older children can transmit the virus, as the highest COVID-19 rate (18.6%) was found in their household connections aged 10-19 y. A 44 percent attack rate was observed in a summer camp outbreak, indicating that children of all ages are susceptible to SARS-CoV-2 infection and may play a role in transmission. According to recent modeling, school closures in the United States are connected with a drop in total COVID-19 incidence and death. Every year, approximately 3.8 million children are born in the United States, and all of them are at risk of contracting COVID-19. Children are expected to function as reservoirs in the absence of a COVID-19 vaccine, hampering efforts to terminate the epidemic. It is difficult to picture the economy recovering, and things returning to normal as they were before the outbreak until all children can safely return to school and parents can return to full-time work [3].

MATERIALS AND METHODS

Design

This research uses a prospective cross-sectional study to evaluate the comparison between the Sinovac vaccine and Pfizer among Indonesian children and teenagers under 18 y old used questionnaires. This study was conducted for 3 mo (October-December). For sampling techniques using convenience, sampling takes all items that make up the research's inclusive criteria. The inclusion criteria are all Indonesian children and teenagers under 18 y old who get the Sinovac or Pfizer vaccine and are willing to provide informed consent will be included in the study. The exclusion criteria are all Indonesian society under 18 y old who have not been vaccinated with the full dose yet, Indonesian society who have cancer (stage 3and4), HIV/AIDS patients, TB patients, autoimmune patients (Lupus patients).

Participants

The participants in this study were all children and teenagers in Indonesia under 18 y of age who had been vaccinated by Sinovac or Pfizer with a complete dose with a total of 400 respondents.

Instrument

This study used questionnaires distributed through social media (WhatsApp, Twitter, Facebook, Instagram, and Telegram). The total number of questioners in this study is 60 out of the question of identity and comorbid diseases. The 60 questions were about the side effects received after the first and second doses of vaccination in the short and long term, as well as monitoring the side effects of the vaccine for 1-6 mo of getting vaccinated.

Statistical analysis

The results collected were analyzed using the SPSS version 25 application. The Fisher, Chi-square, Mann-Whitney, and Kruskal-Wallis tests were used to find an association between risk factors (gender, age, BMI, vaccine type) and side effects. The p-value ≤ 0.05 is considered significant.

Ethical approval

As stated in fig. 1, ethical approval was obtained before conducting the study. Ethical approval was sourced from the health research ethics committee 17 Agustus 1945 Jakarta University, with an approval letter, No.04/KEPK-UTA45JKT/EC/EXP/11/2021.

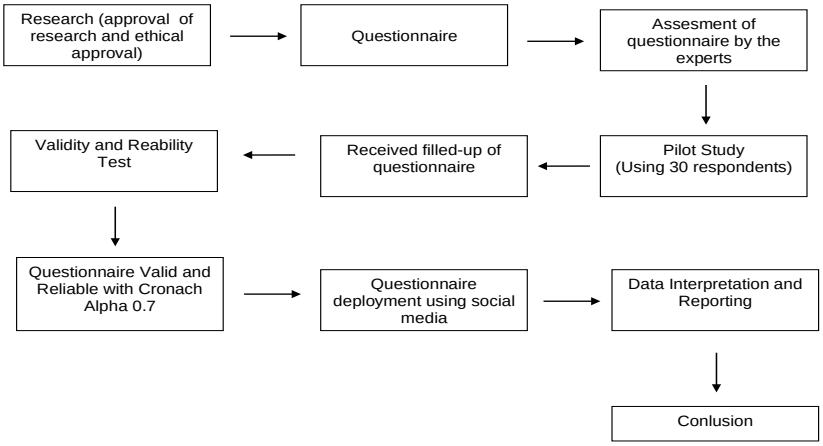


Fig. 1: Research framework

RESULTS

This study was conducted spread throughout Indonesia with the percentage of domicile of each respondent was 54.5% from DKI Jakarta, 40.2% from other Java islands such as (Banten, DI Yogyakarta, Central Java, East Java, and West Java), 1.1% from Kalimantan, 3.3% from Bali Island, 0.6% from Sumatra and 0.6% from Sulawesi, as already shown in fig. 2. Domicile is not one of the factors that affect the side effects and efficacy of vaccines; this is seen from the absence of significance between these two varieties.

Out of a total of 400 patients with each of the 200 patients who received the Sinovac vaccine and 200 patients received the Pfizer vaccine with a comorbid percentage in the overall total of respondents was 1.3% had comorbid asthma, 0.3% with comorbid GERD disease, and 98.5% without comorbid disease, as already shown in fig. 3. No significant data is proving a link between comorbid and vaccine side effects and efficacy. The possible reason is that most of the respondents in the study did not have comorbid diseases.

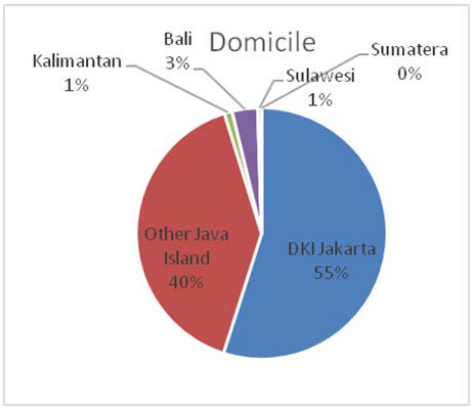


Fig. 2: Prevalence of participant based on domicile

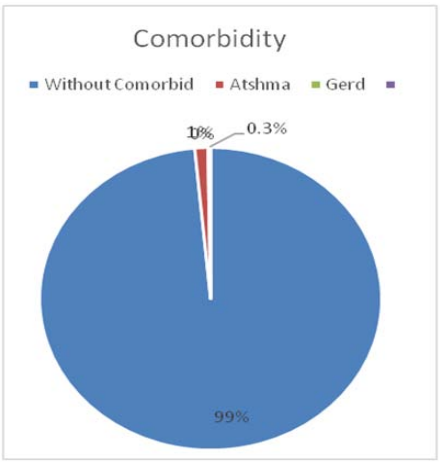


Fig. 3: Prevalence of participant based on comorbidity

Efficacy of each vaccine is 99.5% for Sinovac vaccine and 99.75% for Pfizer vaccine, efficacy obtained from patients infected with covid after getting dose 1 and dose 2 of each vaccine as seen in fig. 4.

From the results of the Fisher Test, where the variable type of vaccine as categorical data was analyzed with the question of side effects as other categorical data, found results as presented in table 1.

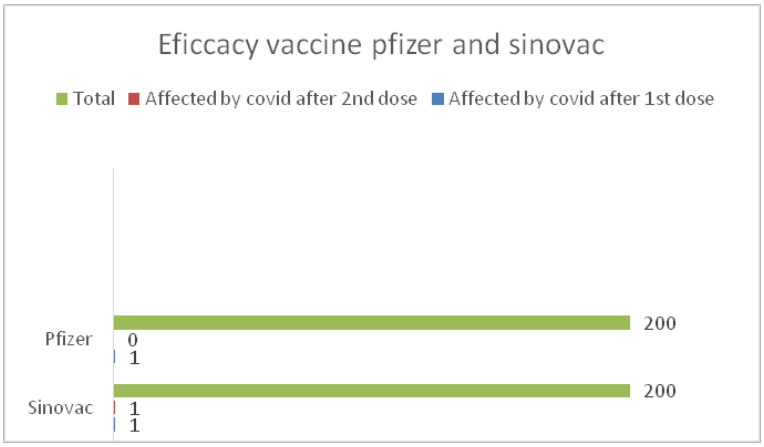


Fig. 4: Prevalence of efficacy pfizer and sinovac vaccine

Table 1: Correlation between type of vaccine and side effect and efficacy of the vaccine

Variables	Frequency/Percentage (%)		p-value*
	Sinovac (n=200)	Pfizer (n=200)	
Side effects 1st vaccination			
Fever	11/5.5	56/28	0.000
Pain in the upper arm	78/38.5	136/68	0.000
Dizziness	22/11	44/22	0.018
Monitoring after 1st dose			
Fever	5/2.5	41/20.5	0,000
Dizziness	11/5.5	28/14	0.006
Side effects 2nd vaccination			
Fever	11/5.5	50/27.5	0.000
Pain in the upper arm	76/38	116/58	0.000
Monitoring after 2nd dose			
Fever	6/3	28/14	0.000

*Fisher test

There was significance between the type of vaccine and the side effects felt by patients after the receipt of doses 1 and 2 where the results showed that Pfizer's vaccine provided more side effects than Sinovac. As found that out of a total of 200 respondents who received the Pfizer vaccine felt the side effects of fever as much as 28%, 68% felt pain at the injection site and 22% felt dizziness after the first dose of vaccination, while for 200 other respondents who received the Sinovac vaccine 5.5% felt fever, 38.5% felt pain at the injection site and 11% felt dizzy. In the period after receiving the first dose of vaccine until the acceptance of the 2nd dose of vaccine, 20.5% of respondents who received the Pfizer vaccine had a fever and 14% had experienced dizziness, while for respondents receiving the Sinovac vaccine were 2.5% and 5.5%.

For side effects after vaccination dose 2, 27.5% of respondents who received Pfizer type vaccination experienced side effects of fever while for Sinovac vaccine recipients were 5.5%. Another significant side effect between the two vaccines was 58% pain at the injection site for Pfizer vaccine recipients and 38% for Sinovac vaccine recipients. While for monitoring after vaccination dose 2, is 14% of respondents Pfizer vaccine recipients have had a fever, while for recipients of Sinovac vaccine is 3%.

In addition to the type of vaccine, another variable that also has a significant correlation with side effects that arise is gender. Out of a total of 400 respondents, 40.75% of respondents were male and 59.25% were female. Details of the data have been presented in table 2.

Table 2: Correlation between gender and side effects of the vaccine

Variables	Frequency/Percentage (%)		p-value
	Male (n=163)	Female (n=237)	
Side effects 1st vaccination			
Dizziness	18/11	44/18	0.049*
Fever	19/11.65	48/20.25	0.029*
Monitoring after 1-3 mo			
Menstrual problems	0	17/7.17	0.000#
Monitoring after 4-6 mo			
Menstrual problems	0	3/1.26	0.000#

*Fisher test, #Chi-square test

From fisher test results to questions regarding side effects of receiving the first dose of vaccine and chi-square test results for questions regarding monitoring after 1-3 mo and 4-6 mo of getting vaccinated, it is seen the significance between gender and side effects felt by patients. As found that female vaccine recipients feel more side effects compared to male vaccine recipients. 18% of female respondents experienced side effects of dizziness after receiving the first dose of the vaccine, while for men, it was 11%, other side effects were fever, where women were 20.25% and men were 11.65%.

For monitoring 1-3 mo after vaccination found 7.17% of female vaccine recipients experienced changes in the menstrual cycle, while for monitoring 4-6 mo after vaccination found 1.26%.

Other variables that had a significant correlation were age and side effects and efficacy of each vaccine. In this study, the overall age range of respondents was 12-17 y. Details of the data have been presented in table 3.

From the results of the man-Whitney test for questions regarding side effects after the receipt of the vaccine and the results of the Kruskal Wallis test for questions regarding monitoring side effects after 1-3 mo and 4-6 mo of getting vaccinated, it was seen the significance between age and the side effects felt by respondents.

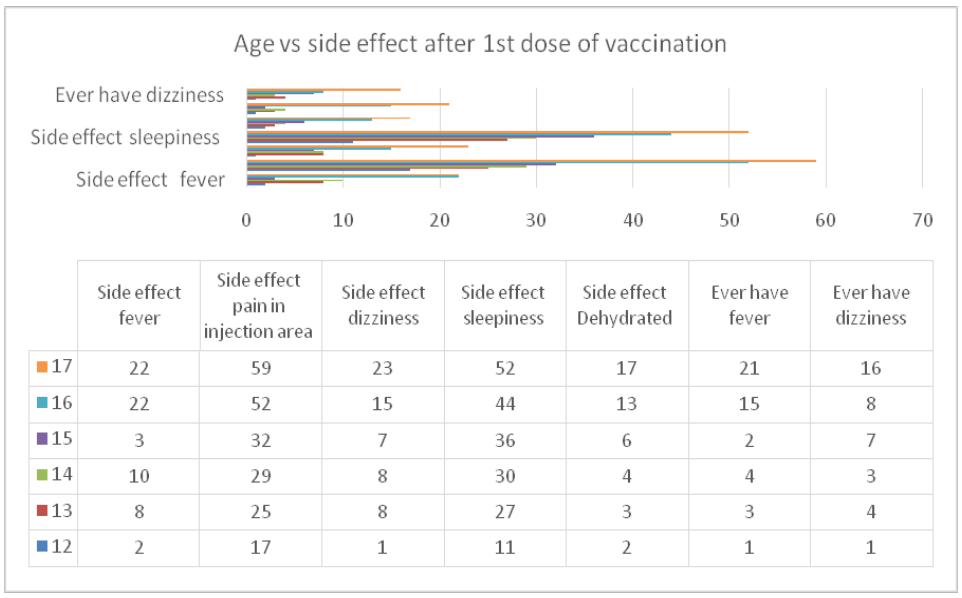
As shown in fig. 5,6,7, respondents aged 17 y dominated the overall vaccine recipients who experienced side effects.

The last variable that correlated with the side effects and efficacy of the vaccine was BMI. The BMI level range of 400 respondents was from 10.41–44.16, with a mean score of 20.01, as shown in table 4.

Table 3: Correlation between age and side effect of the vaccine

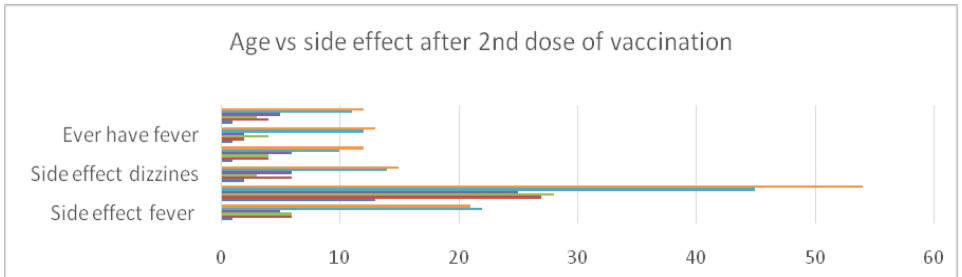
Variables	Frequency/Percentage (%)	p-value
	Age (n: 400 mean: 14.95)	
Side effects 1st vaccination		
Fever	67/16.75	0.002*
Pain in the injection area	214/53.5	0.001*
Dizziness	62/15.5	0.001*
Sleepiness	200/50	0.017*
Dehydrated	45/22.5	0.001*
Covid-19 infection after 1st dose		
Fever	46/11.5	0.000*
Dizziness	39/9.75	0.003*
Side effects 2nd vaccination		
Fever	61/15.25	0.000*
Pain in the injection area	192/48	0.007*
Dizziness	46/11.5	0.013*
Dehydrated	37/9.25	0.030*
Covid-19 infection after 2nd dose		
Fever	34/8.5	0.001*
Dizziness	36/9	0.015*
Monitoring after 1-3 mo		
Mestruated Problem	17/4.25	0.002#
Tired easily	25/6.25	0.005#
Pain in the upper arm	22/5	0.000#
Dehydrated Easily	18/4.5	0.001#
Monitoring after 4-6 mo		
Mestruated Problem	3/1.26	0.000#

*Man-whitney test, #Kruskal wallis test



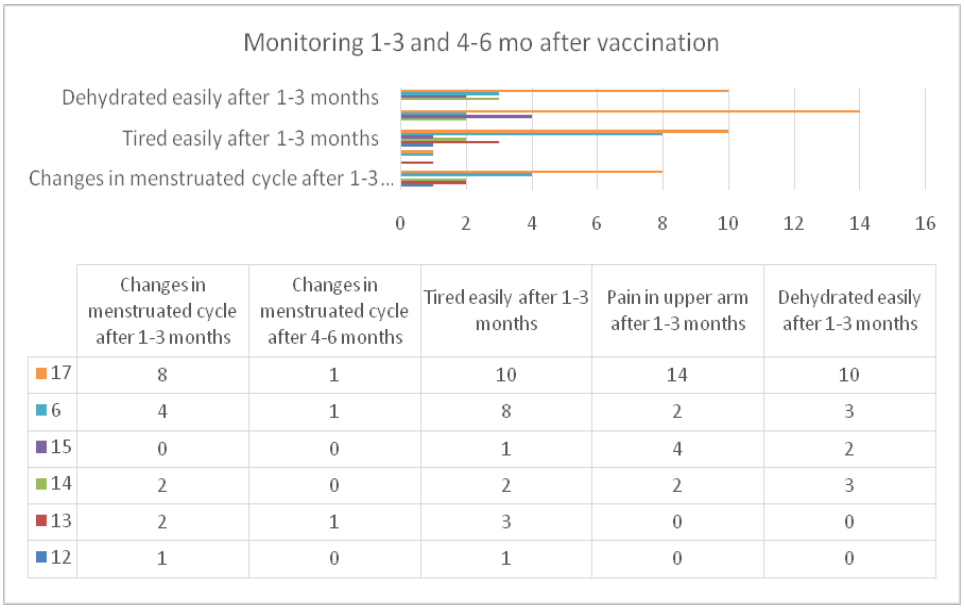
	Side effect fever	Side effect pain in injection area	Side effect dizziness	Side effect sleepiness	Side effect Dehydrated	Ever have fever	Ever have dizziness
17	22	59	23	52	17	21	16
16	22	52	15	44	13	15	8
15	3	32	7	36	6	2	7
14	10	29	8	30	4	4	3
13	8	25	8	27	3	3	4
12	2	17	1	11	2	1	1

Fig. 5: Prevalence of correlation between age and side effect after 1st dose of vaccination



	Side effect fever	Side effect pain injection area	Side effect dizzines	Side effect Dehydrated	Ever have fever	Ever have Dizziness
17	21	54	15	12	13	12
16	22	45	14	10	12	11
15	5	25	6	6	2	5
14	6	28	3	4	4	3
13	6	27	6	4	2	4
12	1	13	2	1	1	1

Fig. 6: Prevalence of correlation between age and side effect after 2nd dose of vaccination



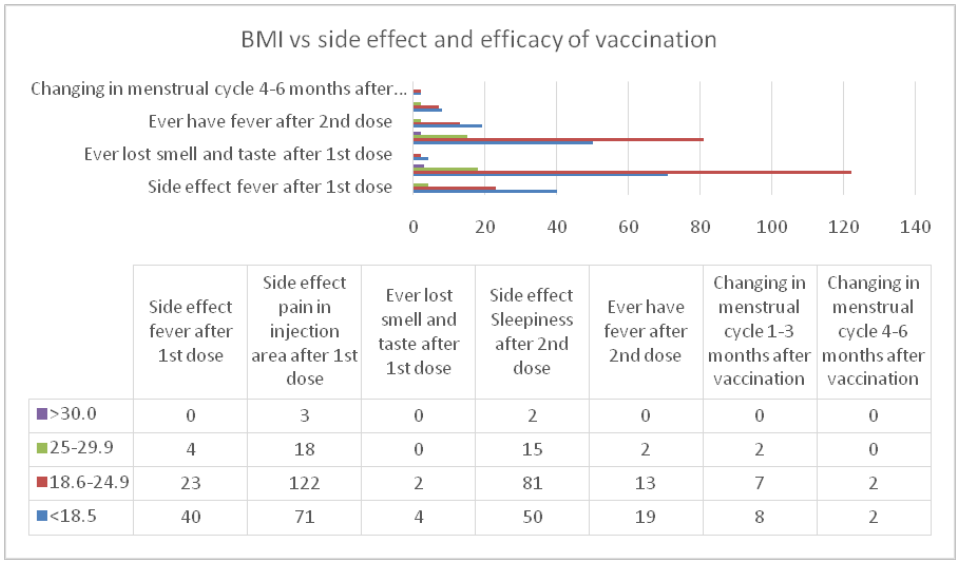
	Changes in menstruated cycle after 1-3 months	Changes in menstruated cycle after 4-6 months	Tired easily after 1-3 months	Pain in upper arm after 1-3 months	Dehydrated easily after 1-3 months
17	8	1	10	14	10
6	4	1	8	2	3
15	0	0	1	4	2
14	2	0	2	2	3
13	2	1	3	0	0
12	1	0	1	0	0

Fig. 7: Prevalence of correlation between age and monitoring 1-6 mo after vaccination

Table 4: Correlation between BMI and side effects of the vaccine

Variables	Frequency/Percentage (%) BMI (n: 400 mean: 20.01)	p-value
Side effects 1st vaccination		
Fever	67/16.75	0.000*
Pain in the injection area	214/53.5	0.020*
Lost smell and taste	6/1.5	0.021*
Side effects 2nd vaccination		
Sleepiness	148/37	0.010*
Covid-19 infection after 2nd dose		
Fever	34/8.5	0.032*
Monitoring after 1-3 mo post-vaccination		
Menstrual problems	17/4.25	0.027#
Monitoring after 4-6 mo post-vaccination		
Menstrual problems	3/1.26	0.019#

*Man-whitney test, #Kruskal wallis test



	Side effect fever after 1st dose	Side effect pain in injection area after 1st dose	Ever lost smell and taste after 1st dose	Side effect Sleepiness after 2nd dose	Ever have fever after 2nd dose	Changing in menstrual cycle 1-3 months after vaccination	Changing in menstrual cycle 4-6 months after vaccination
>30.0	0	3	0	2	0	0	0
25-29.9	4	18	0	15	2	2	0
18.6-24.9	23	122	2	81	13	7	2
<18.5	40	71	4	50	19	8	2

Fig. 8: Prevalence of correlation between BMI and Side effect, efficacy after vaccination

As shown in fig. 8, vaccine recipients with a BMI of 18.6-24.9 and<18.5 dominated the overall vaccine recipients who experienced side effects.

DISCUSSION

Efficacy and side effects

From the results of research on Indonesian children and teenagers aged 18 y receiving Pfizer and Sinovac vaccines, it was found that the efficacy of the Pfizer vaccine was higher than the Sinovac vaccine with a percentage of 99.75% for Pfizer and 99.5% for Sinovac. This is because the method for Pfizer has utilized lipid nanoparticles (LNPs) with a formulated mRNA vaccine [28]. The vaccine's genetic material is mRNA, which is transmitted as an oil shell inside the oil nanoparticle. Human cells will create the spike protein after being introduced into the deltoid muscle. Because natural human enzymes will degrade mRNA injected directly, these small molecules must be wrapped in oil nanoparticles to be preserved [29]. Even though mRNA-based vaccinations have never been licensed before, this work was moved forward at an unparalleled rate. RNA vaccines are a cutting-edge method in which genetically edited RNA is used to create a protein that safely triggers an immune response. Because of their synthetic nature, which eliminates the requirement for cell culture or virus fermentation, mRNA-based vaccines have the greatest promise for rapid development. mRNA vaccines have emerged as a promising alternative vaccination development technique for different infectious diseases and malignancies due to their high efficacy, rapid development, and inexpensive production costs [29].

As shown in table 1, the results of this study say that the Pfizer vaccine provides more side effects than the Sinovac vaccine; this is supported by the p-value of several variables that show a number>0.005, some of the reported side effects that show significance are: fever, dizziness, and pain in the upper arm. This is because the Sinovac vaccine is an inactivated vaccine, whereas the Pfizer vaccines are nucleic acid and viral vector vaccines. As a result, variations in the severity and pattern of adverse effects might be ascribed to the vaccine type [30].

Correlation between gender and side effects of vaccine

From the results of the study, it was found that gender had a p-value<0.005, which means it has a significant correlation with the side effect of the vaccine. As shown in table 2, female vaccine recipients were more dominant in experiencing the side effects of these two types of vaccines**.** In research by Ahlam Alghamdi *et al.*, it was also discovered that women reported higher COVID vaccination side effects than men. According to the researcher, females' pain perception is typically higher than males' due to psychological factors such as gender roles beliefs, coping methods, or biological aspects such as sex hormones [31]. Other researchers have discovered similar results, indicating that women are more susceptible to the negative effects of vaccines, including not only the covid vaccine but also women in general. Influenza, measles–mumps–rubella combination vaccine (MMR), attenuated Japanese encephalitis, and attenuated Dengue vaccines have all been linked to an increased incidence of side effects [32].

Correlation between age and side effects of vaccine

As the data in table 3 illustrates, age has an impact on the vaccine's side effects. The findings of this study also revealed that 17-year-old adolescents were the ones who were most affected by the vaccine's side effects. However, the findings of this study differ from those of a Malaysian study of vaccine recipients aged 18 and up, which found that the younger age group (18–30) had 7.4 times the chance of experiencing vaccine-related side effects [30]. This is most likely due to younger people's immune systems being stronger and more efficient than those of elderly people [33]. Another theory is that younger children's clinical symptoms are milder than older children's due to the lesser inflammatory response to lung injury [25].

Correlation between BMI (body-mass index) and side effects of the vaccine

As shown in table 4, vaccine recipients with a BMI of less than 25 have a higher risk of having side effects from the covid vaccine. The p-value, which is less than 0.05, demonstrates this. According to research conducted in Iran, the occurrence of adverse effects was higher in people with a BMI of more than 25. Headache and flu-like symptoms, on the other hand, are more common in people with a low BMI [27]. This may be because the majority of the total respondents have a BMI of less than 25, with percentages of 39.9% for those with a BMI of less than 18.5 and 51.5 percent for those with a BMI of 18.6–24.9. More research into the relationship between BMI, side effects, and vaccine efficacy is required.

CONCLUSION

In conclusion, this study found that the Pfizer vaccine had slightly higher efficacy than the Sinovac vaccine with a percentage of 99.75% for Pfizer and 99.5% for Sniovac; however, these two types of vaccines have a fairly high level of efficacy for children and adolescents in Indonesia. Under 18 y. For side effects, a significant correlation was found, indicating that the Pfizer vaccine had more side effects than the Sinovac vaccine, while the side effects were fever, dizziness, and pain in the upper arm. No significant severe side effects were found in these two types of vaccines. Variables that affect side effects and vaccine efficacy are genders, age, and BMI. For

gender, female vaccine recipients were more likely to experience side effects than males, for the age of 17 y old vaccine recipients dominated in vaccine recipients who experienced side effects after the vaccine, while for BMI it was found that vaccine recipients with a BMI level below 25 This shows the significance of experiencing side effects, this is also possible because most of the respondents in this study had a BMI level below 25.

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AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

Declared none

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