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Covid-19 Vaccines in Iraq

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لقاحات كوفيد -19 في العراق

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ABSTRACT

Background

The emergence of the new corona virus (SARS-CoV-2) in the late 2019 threatened the whole world and scientists throughout the word began searching for biological activities of the virus , During an unprecedented record period that did not exceed one year, scientists were able to develop a number of safe and effective vaccines , which have been tested on tens of thousands of volunteers around the world. Different companies prepared many vaccines and few of them get emergency approval by Food and Drug Administration (FDA) and used in different countries. The aim of the current study is to describe COVID 19 vaccines, structures, efficacy and safety used in Iraq. Three vaccines (Pfizer Biontech vaccine, AstraZenica Oxford vaccine and Sinopharm vaccine) are used to vaccinate people. All used vaccines showed variable effectiveness with different antibody titers. The ideal vaccine should be cheap, prophylactic, prevent congenital abnormalities, control the disease and eradicate it and be effective at all ages, at different health conditions and its effect is its effect lasts for a long time.

Conclusion

Pfizer's Biontech vaccine seems to be preferred by Iraqi as it gives highest antibody titter as well as its availability and universal usage compared to others vaccines.

Key Words:

COVID-19, Vaccines , Pfizer Biontech vaccine, AstraZenca Oxford vaccine, Sinopharm

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الخلاصة

المقدمة

ان ظهور فايروس كورونا الجديد ("SARS–CoV–2") في أواخر عام 2019 هدد العالم بأسره و بدأ العلماء في جميع أنحاء العالم بالبحث عن الأنشطة البيولوجية للفايروس. خلال فترة قياسية غير مسبوقة لم تتجاوز العام الواحد، تمكن العلماء من تطوير عدد من اللقاحات الآمنة والفعالة، والتي تم اختبارها على عشرات الآلاف من المتطوعين حول العالم. أعدت شركات مختلفة العديد من اللقاحات وقليل منها حصل على موافقة طارئة من قبل إدارة الغذاء والدواء ويستخدم في بلدان مختلفة. تهدف الدراسة الحالية الى وصف اللقاحات, تركيبها, وسلامتها. في العراق ، تُستخدم ثلاثة لقاحات (لقاح فايزر بيونتيك ولقاح أسترازينيكا أكسفورد ولقاح سينوفارم) لتطعيم الناس. أظهرت جميع اللقاحات المستخدمة فعالية متفاوتة مع عيارية الأجسام المضادة المختلفة. ان اللقاح المثالي يجب أن يكون رخيصاً وقائياً ويمنع التشوهات الخلقية ويقاوم المرض ويقضي عليه ويجب ان يكون فعالاً في كل الأعمار و في ظروف صحية مختلفة وتأثيره يستمر لفترة طويلة.

الاستنتاجات:

يبدو أن لقاح Pfizer Biontech مفضل من قبل العراقيين لأنه يعطي أعلى عيارية للأجسام المضادة بالإضافة إلى توفره واستخدامه العالمي مقارنة باللقاحات الآخرى.

INTRODUCTION

In late 2019, a novel corona virus outbreak named SARS-CoV-2 virus, caused COVID-19 infections. The outbreak began in the city of Wuhan, China and developed very quickly and spread to other parts of China, and from there to many countries of the world **[1 and 2]**. On March 2020, WHO declared COVID-19 as pandemic **[3]**.

Because of the outbreak and its severity, thousands were fighting for their lives in hospitals of all countries and the world took strict measures to limit the spread of the virus **[4 and 5]**.

In an unprecedented record period that did not exceed one year, scientists were able to develop a number of safe and effective vaccines, which had been tested on tens of thousands of volunteers around the world **[6 and 7]**. The global regulator has given green light for a number of these vaccines for emergency use to prevent COVID 19 infection, such as Pfizer's Biontech, Moderna, AstraZeneca University of Oxford, Johnson & Johnson, Chinese Sinopharma, and Sputnik Russian **[8]**.

Importance of Vaccines

Vaccines represent one of the greatest success stories in the history of modern medicine. The World Health Organization estimates that vaccines have prevented at least 10millions of deaths occurred between 2010 and 2015 **[9]**. Traditional approach to control viral infections is based on an Arabic proverb which says "prevention is better than cure". The great success of World Health Organization (WHO) program had been achieved by complete eradication of small pox in 1974 **[10]**. Thanks to the progress with the continuous expansion of

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the scope of immunization, the world has reached a stage it has not reached before in limitation of polio [11].

Vaccines help the body's immune system to fight pathogens through the release of specialized immune responses. Vaccines often consist of weakened or killed forms of microorganisms or other components, which retain their ability to stimulate the immune system of the recipient, to produce antibodies and killer T cells capable of recognizing the virus, attacking and destroying it. It generally takes several weeks after vaccination for the body to produce and store immunoglobulins, memory B cells, and memory T cells, which are Long-lived cells can "remember" the pathogen and prevent and eliminate the pathogens if attack the body in the future [12 and 13].

Vaccine Development and Testing Stages

The development and production of a vaccine usually goes through two main stages, the preclinical (or pre-human trial)stage, where researchers give the vaccine to laboratory animals such as mice or monkeys to see if it will lead to a good immune response, followed by the clinical stage (human trials) [14].

The test of vaccine consists of three phases: Phase I: A small number of people are given the vaccine by scientists, usually including about 20 volunteers tested for safety and dosage, and to learn more about the response of the immune system it induces [2], [15]. In phase 2, scientists administer the vaccine to hundreds of people, divided into categories such as children and the elderly, to determine whether the vaccine is effective in different age groups. These trials also assess the vaccine's safety and dosage, as well as its capacity to boost the immune system [14].

If the vaccine is proven to be effective and does not cause health problems, it will be expanded to include thousands of volunteers, which is called phase 3. These experiments can determine whether the vaccine protects against the emerging corona virus. This phase is also important to confirm the safety of the use of the vaccine by determining the real reactions including rare side effects. Following phase 3, FDA approval then manufacturing and distribution will take place [16].

How Do Vaccines Work?

Scientists use different techniques in their experiments to develop vaccines, two of which work in the same way that has been proven to be effective in previous vaccines (Figure 1) [17].

The first two methods are to inject the body with a weak (attenuated) or dead virus (inactivated), as is used in polio, smallpox, and influenza vaccines. The third method depends on injecting the body with a small part of the virus to stimulate the body's immune system [18 - 20].

The "Swedish-British company, AstraZeneca, and its partner, the University of Oxford", were taking a forth approach, during which experts transfer some corona virus proteins

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to a different virus without causing infection, which enhances the immune system's ability to recognize signs of future virus invasion [21 and 22].

The American company "Pfizer" and its partner, the German "Biontech", and the American company "Moderna" were also using a fifth and six methods in developing the vaccine, which depends on the production of a "genetic vaccine", by injecting volunteers with "messager RNA" or the genetic code that carries the information to produce viral proteins, in the body cells. The immune system recognizes these foreign proteins and initiates an immune reaction against them. [23 - 25].

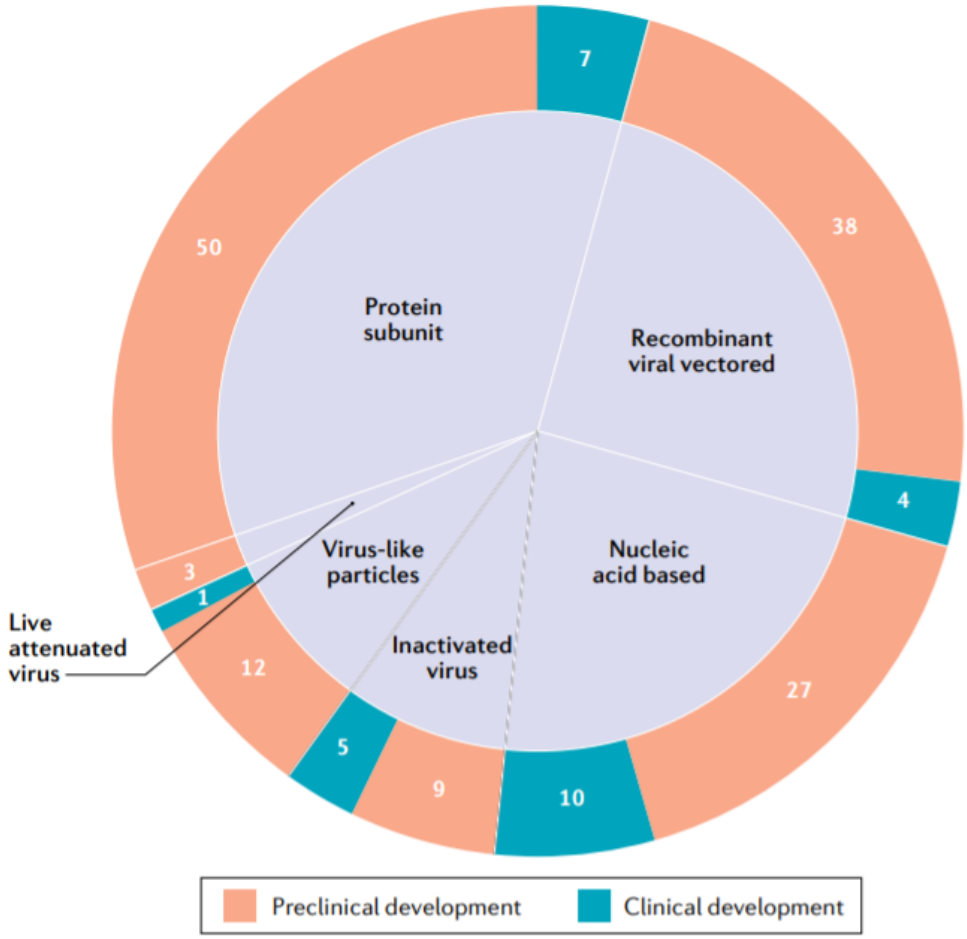

Figure 1. The global COVID-19 vaccine landscape

The early response against SARS-CoV-2 following vaccination is achieved by innate immunity. The cells of the innate immunity remove viral particles and give signals to other cells. Subsequent host cells prevent the spread of virus from infected cells to other parts of the body. Following this, T and B cells will be stimulated and destroyed virus by activated cytotoxic T cells (CTC) and neutralizing antibodies produced by activated B cells . On reinfection, memory T and B cells react quickly (Figure 2) [26]. The formation of strong T cells in people who recovered from SARS-CoV-2 infection is likely to provide long protection [27].

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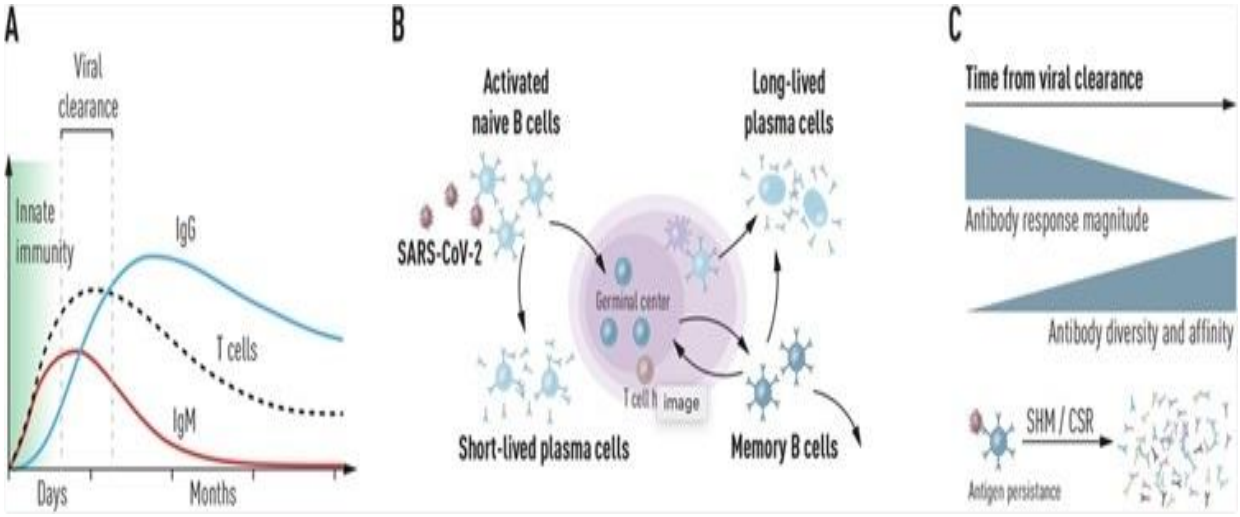

Figure 2. Kinetics of innate and adaptive immune responses following SARS-CoV-2 infection

The Most Prominent Corona Vaccines Used In Iraq

- **Pfizer Biontech vaccine**:

The vaccine is a modern technology that has not been previously used in humans, using messenger RNA (mRNA) coding for the production of spike proteins, the most dangerous proteins responsible for viral attachment to receptors on the surface of the human cell [28]. After being injected, the vaccine or genetic code penetrates the human cell membrane with the help of lipid nanoparticles and protein synthesis in the ribosome started making spike protein, which move to the cell surface and in turn, it alerts and stimulates the immune system [29 and 30]. The vaccine is given intramuscular in two doses at 28 days interval (Figure 3) [30]. The Pfizer Biontech vaccine needs to be stored very cold at a temperature of -70 C^{o} at all times, therefore it requires expensive specialized equipment which represents a major logistical challenge to the process of transporting and storing the vaccine. It was reported that the chief scientist at Pfizer Biontech was announced soon to work on the second version of the vaccine in the form of powder needs regular refrigerator instead of freezing [31 and 32].

In the United States, the FDA recently lowered the age at which people can get Pfizer's COVID-19 vaccination from 12 to 15 years old [33].

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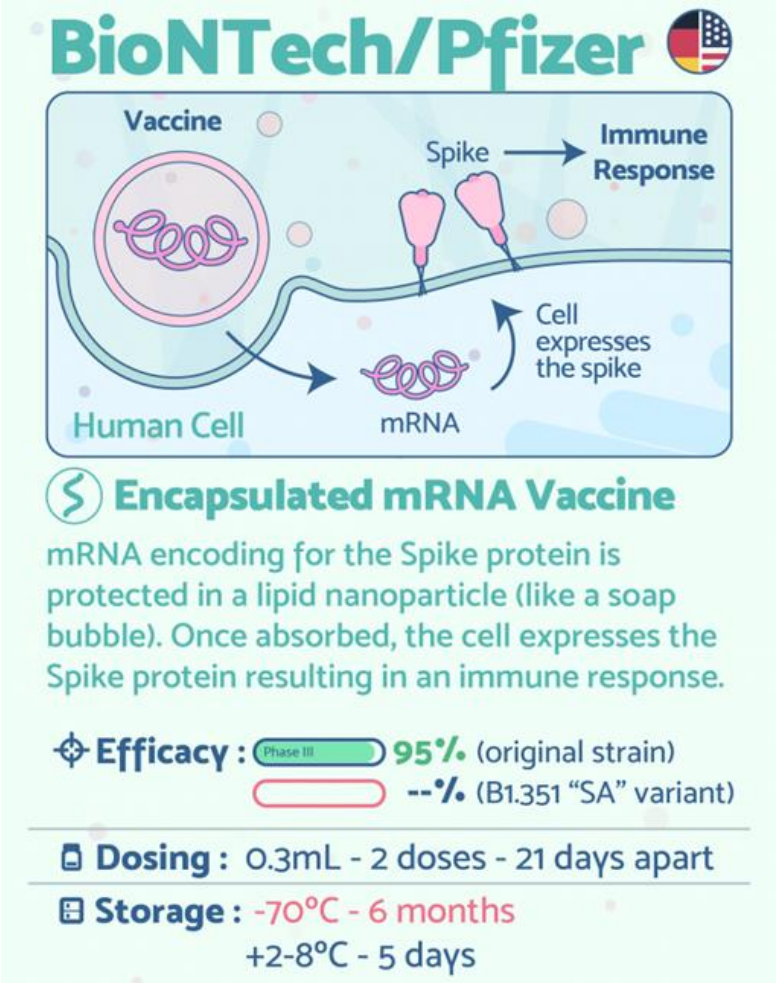

Figure 3. Details of mRNA vaccine (Pfizer)

- **AstraZeneca University of Oxford Vaccine:**

A vaccine was developed by the University of Oxford and manufactured by AstraZeneca, a British-Swedish firm, has had as a significant component in the drive to meet global demand for Covid-19 vaccinations. The vaccine is built on a foundation that Oxford researchers have been working on for years in order to produce vaccines for other diseases. They started with an adenovirus that ordinarily infects chimps and genetically modified it to carry the corona virus's spike gene **[29 , 34 and 35]**. Vaxzevira, a vaccine with a 76% efficacy, is being mass-produced in large quantities at a reasonable cost because it simply needs to be refrigerated rather than frozen. (Figure 4) **[30]**. It had a far broader application than mRNA vaccines **[36 and 37]**. Oxford declared on July 29th2021 that a billion doses of Vaxzevira had been distributed worldwide. The vaccination is administered intramuscularly in two doses separated by eight to twelve weeks **[36 - 38].** A third dosage of the AstraZeneca vaccine elicited substantial immune responses in volunteers, according to Oxford researchers in June 2021**[39]**.

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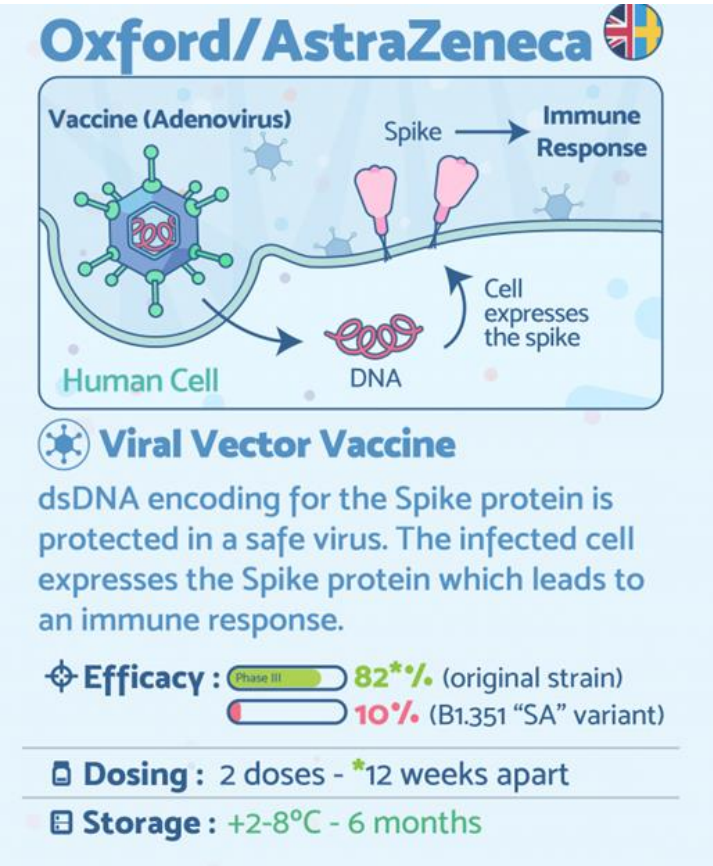
AstraZeneca and Oxford are developing a new version of the vaccine to defend against the Beta variant and are currently evaluating a nasal spray version. Participants received doses of the Beta version vaccine AZD2816 on June 28th, 2021. European medical officials were concerned in March 2021 after learning about a tiny number of incidences of blood clots in younger patients who had gotten Vaxzevria. The European Medicines Agency concluded that the vaccination caused blood clots in major veins in combination with low platelets, which was a relatively rare side effect **[29].**



- **Sinopharm Vaccine (SBBIBP-CorV):**

A vaccine developed by the Beijing Institute of Biological Products and Sinopharm had emerged as China's leading Covid-19 vaccine both domestically and internationally. The institute's researchers created BBIP-CorV by cultivating live corona viruses in cells, inactivating them, and injecting them into the body. These inactivated viruses can't infect cells, but they can get the immune system's attention **[39 and 40]**.

Sinopharm revealed on December 30th, 2020, that the vaccine had a 79.34 percent efficacy rate, prompting the Chinese authorities to approve it. (Figure 5) **[30]**. WHO issued an

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emergency use authorization for the vaccine on May 7th, 2021, based on a 78.1 percent efficacy estimate. Sinopharm's vaccine received emergency approval in a number of nations. In China, the vaccine was approved for emergency use in children and adolescents in July 2021 **[40 and 41]**.

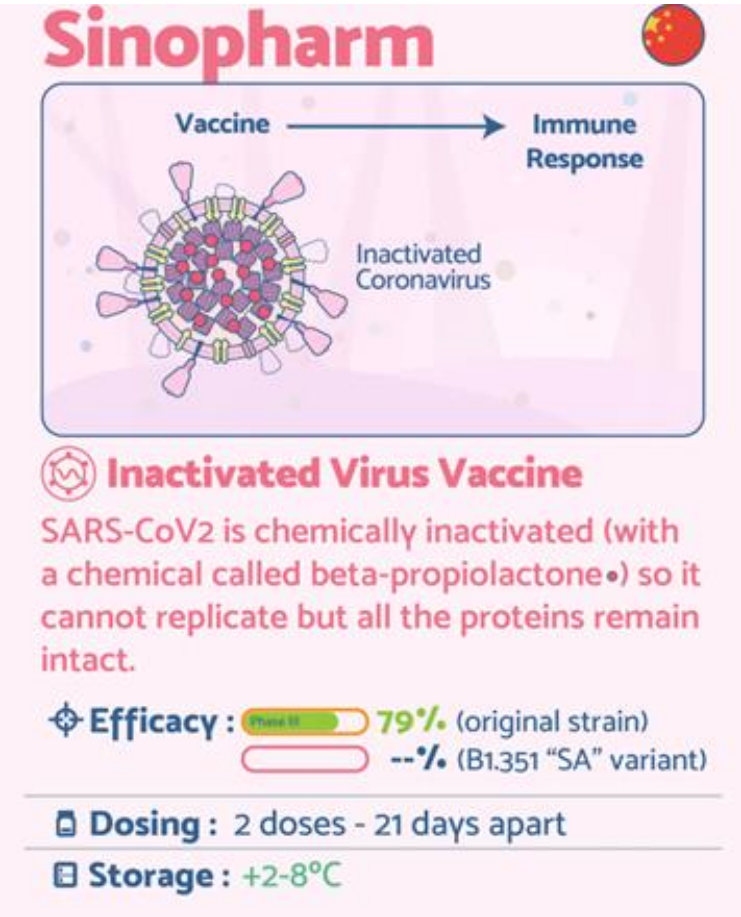

Figure 5. Details of Sinopharm Vaccine

What is the most appropriate vaccine for Iraq?

Pfizer's Biontech and Moderna vaccines, which have shown effective 95% of success, are considered appropriate options, but they face many problems, which are the high cost and logistical difficulties in storage and transportation. An ideal vaccine should be cheaper, prophylactic, prevent congenital abnormalities and control disease and eradicate it. Vaccine must be effective at all ages , at different health conditions and its effect is sustainable for a long period.

Conclusion

The three used vaccine in Iraq showed variable effective ranging from 79-95 % . Pfizer's Biontech seems to be preferred by Iraqi as it gives highest antibody titter and availability as well as its universal usage compared to others.

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Conflict of interests.

There are non-conflicts of interest.

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