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Review Article

Comparison Study of Different Vaccine Against COVID-19

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ABSTRACT

The study aims on understanding some of the widely used vaccines used in the fight against Covid 19. The vaccines selected for the comparison here are Pfizer-BioN-Tech and the Moderna vaccines. Both of these vaccines received FDA approval and are being used widely. This is the reason they are chosen for the comparison study. The various characteristics associated with the vaccines are evaluated in a detailed manner. It can be found from the study that both of them are equally effective. However, Pfizer – BioN tech needs more attentive care towards storage.

INTRODUCTION

SARS- CoV-2 or the Severe Acute Respiratory Syndrome Corona Virus 2 has resulted in a number of challenges for the healthcare segments all across the globe. The nature of the virus is highly contagious and it creates disruptions for world health and economy. As a countermeasure to stop the rapid spread of the virus, lockdown has been initiated by countries across the world. It also indicated a need for preventive care or vaccines. The factors associated with the virus such as its prevalence and the mortality rates are changing every day, making it harder to fixate on a specific cure. As the data from WHO indicates, the fatality rate of the virus is over 2% and it affected 216 countries as of December, 2020. During the pandemic, it has been observed that people are facing a lot of issues related to the virus along with the health care challenges. The lockdown is also resulting in mental health problems such as anxiety and stress. The absence of a specific treatment has made it more difficult for the healthcare segment to control the outbreak. The rapid outbreak of the virus along with this lack of a specific therapy can only be stopped with the help of a vaccination process. It can be mentioned that vaccination will be a major weapon in the battle against Covid. In recent times, the US Food and Drug Administration (FDA) allowed authorization towards the Pfizer-BioN-Tech and the Modern vaccines (Britton *et al.* 2021). These

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vaccines are developed in a short period of time so that the rapid spread can be stopped somehow. These vaccines also reached EUA status since the CoV-2 genome was released back in 2020. This is the fastest vaccine launch in the history of healthcare and this also indicates the severity of the situation. Apart from Pfizer-BioNTech, vaccines from other companies are also being administered towards the segment. Some of the examples of other vaccines are Moderna, Johnson & Johnson, Oxford - AstraZeneca and Novavax. However, this research mainly focuses on BioN-Tech and the Moderna vaccines.

The main aim of the study is to compare the different vaccines against Covid 19. The objectives are termed as

- To gather information about the different Covid vaccines
- To understand the effectiveness of the different vaccines

a. Pfizer - BioNTech

This is the first Covid vaccine that received FDA approval along with authorization for emergency usage. The company conducted multiple clinical trials in the beginning phase and it showed the effectiveness of the vaccine (Tanne, 2020). It was observed that the vaccine is able to stop a symptomatic disease. As per the views of Oliver *et al.* (2020), the vaccine can be termed as a cutting edge product as it is an mRNA vaccine. However, delivering the vaccine is a bit difficult as it needs to be stored in a specific room temperature. The vaccine is recommended for anyone over the age of 12 and it is still being studied in kids below the age of 11. There are a number of common side effects that can be observed after taking the vaccine. Some of these symptoms include headache, pain or nausea (Subbarao*et al.* 2021). A swelling at the point of penetration is also observed in some cases. Though most of these symptoms are relatively common and can be termed as a reaction of the vaccine entering the patient's stream, these symptoms should not last more than 72 hours (Shimabukuro and Nair, 2021). In that case, medical advice should be taken. In some rare cases, the vaccine can also trigger a severe reaction known as anaphylaxis. This is why the patients are monitored for the next 15 minutes after the vaccine is admitted. There is also a warning level placed by the FDA on the vaccine. It mentions that the vaccine can also result in a case of heart inflammation in some cases (Britton *et al.* 2020). However, it is not a critical issue and does not need medical supervision. The way in which the vaccine works is different from traditional vaccines. Usually, an inactivated disease germ is usually placed in the body so that antibodies can be created with the help of it. However, it is different here as the Pfizer vaccine inserts a genetic code into the body. This genetic code is extracted from the SARS CoV-2 towards the host cells present in the body. This piece of genetic code provides instruction towards the host cells. The host cells start to make copies of the spike proteins. The spikes are usually the ones that penetrate the walls of the host cells and infect them. The proteins created by the cells result in an immune response and antibodies are created. Furthermore, the memory cells are also created here. These memory cells identify the same type of pattern of attack in the future and respond in the most viable way possible so that the virus can be neutralized. The effectiveness of the Pfizer's is promising and it is still being tested so that more information can be extracted. The Phase 3 data presented by the company indicated a 95% efficacy, in December (Pfizer.com, 2021). The company announced in April that the vaccine has almost 92% efficacy against the Covid 19 (Pilishavili*et al.* 2021). These results are based on the tests that are conducted for a time period of 6

months (Pfizer.com, 2021). Apart from that, it is also an effective solution towards the severe diseases that are identified by the CDC and FDA. There are a number of studies that can be found on the vaccine and the mutations (CDC.gov, 2021). Pfizer is 95% against both the Alpha and Beta variant of Covid (Pfizer.com, 2021). However, the effectiveness could drop as more variations are resulting from virus mutations.

b. Moderna (mRNA-1273)

Followed by Pfizer, Moderna's vaccine was also allowed for emergency usage as well. The same type of mRNA structure can be observed here as well. The efficacy for preventing symptomatic diseases is similar for this vaccine as well. Just like the previous vaccine, it also needs to be stored under freezer temperatures. This vaccine is also recommended for people over the age of 18. Furthermore, the company mentioned that it will also work as protection for children for the age group of 12 year (Anthes, 2021). The side effects of moderna are almost similar to Pfizer. Some of the commonly observed side effects are chills, tiredness or swelling at the spot of injection. Most of these symptoms will go away on their own in a day or two. Patients are monitored as well for the symptoms. The vaccine is administered to the upper arm muscle and the mRNA acts as instructions. The cells also create the protein piece and once it is made, the genetic piece of code is broken down and destroyed. The protein piece is displayed on the surface and it is identified by the immune system as an intruder. These results in a natural immune response and antibodies are created. Once the process is done, the body is ready to protect itself from the same kind of infections in the future. More than 90% efficacy is observed in accordance with the covid cases. For severe cases, this rate is more than 95% (Investors.modernatx.com, 2021). The follow up for the next 6 months once the vaccination is done indicated these results. The studies that are conducted in phase 3 showed a 94.1% effective rate of the vaccine towards the symptomatic infections. However, the rate is a little lower for the people over the age of 65 (Investors.modernatx.com, 2021). The vaccine can provide protection against the Beta and Delta variant as well.

c. Johnson & Johnson's Janssen (JNJ-78436735)

Following the other vaccines of COVID-19, Johnson & Johnson's Janssen is allowed for the women who are especially under 50 years old. It is underlying viral vector category and required only one shot to get protection from coronavirus. This vaccine has to be given by through the upper arm and it will working within 4 hours after vaccination. In the case of having heavy allergic reaction, the candidate should not take Johnson & Johnson's Janssen vaccine. In this vaccination the symptoms are swelling, hives, and wheezing. The vaccine recommended for above 18 and under 50 years. As women who are under 50 have the risk blood clots with low platelets, this vaccination helps them to provide an extra support in this regard.Before this vaccination, candidate not to be taken latex, eggs, preservatives, and metals. The study follows a positivism philosophy. This is chosen so that more amount of factual knowledge can be gained from the observations, resulting in successful outcomes. Apart from the front hat, the research followed a descriptive design so that different aspects associated with the topic can be evaluated in a better way. The information that is required in the study is collected from a number of sources. These sources include multiple relevant databases along with medical indications and contradictions. The effects and the adverse effects for both the vaccines are also under consideration. The related literature is also reviewed so that more information can be collected on the topic.

Authentic databases such as Web of Science, Pub Med, WHO and FDA are also used for the purpose of data collection. The descriptive information collected from these sources is combined together so that a more coherent dataset can be identified. The information gathered on the vaccines is compared in the discussion portion of the study so that their differences can be understood. Ethical approval was not necessary as all the information is collected from the publicly available databases.

Table 1. It shows comparative study of described vaccines. (Zahid, 2021)

Manufacturer	Type of Vaccine	Storage condition	Efficacy
Moderna	mRNA-1273	-20°C for up to 6 months	94.1%
BioNTech	BNT 162b2 (mRNA)	-70°C	95%
Jansen	JNJ-78436735 Recombinant V vector	Normal fridge temperature	85%
Sputnik V	Viral Vector	Normal fridge temperature	95%

DISCUSSION

The Novel corona virus presented itself as a major health concern as a lot of people across the world have been infected by it. It has been more than a year and the pandemic has converted itself into a global catastrophe. Both Pfizer and Moderna are authorized for this purpose. It has resulted in a ray of optimism towards the fight against the virus. As it can be seen from the comparison, both the vaccines use the same modified RNA so that spike protein can be encoded. The spike proteins are locked into a specific three dimensional shape. Both of the vaccines also use the lipid nanoparticle delivery system. This is why both of these vaccines are more effective compared to the traditional antibodies system. Once the vaccine is formulated in the lipid particles, RNA delivery towards the host cells is enabled. The results in the expression for the SARS-CoV-2 s antigen. This is the main reason behind this immune response observed towards the S antigen. The differences between the vaccines are related to the external factors such as the cost, adverse effects or required storage temperature. If the price is considered, Pfizer is cheaper than Moderna. This makes Pfizer a better choice for mass vaccination, especially in the low income countries. It has been observed in the related studies that mass vaccination will work as a better option to create resistance against the virus along with stopping community spread. Though the Pfizer is cheaper, it requires a lower storage temperature compared to the Moderna. The required temperature for Pfizer is -80ºC and -60ºC, which is a lot lower compared to the Moderna. The temperature requirement for Moderna is 25º and -15ºC, which can be maintained easily. This also indicates that the chances of waste are higher for Pfizer as a slight miscalculation can result in the vaccine being ineffective. For the low income countries, the temperature requirements can be termed as a challenge as they may not have proper infrastructure present for vaccine storage. The humeral response rate is equal for both of the vaccines. Compared to Moderna, Pfizer is able to trigger stronger T-cell responses. If the overall adverse effects are considered, both of the vaccines have shown some common and some serious reactions such as anaphylaxis. However, it can still be mentioned that both of these vaccines are still the most viable choice towards mass

vaccination. As it can be seen from the overall demand of the vaccine, monitoring the effectiveness of the vaccines towards public health and the associated outcomes should be considered as a topmost priority. Most of the implications are done on the basis of the patient data. In case of the adults that are fully vaccinated, the effectiveness stands around 94%. For the group of people that are partially vaccinated, this rate stands around 64%. This is being considered for the cases where the illness stayed for 14 or more days, which is considered as a general cycle of the virus. The findings can also be aligned with the efficacy determined from the clinical trials. Equal administration of both the vaccines can also be used as a measure of their effectiveness. In both cases, only a single dose did not show any specific changes in the rate of efficacy. There are chances of a bias being present in the estimations of completed or partial vaccination. As a side effect of the immune response, illness is observed shortly after the administration of the vaccines. However, it is still recommended to maintain the safety measures. The virus is continuously mutating, resulting in some new protein spikes. The RNA treatment may not work for the more advanced strains. This is why it is essential to keep enhancing the vaccines so that they are able to counter these new strains. From the overall evaluation of the information, it can be concluded that both Pfizer and Moderna vaccines have an almost equal efficacy rate. However, the adverse effects are lower in case of Pfizer. However, the strict storage requirements can be a problem in using Pfizer as a mass vaccination tool. The protein spikes and their characteristics based on the immune response are also equivalent. Other than that, both of them can be termed as equally effective.

CONCLUSION

Based on the entire study it can be stated that this study has shed light on the different types of vaccines that have become useful in recovering from COVID-19. In this scenario, SARS- CoV-2 or the Severe Acute Respiratory Syndrome Corona Virus 2 has identified as most useful vaccines and provide a tough challenge for healthcare segments all across the globe. Because of this immune response observed towards the S antigen. Thus, the novel corona virus presented itself as a major health concern as a lot of people across the world have been infected by it. Vaccine has identified as one of the vital requirements that help in protecting human body from the infection of virus. Both Pfizer and Moderna are authorized for this purpose to provide its impact on human health. Though, there are chances of a bias being present in the estimations of completed or partial vaccination. All the issues related to the virus along with the health care challenges also have mentioned in this study to recognize its cruel impact over human beings cross the world. Accompanied with positivism philosophy the researcher has collected research data and information from reliable and valid source. In addition, following a descriptive design the researcher has illustrated the analysis of the outcomes in a better systematic way. Depending on authentic databases such as Web of Science, Pub Med, WHO and FDA are also used for the purpose of data collection the researcher has successfully made this research study valid and reliable. In order to understand the real impact of vaccination on human lives, the researcher has followed up for the next 6 months once the vaccination is done. Moreover, this entire study can provide the readers a clear concept regarding vaccination and its profit.

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