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*Article Review*

# *The Impact of Covid 19 Vaccination on T Cells in the Immune System*

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**Abstract**

*We have carried out research using the literature study method to produce articles that are relevant to the theme we have taken. Our theme is about the impact of Covid-19 vaccination on T cells in the human immune system. The COVID-19 vaccine can trigger a T cell response involving helper T cells (CD4+) and cytotoxic T cells (CD8+), which are important in fighting SARS-CoV-2 infection. This response also allows the formation of memory T cells. However, interindividual variations and differences between vaccine types need to be considered. Further research is needed to deeply understand the impact of vaccines on T cells and improve COVID-19 vaccination strategies.*

***Keywords:*** *Vaccines, Covid-19, T Cells, Immune System*

## INTRODUCTION

COVID-19, which stands for "Coronavirus Disease 2019", was first discovered in Wuhan, China's Hubei Province, in December 2019. The disease is caused by a virus known as SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2). Therefore, COVID-19 is named after the year of identification and the primary source of its initial discovery. On March 11, 2020, the World Health Organization (WHO) agreed to declare the COVID-19 outbreak a pandemic. Since then, COVID-19 has spread around the world and become a serious lobal g health issue. In early 2020, global efforts to contain the spread of the disease have included the development and deployment of a COVID-19 vaccine (Rubiana et al.)

The main way the virus is spread is through saliva droplets released by infected individuals when they sneeze, cough, chat, sing or simply breathe. These droplets contain the virus and can infect any human in close proximity to the infected individual. This is one of the important reasons why physical distancing and wearing masks are important to prevent the spread. In addition, virus-containing saliva droplets can become airborne and survive indoors where there is less exposure to sunlight or less ventilation. This is the reason why the spread of the virus can occur in crowded indoor spaces. Other than through saliva droplets, contact with contaminated surfaces can also spread the infection. Although not the main way of spreading, the virus can stick to the surfaces of objects such as doorknobs, elevator buttons, tables, or electronic devices. A

person can transmit the infection to themselves if they come into contact with a contaminated surface and then touch their face especially the mouth, nose, or eyes.

Transmission of the virus is possible through direct contact with those who are already infected, such as caring for them, sharing personal equipment, or shaking hands. In addition, there is also a risk of transmission through smaller aerosol particles in the air, especially in situations with poor ventilation and physical activities that increase the production of aerosol particles, such as talking loudly, singing, or exercising (Hastuti, Djanah, and Soepomo) . Mass vaccination has been one of the key steps in the effort to end this pandemic and return lives to normal levels. COVID-19 vaccines have proven highly effective in reducing the incidence of severe infection and disease, and have saved thousands of lives. One important component of the body's immune response to viral infections is T cells, which play a crucial role in fighting infectious agents, including the SARS-CoV-2 virus.

T cells are involved in identifying and destroying infected body cells, as well as helping to regulate the body's overall immune response. In the context of COVID-19 vaccination, the question arises to what extent vaccination affects T cell responses and how this can enhance protection against the virus. Recent research findings have revealed various aspects regarding the impact of COVID-19 vaccination on T cells in the immune system. This information is not only important for a deeper understanding of protection mechanisms through T cell responses, but is also relevant in addressing issues such as the development of new variants of the virus. This article will discuss the latest findings in the research revealing how COVID-19 vaccination affects T cells, as well as the implications for the body's protection against SARS-CoV-2 infection.

## RESEARCH METHODS

This article uses a literature review methodology that incorporates theories related to the research question. In this section, the theories and concepts used are evaluated based on currently available literature, particularly works that have been published in various scientific publications. The purpose of literature research is to build a foundation of concepts or theories that will form the basis of this research. The literature review method primarily aims to develop an understanding of the theoretical aspects and practical benefits. Thus, the author can utilize this research method as a tool to address the research problem more effectively.

## RESULTS AND DISCUSSION

### Introduction to the Immune System, COVID 19 Vaccination, and T Cells

The immune system, or commonly referred to as the immune system, is a complex system that functions protect the body from infection, disease, and other foreign objects. The immune system works by recognizing, attacking, and destroying pathogens (disease-causing microorganisms) in the form of viruses, fungi, bacteria and parasites (Wahyuni 2018) . T cells are a type of cell that is one of the main components in the human immune system, and they play a very important role in the body's defense process against infection. There are several stages in how the immune system works. First, the immune system identifies the pathogen by recognizing special molecules called antigens found on the pathogen. Immune cells such as macrophages, dendritic cells and B cells then take on the important role of responding by recognizing the antigens on the pathogen and initiating an immune response.

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T cells and B cells are important components in the body's immune response, with B cells producing antibodies that can bind to and destroy pathogens, while T cells have various types that help organize and eliminate or destroy cells that have been infected or contaminated. T cells also play a role in the formation of memory cells, which "remember" pathogens and provide long-term protection (Anon) .In fighting infection, the role of T cells is crucial. Helper T cells help regulate the body's immune response, cytotoxic T cells are responsible eliminating body cells that have been contaminated or infected, and T cells turn into memory cells to store information about pathogens once encountered. As such, T cells have a central role keeping the body healthy and fighting infection, as well as being an important part of the immune response to vaccinations such as the COVID-19 vaccine.

The SARS-CoV-2 virus affects T cells in the human body revealing a significant impact on the immune system of individuals infected with this virus. When an active infection occurs, SARS-CoV-2 can infect T cells, which are one of the important components in the body's immune response. It can disrupt the normal function of T cells and inhibit their ability to participate in fighting the virus as well as regulating the overall immune response. Helper T cells, which function to coordinate the immune response, can also be affected by this virus. A decrease in the number and function of helper T cells can lead to an ineffective immune response, increasing the risk of serious complications due to COVID-19.

In addition, the SARS-CoV-2 virus also affects cytotoxic T cells, which function in identifying and eliminating body cells that have been contaminated with the virus. Infection of cytotoxic T cells can inhibit the body's ability to clear the virus and control infection. In this context, understanding how SARS-CoV-2 modulates T cell responses is important as it can provide insights the factors that may influence disease severity and the recovery process (Tedjo, Noor, and Heryanto 2021) . In addition to the effects on directly infected T cells, studies have also shown that SARS-CoV-2 can also induce excessive or deleterious immune responses in some individuals, which can result in autoimmune disorders. This demonstrates the complexity of the interaction between the virus and the immune system.

**The Role of T Cells in Long-term Immunity**

The T cell response triggered by vaccines for COVID-19 can have the positive effect of protection against the virus, although a number of factors can affect the level and duration of this protection. The various COVID-19 vaccines, such as the Pfizer-BioNTech and Moderna mRNA vaccines that stimulate T cell responses have the potential to produce strong and long-lasting T cell responses. The memory T cells that result from vaccination are a key element in providing long-term protection, as they "remember" the pathogen and can respond quickly if exposed to the virus in the future.

, the ability of the SARS-CoV-2 virus to undergo mutations and the emergence of variants that can evade the immune response is an important consideration. Therefore, booster doses of vaccine have been introduced in some cases to maintain and prolong T cell responses and protect against newly emerging variants. Research is ongoing to understand more about T cell responses and how T cell vaccination can contribute to long-term protection against COVID-19. , currently, COVID-19 vaccines remain the main

tool in tackling pandemic, while practicing preventive measures such as mask wearing and physical distancing also remain important (Anon.) .

**Knowing the Effectiveness of Vaccination on T Cells**

For almost two and a half years, the COVID-19 pandemic has had a very significant negative effect on individuals, communities and economies around the world, as well as causing a huge loss of life. To address this situation, vaccines have also been developed and distributed to the public. While these vaccines have had a major positive impact, evaluating their effectiveness remains important. For this reason, alternative testing methods such as the SARS-CoV-2 Surrogate Virus Neutralization Test (sVNT) have been developed to avoid the use of dangerous live viruses. Furthermore, in addition to antibody responses, T cell responses also have an important role in fighting the coronavirus. Some studies have shown that antibody responses can sometimes be delayed or undetectable, while T cell responses remain active and important in early protection against the virus. , evaluation of T cell responses is also important in assessing the effectiveness of COVID-19 vaccines. Methods that have been used for this include interferon gamma release assays (IGRAs), such as the T-SPOT.COVID test.

This pandemic has been going on for a long time, and with the emergence of different variants of the virus, further research on vaccine effectiveness against different variants is crucial. By understanding both humoral immunity and cellular immunity, we can better evaluate the effectiveness of vaccines and attempt to slow down and reduce the impact of this pandemic (Yi-Chen Fu et al., 2022). In addition, vaccination also has side effects in its use, Post-Immunization Adverse Events (AEFI) is a medical feature which can appear when a vaccine or immunization related to a vaccine has been given. KIPI has a temporary nature and is not too severe, and will usually disappear its own without requiring additional treatment. If someone experiences a bodily reaction after receiving a vaccine, it is important to remain calm. Symptoms such as pain, swelling or redness of the injection area can be managed by applying cold compresses. If a fever occurs, you can relieve it using warm compresses, increasing fluid intake, resting, and taking medication if needed.

**Implications for Vaccine Development**

Developing a vaccine usually takes years, but the development of a COVID-19 vaccine has been much faster, with only about six months from the discovery of the virus' genetic sequence to the first phase of clinical trials. As of August 2020, there are many COVID-19 vaccines in various stages of development. This is due to prior knowledge of the coronavirus, faster vaccine technology and the ability to conduct multiple stages of development in parallel (Henao et al., 2020).

The development of COVID-19 vaccines has had several important implications, the first of which is speed of development. The development of COVID-19 vaccine has been rapid, taking much less time than vaccines for other diseases. This shows that in emergency situations such as a pandemic, collaboration and intensive research can accelerate vaccine development. The second is Innovative Vaccine technology, the COVID-19 vaccine has encouraged the development of innovative vaccine technologies, such as nucleic acid-based vaccines and viral vector vaccines, which may be the foundation for future vaccine development

Next up is Bioethics: Bioethics play an important role in vaccine development, especially when there is pressure to shorten the timeframe of clinical trials. Ensuring safety and ethics in vaccine clinical trials remains a priority. As well as efficacy and

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Safety: A better understanding of the efficacy and safety of COVID-19 vaccines will help in addressing this pandemic and may provide insights for future vaccine development.

## CONCLUSION

The immune system, COVID-19 vaccinations and the role of T cells are key elements in maintaining immunity. The immune system protects the body from disease by recognizing and responding to foreign bodies. T cells, a major component of the immune system, play an important role in the body's defense against infection. Helper T cells regulate immune responses, cytotoxic T cells remove infected cells, and both become memory cells to store pathogen information.

The SARS-CoV-2 virus affects cytotoxic T Cells, which are in charge of identifying and destroying infected cells. COVID-19 vaccines, such as Pfizer-BioNTech and Moderna, stimulate the T Cell response, providing long-term protection despite the influence of certain factors. Innovative vaccine technologies, such as nucleic acid and viral vector vaccines, are developing thanks to COVID-19 vaccines, providing a potential basis for future vaccines. Further understanding of the efficacy and safety of COVID-19 vaccines is crucial to overcome the pandemic and provide insights for the development of future vaccines.

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