PriMera Scientific
Medicine and Public Health
Volume 2 Issue 6 June 2023
ISSN: 2833-5627

Review on CoviShield and Covaxin Vaccine against Covid-19

Type: Review Article
Received: May 01, 2023
Published: May 29, 2023

Citation:
Jayvadan K Patel., et al. "Review on CoviShield and Covaxin Vaccine against Covid-19". PriMera Scientific Medicine and Public Health 2.6 (2023): 50-56.

Prashant B Patil[1,2], Dipak M Patil[3], Zamir G Khan[1], Sai A Patel[4], Jayvadan K Patel[2,5]*

[1]Department of Pharmaceutical Chemistry, H. R. Patel Institute of Pharmaceutical Education and Research, Shirpur, India

[2]Faculty of Pharmacy, Sankalchand Patel University, Visnagar, India

[3]Department of Pharmaceutics, H. R. Patel Institute of Pharmaceutical Education and Research, Shirpur, India

[4]Shree S.K. Patel College of Pharmaceutical Education and Research, Ganpat University, India

[5]Aavis Pharmaceuticals, Hoschton, GA, USA

***Corresponding Author:** Jayvadan K Patel, Department of Pharmaceutical Chemistry, H. R. Patel Institute of Pharmaceutical Education and Research, Shirpur, India; Aavis Pharmaceuticals, Hoschton, GA, USA.

Abstract

Since the pandemic began, India has confirmed more than 35 million cases and 50 lakh deaths (COVID19). The country has the second-highest number of Covid-19 infections in the world. As a result, vaccines that are both safe and effective required. The most widely used vaccinations in India are CoviShield and Covaxin. While the Serum Institute of India in Pune produces CoviShield, Covaxin is wholly designed, developed, and manufactured in India. CoviShield, a viral vector vaccine developed, it delivers spike proteins and mounts a tolerable immune response to a live virus using an adenovirus discovered in chimps, ChAD0x1. Covaxin is an inactivated coronavirus vaccine. India has reached the milestone of more than 1 billion vaccination doses. In addition, India achieves a world record by administering 2.5 million vaccines in a single day. The major goal of this research is to distinguish between the two most often used vaccinations in India, CoviShield and Covaxin. Also everyone in the public is aware of how it works, safe, effective and harmful it is. As a result of these vaccines, India plays a critical role in halting the coronavirus in the present and near future, perhaps saving millions of lives.

Keywords: CoviShield; Covaxin; Vaccine; Covid-19; India; Virus

Introduction

India has reached a milestone of 1 billion vaccination doses administered. India also establishes a new world record for the number of vaccines administered in a single day, at 2.5 billion. The major goal of this study is to distinguish between CoviShield and Covaxin, India's two most popular vaccines. And they're aware of how it works, how safe it is, how effective it is, and how harmful it is to the community. As a result of these vaccines, India plays a critical role in preventing the coronavirus in the present and near future, perhaps saving the lives of millions of people [1, 2]. SARS-CoV-2 is a new and dangerous virus. Countries all around the world are competing to find and implement potential preventative, therapeutic, and preventive strategies to reduce morbidity and mortality linked with this virus.

SARS-CoV-2 was first transmitted through the nose, and the virus soon moved to the lungs, exploiting the binding receptor Angiotensin-converting enzyme (ACE) 2 to infect epithelial cells. If the immune system fails to combat SARS-CoV-2 at this point, the virus spreads to the lungs, where it might cause death. 6 The ACE-2 receptor is located on the surface of a range of pulmonary and extra pulmonary cell types, including cardiac, renal, intestinal, and pancreatic cells, as well as endothelial cells7, which could explain why comorbid individuals have such severe conditions [2-5].

COVID-19 has been treated with antiviral, antibacterial, antimalarial, and immunoglobulin's, among other drugs, with varying degrees of success. The development of a COVID-19 vaccine is regarded an essential and critical component of global efforts to contain the Pandemic, and numerous businesses are working to develop a safe and effective vaccine [6, 7]. Vaccination is a cost-effective and risk-free method of protecting individuals against disease. It builds resistance to specific illnesses by utilizing one's natural defensive mechanism. Vaccines instruct the human immune system to produce neutralizing antibodies in the same way that it does when it is exposed to a disease. These vaccinations, on the other hand, only contain weakened or destroyed viruses or bacteria that lack the ability to proliferate and cause disease. There is no danger of problems with these immunizations. The majority of vaccinations are administered via injection, however others are administered subcutaneously (under the skin), orally (such as Polio) or through the nose. It could take years to develop safe and effective vaccines. The manufacture of vaccines entails a number of time-consuming stages that are guided by deliberate and measurable methodology [8, 9]. In January 2021, the Drug Controller General of India approved vaccines for restricted use in emergency situations in India: CoviShield vaccine and Covaxin [2, 10]. The mechanism of action, efficacy etc. of the Covid-19 vaccines, which have been approved by the DCGI in India for limited usage in emergency settings, will be examined in this review.

Covishield Vaccine

The University of Oxford collaborated with the British-Swedish business AstraZeneca to develop and test the ChAdOx1 nCoV-19 or AZD1222 coronavirus vaccine. A comprehensive clinical trial found that the vaccination provided substantial protection, with a 76 % overall effectiveness and their mechanism depicted in Figure 1 [11, 12].

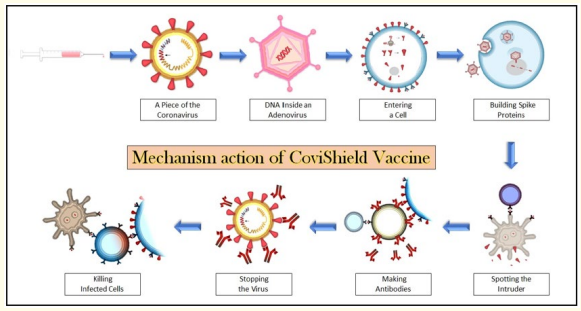

Figure 1: Mechanism action of CoviShield.

How the CoviShield vaccine work

A Piece of the Coronavirus - The SARS-CoV-2 virus has proteins embedded in it that it uses to penetrate human cells. Vaccines and treatments based on these so-called spike proteins are an intriguing target. The vaccine developed by Oxford-AstraZeneca is based on the virus's genetic instructions for constructing the spike protein. The Oxford vaccine, unlike the Pfizer-BioNTech and Moderna vaccines, stores the instructions in double-stranded DNA rather than single-stranded RNA [13, 14].

DNA inside an Adenovirus (The DNA of an Adenovirus) - The gene for the coronavirus spike protein was inserted into an adenovirus by the researchers. Colds and flu-like symptoms are caused by adenoviruses, which are common viruses. The Oxford-AstraZeneca team utilized ChAdOx1, a modified variant of a chimp adenovirus. It has the ability to enter cells but not to multiply within them [15]. Adenovirus-based vaccines have been studied for decades, and AZD1222 is the result of that research. The first, a vaccine for Ebola developed by Johnson & Johnson, was authorized for broad use in July. Other diseases, such as H.I.V. and Zika, are undergoing advanced clinical trials [16]. The Oxford-AstraZeneca Covid-19 vaccine is more durable than Pfizer and Moderna's mRNA vaccines. The adenovirus's strong protein coat helps safeguard the genetic information within since DNA is not as brittle as RNA. As a result, the Oxford vaccination is no longer required to be frozen. When kept refrigerated at 38–46°F (2–8°C), the vaccination should survive at least six months [17].

Entering a Cell - The adenoviruses bump into cells and latch onto proteins on their surface after being injected into a person's arm. The virus is engulfed in a bubble by the cell, which pulls it within. Once inside, the adenovirus breaks free from the bubble and proceeds to the nucleus, the cell's DNA storage chamber. The DNA of the adenovirus is pushed into the nucleus. Although the adenovirus can't replicate itself, the coronavirus spike protein gene may be read by the cell and copied into a molecule called messenger RNA, or mRNA [1, 18].

Building Spike Proteins - The cell's molecules read the mRNA's sequence and begin constructing spike proteins after it leaves the nucleus. Some of the cell's spike proteins make spikes that migrate to the cell's surface and stick out their tips. Some of the proteins are also broken down into pieces by the vaccinated cells, which they present on their surface. The immune system can then recognize these protruding spikes and spike protein fragments. By activating the cell's warning systems, the adenovirus also activates the immune system. The cell sends out warning signals to surrounding immune cells, causing them to activate. The Oxford-AstraZeneca vaccine causes the immune system to react more forcefully to the spike proteins by heightening this alert [19].

Spotting the Intruder (Detection of the Intruder) - When a vaccinated cell dies, the debris contains spike proteins and protein fragments that can be picked up by an antigen-presenting cell, a type of immune cell. The cell's surface is covered in spike protein fragments. When other cells known as helper T cells recognize these pieces, they can raise an alarm and assist other immune cells in fighting the infection [1].

Making Antibodies - Other immune cells, known as B cells, may come into contact with coronavirus spikes on vaccinated cells' surfaces or free-floating spike protein fragments. A few B cells might be able to latch on to the spike proteins. These B cells will proliferate and produce antibodies against the spike protein if they are activated by helper T cells [20].

Stopping the Virus (Virus Elimination) - Antibodies can bind to coronavirus spikes, marking them for destruction and preventing infection by preventing the spikes from adhering to additional cell [1, 21].

Killing Infected Cells - Antigen-presenting cells can also trigger a type of immune cell known as a killer T cell, which will look for and destroy any coronavirus-infected cells with spike protein fragments on their surfaces.

Side effects

Common - Where the injection is given, there may be swelling or redness, fever, body pain, headache, nausea, or vomiting.

Rare - Abdominal pain, pain in limbs, shortness of breath, thrombocytopenia [22].

Efficacy - The Covishield chAdOx1-S [recombinant] vaccine shows 70.4 % efficacy against the SARS-CoV-2 Covid 19 disease. The Covishield vaccine has been proved its efficiency and effectiveness in real worldwide and also has a significant health impact on the public in terms of lowering infection, hospitalization, and also death [23].

Storage condition - It can be stored in the refrigerator at temperatures between +2˚C to +8˚C. Multi-portion vials should be used as soon as feasible after opening, preferably within 6 hours if stored between 2˚C to 25˚C [22, 24].

Covaxin Vaccine

Covaxin is an inactivated coronavirus vaccine developed by the Indian company Bharat Biotech in collaboration with the National Institute of Virology and the Indian Council of Medical Research. On Jan. 3, India approved the vaccine for emergency use, and subsequent testing revealed that it has a 77.8% effectiveness rate their mechanism of action graphically represent in Figure 2 [25, 26].

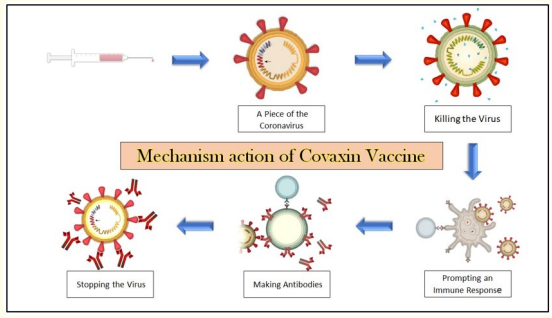

Figure 2: Mechanism action of Covaxin.

How the Covaxin vaccine work - Covaxin works by instructing the immune system to produce antibodies against the coronavirus SARS-CoV-2. Antibodies bind to viral proteins like the spike proteins that pepper the virus's surface [27]. Bharat Biotech used a coronavirus sample isolated by India's National Institute of Virology to make Covaxin [28, 29].

Killing the Virus (Virus Elimination) - After mass-producing coronaviruses, the researchers utilized a chemical called beta-propiolactone to douse them. By binding to the coronaviruses' genes, the chemical rendered them inactive. Coronaviruses that had been inactivated could no longer multiply. However, their proteins, including spike, were unaffected. The researchers then took the inactivated viruses and blended them with a little amount of an adjuvant, which is an aluminum-based chemical. Adjuvants improve the immune system's reaction to a vaccine by stimulating it [30, 31].

Prompting an Immune Response (Prompting an Immune Response) - Covaxin can be injected into the arm without developing Covid-19 since the coronaviruses in it are dead. Some of the inactivated viruses are swallowed by an immune cell called an antigen-presenting cell once inside the body. The coronavirus is torn apart by the antigen-presenting cell, which then displays some of the fragments on its surface. The fragment could be detected by a type of T cell known as a helper T cell. The T cell becomes activated and can help recruit other immune cells to respond to the vaccine if the fragment fits into one of its surface proteins [32, 33].

Making Antibodies (Antibody Production) - A type of immune cell known as a B cell may also come into contact with the inactivated coronavirus. Surface proteins on B cells come in a wide range of shapes, and a few of them might be the proper shape to latch onto the coronavirus. When a B cell binds to a virus, it can drag some or all of the virus inside, resulting in coronavirus fragments on its surface [34, 35]. A coronavirus-activated helper T cell can latch on to the same fragment. The B cell is also stimulated when this happens. It multiplies and produces antibodies that are identical in form to their surface proteins [36, 37].

Stopping the Virus - The immune system can respond to a live coronavirus infection after being vaccinated with Covaxin. Antibodies produced by B cells bind to invaders. Antibodies against the spike protein can stop the virus from infecting cells. Antibodies of different types may be able to stop the virus in different ways [38, 39].

Side effects

Common - Injection site pain, fatigue, headache, fever, muscle pain.

Rare - Joint pain, Flu-like symptoms, Digestive problems [40].

Efficacy - On the basis of a report from a phase 3 efficacy, safety, and immunogenicity clinical trial of Covaxin BBV152, a whole virion inactivated SARS-CoV-2 vaccine. The Covaxin vaccine shows 77.8% efficacy against the SARS-CoV-2 Covid 19 disease [41, 42].

Storage condition - It can be kept in the fridge at temperatures ranging from +2˚C to +8˚C, making it excellent for vaccination cold chains [22, 43].

Conclusion

Epidemiological studies must be conducted in order to provide a clear endpoint for measuring vaccine efficacy. According to available and represented in Table 1 data, both vaccines to induce neutralizing antibodies with a wide range of coverage, which has also shown sufficient efficacy in overall old as well as new variants in the prevention of Covid-19 and has not been associated with serious adverse events; however, considering new variants, additional research may be required. The main goal of vaccination is to reduce deaths, protect the health-care system, and finally, control disease transmission. This can only be accomplished if a larger number of people are vaccinated with locally available Covid-19 vaccine and have self-awareness about disease transmission prevention. Even after vaccination, wearing a mask, keeping a safe distance, washing hands frequently, and avoiding crowds are still the best ways to avoid SARS-CoV-2 infection.

Name of Vaccine	*Type of antigen \ Vector*	*Doses and Interval*	*Efficacy*	*Storage Condition*	*References*
CoviShield	Viral vector	2 doses, 4-12 weeks	70.4%	+2˚C to +8˚C	[14, 22, 23, 44]
Covaxin	Inactivated virus	2 doses, 4 weeks	77.8%	+2˚C to +8˚C.	[22, 25, 41]

Table 1: Evaluation of CoviShield and Covaxin vaccine authorized in India.

References

1. Bukhari MH, M Syed and S Zain. "The Differences between Traditional Vaccines and RNA Vaccines: Safety, Efficacy, Reliability and Future of COVID-19 Vaccines". Annals of King Edward Medical University 27.2 (2021).
2. Zheng H and JJ Cao. "ACE gene polymorphism and severe lung injury in patients with COVID-19". The American journal of pathology (2020).
3. Dai L and GF Gao. "Viral targets for vaccines against COVID-19". Nature Reviews Immunology 21.2 (2021): 73-82.
4. Lipworth B, C Kuo and R Chan. "Emerging pharmacotherapy for COVID-19". Journal of the Royal College of Physicians of Edinburgh 50.2 (2020): 133-137.
5. Cheng H, Y Wang and GQ Wang. "Organ-protective effect of angiotensin-converting enzyme 2 and its effect on the prognosis of COVID-19". Journal of medical virology 92.7 (2020): 726-730.
6. Pillaiyar T, S Meenakshisundaram, and M Manickam. "Recent discovery and development of inhibitors targeting coronaviruses". Drug discovery today 25.4 (2020): 668-688.
7. Dhama K., et al. "COVID-19, an emerging coronavirus infection: advances and prospects in designing and developing vaccines, immunotherapeutics, and therapeutics". Human vaccines & immunotherapeutics 16.6 (2020): 1232-1238.

8. Deb B, H Shah and S Goel. "Current global vaccine and drug efforts against COVID-19: Pros and cons of bypassing animal trials". Journal of biosciences 45.1 (2020): 1-10.
9. Le TT., et al. "Evolution of the COVID-19 vaccine development landscape". Nat Rev Drug Discov 19.10 (2020): 667-668.
10. Basavaraja CK., et al. "Adverse events following COVID-19 vaccination: first 90 days of experience from a tertiary care teaching hospital in South India". Therapeutic Advances in Vaccines and Immunotherapy 9 (2021): 25151355211055833.
11. Shahzamani K., et al. "Vaccine design and delivery approaches for COVID-19". International Immunopharmacology 100 (2021): 108086.
12. Uttarilli A., et al. "Super-rapid race for saving lives by developing COVID-19 vaccines". Journal of Integrative Bioinformatics 18.1 (2021): 27-43.
13. Callway E. "Oxford covid vaccine results puzzle scientists". Nature 588 (2020): 16-18.
14. Mascellino MT., et al. "Overview of the Main Anti-SARS-CoV-2 vaccines: mechanism of action, efficacy and safety". Infection and drug resistance 14 (2021): 3459.
15. Garofalo M., et al. "Prospects of replication-deficient adenovirus based vaccine development against SARS-CoV-2". Vaccines 8.2 (2020): 293.
16. Kurup D and MJ Schnell. "SARS-CoV-2 vaccines–The biggest medical research project of the 21st century". Current Opinion in Virology (2021).
17. Angeli F., et al. "SARS-CoV-2 vaccines: Lights and shadows". European Journal of Internal Medicine (2021).
18. Miller JM., et al. "Guidelines for safe work practices in human and animal medical diagnostic laboratories". MMWR Surveill Summ 6.61 (2012): 1-102.
19. Nikhra V. Evolving COVID-19 Pandemic: The Lurking Dangers and Pillars of Hope.
20. Zahid A. Johnson & Johnson Vaccine Update.
21. Huang KY., et al. "Humanized COVID-19 decoy antibody effectively blocks viral entry and prevents SARS-CoV-2 infection". EMBO molecular medicine 13.1 (2021): e12828.
22. Shrestha Y., et al. "Covid-19 Vaccine Authorized in India-A Mini Review". (2021).
23. Voysey M., et al. "Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK". The Lancet 397.10269 (2021): 99-111.
24. Analytica O. "India's vaccine roll-out faces key obstacles". Expert Briefings (2021).
25. Darbar S, S Agarwal and S Saha. "COVID19 Vaccine: COVAXIN®-India's First Indigenous Effective Weapon to Fight against Coronavirus (A Review)". Parana Journal of Science and Education 7.3 (2021): 1-9.
26. Srivastava R, P Ish and S COVID. "The initial experience of COVID-19 vaccination from a tertiary care centre of India". Monaldi Archives for Chest Disease (2021).
27. Majumdar S., et al. "Perspectives about modulating host immune system in targeting SARS-CoV-2 in India". Frontiers in genetics 12 (2021): 125.
28. Wani R, PH Manihar and VJ Wani. "Covid-19 Vaccination: Part Played in Pregnancy". The Indian Practitioner 74.3 (2021): 7-10.
29. Sharma P and G Pardeshi. "COVID-19 vaccination in India: An ethical perspective". Diabetes & Metabolic Syndrome: Clinical Research & Reviews 15.6 (2021): 102314.
30. Abdulla ZA., et al. "A Summary of the SARS-CoV-2 Vaccines and Technologies Available or under Development". Pathogens 10.7 (2021): 788.
31. Kumar M., et al. "A Comprehensive Overview on the Production of Vaccines in Plant-Based Expression Systems and the Scope of Plant Biotechnology to Combat against SARS-CoV-2 Virus Pandemics". Plants 10.6 (2021): 1213.
32. Gharate JS, SA Daitkar and KA Aher. Approved Covid 19 Vaccines: A Review (2021).
33. Abduljaleel Z, FA Al-Allaf and SA Aziz. "Peptides-based vaccine against SARS-n CoV-2 antigenic fragmented synthetic epitopes recognized by T cell and β-cell initiation of specific antibodies to fight the infection". Bio-design and Manufacturing (2021): 490-505.
34. Sapkal GN., et al. "Inactivated COVID-19 vaccine BBV152/COVAXIN effectively neutralizes recently emerged B. 1.1. 7 variant of

SARS-CoV-2". Journal of Travel Medicine 28.4 (2021): taab051.

35. Singh AK., et al. "Antibody Response after First-dose of ChAdOx1-nCOV (Covishield) and BBV-152 (Covaxin) amongst Health Care Workers in India: Preliminary Results of Cross-sectional Coronavirus Vaccine-induced Antibody Titre (COVAT) study". medRxiv (2021).
36. Sharma R, S Tiwari and A Dixit. "Covaxin: An overview of its immunogenicity and safety trials in India". Bioinformation (2021): 840-840.
37. Nikhra V. "Stages in COVID-19 vaccine development: The Nemesis, the Hubris, and the Elpis". Int J Clin Virol 4 (2020): 126-135.
38. Cohen J. "Doses of reality". American Association for the Advancement of Science (2021).
39. Sharma M. "Story of the biggest vaccination drive in the world so far". Journal of pharmacovigilance and drug research 2.2 (2021): 1-2.
40. Zare H., et al. "Prevalence of COVID-19 vaccines (Sputnik V, AZD-1222, and Covaxin) side effects among healthcare workers in Birjand city, Iran". International immunopharmacology 101 (2021): 108351.
41. Ella R., et al. "Efficacy, safety, and lot to lot immunogenicity of an inactivated SARS-CoV-2 vaccine (BBV152): a double-blind, randomised, controlled phase 3 trial". MedRxiv (2021).
42. Dar MA., et al. "Safety, efficacy, and immunogenicity of COVAXIN: A review". Journal of Applied Pharmaceutical Science 11.11 (2021): 018-025.
43. Rotbi MF, S Motahhir and AE Ghzizal. "Blockchain technology for a Safe and Transparent Covid-19 Vaccination". arXiv preprint arXiv:2104.05428 (2021).
44. Bobdey S, S Kaushik and A Menon. "The conundrum of two-dose interval of ChAdOx1 nCOV-19 corona virus vaccine: Way ahead". Medical Journal, Armed Forces India 77 (2021): S250.