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IgG Antibody Seroprevalence Post Covishield Vaccination in Western Uttar Pradesh: A Hospital Based Study

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Covid-19, a zoonotic disease caused by Severe Acute Respiratory Syndrome Coronavirus - 2 (SARSCov-2) has emerged as a worldwide infection and has been declared pandemic since March, 2020, by WHO. This has brought about tremendous burden on the health care system of not only the developing or the third world countries but also that of prosperous counties of the world. The recent Covid-19 pandemic has pushed the worldwide scientific and medical community to find a solution with the help of vaccines to control SARS-CoV-2 pandemic. An effective vaccine is one which leads to synthesis of IgG antibodies against SARS-CoV-2, thus aiding the control and decline of the pandemic.
Aim: This study aims to evaluate the antibody titres post 1st dose and post 2nd dose Covishield vaccination and reveals the safety and efficacy of ChAdOx1 nCoV-19(Recombinant) Covishield vaccine.
Methodology: The levels of IgG antibodies were estimated in 215 subjects (both normal subjects and Covid-19 positive subjects) using Enzyme Linked Immunosorbent Assay (ELISA) Technique.

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Results: Two hundred & fifteen subjects from Teerthanker Mahaveer Hospital of Moradabad (western Uttar Pradesh) were enrolled for the study. The participants were divided into two different groups. Group I comprised of 215 subjects who received 1st dose of the Covishield vaccine. Group II comprised of 101 subjects who received both the doses of the ChAdOx1 nCoV-19(Recombinant) Covishield vaccine. Levels of IgG were analysed 28 days post 1st dose of ChAdOx1 nCoV-19(Recombinant) Covishield vaccine and post 2nd dose of ChAdOx1 nCoV-19(Recombinant) Covishield vaccination. After testing serologically for neutralising IgG antibodies, the titre was found to be below the threshold level of 1.1 in 67.40% of the subjects in the study group 1, whereas 32.60% (n=70) were found to be in the seroprotective range (i.e IgG titre > 1.1). Out of the total 101 participants who took both the doses, 39 participants (38.6%) were found to be in the seroprotective range (i.e IgG titre > 1.1).

Conclusion: The two doses of Covishield vaccination (4 weeks interval) given to subjects resulted in increase in IgG antibody titre (Neutralising Antibodies) against both spike protein and nucleocapsid protein after 1st dose and 2nd dose and that single dose may suffice for seroprotection in subjects with previous history of COVID-19 who had recovered from the disease.

Keywords: Covid-19; vaccine; covishield; IgG antibody (neutralising: anti-spike + anti-nucleocapsid).

1. INTRODUCTION

The pandemic caused by SARS-CoV-2, Corona virus has almost entirely shut down the worldwide movements and has restrained people from stepping to the outside world. Since, the virus has spread unanimously to the entire nations of the world; it has led to enormous loss of lives and economy. SARS-CoV-2 is believed to have originated in the year 2019 from Wuhan, China from bats and since then has been a pandemic affecting nearly 188 countries and 25 territories around the globe[1]. More than 175 million people have been infected with COVID-19 and above 3.7 million deaths have been recorded globally till date[2].

Initially, Corona virus SARS-CoV-2 causes moderate respiratory illness which usually culminates into Acute Respiratory Distress Syndrome(ARDS). Clinical outcomes may vary from asymptomatic infections to severe respiratory complications, Multi-organ Dysfunction Syndrome (MODS) and even death. Aged people above 60 years and those having co-morbidities like hypertension, heart diseases, lung diseases, Diabetes Mellitus, obesity and cancer, etc. have higher chances of progressing from mild to severe illness. The constitutional symptoms include fever, dry cough, loss of taste and smell, sore throat, nasal congestion, muscle and joint pains, etc. In severe COVID-19 disease, symptoms such as shortness of breath, loss of appetite, sleep disorders, anxiety and depression have been noted to varying degrees constituting the myriad occurrence of symptoms and signs in Covid-19 patients[3].

The novel corona viruses are structurally pleomorphic enveloped viruses. They have 4 structural proteins; Spike (S) protein, nucleocapsid (N) protein, envelope (E) and Membrane (M) proteins. Out of these proteins, S protein is responsible for attachment and penetration into hosts' cell via ACE receptors[4,5]. They have positive sense ssRNA genome with the N protein which forms the helical nucleocapsids. The genome is both capped and polyadenylated which prolongs the survival and exponential multiplication of the virion particle after entering the host cells[6].

Due to lack of confirmed and validated treatments for COVID-19, health professionals are providing optimal supportive care such as oxygen and advanced respiratory support such as mechanical ventilation for critical COVID-19 patients. Scientists globally are still working to develop definitive treatments for COVID-19. The current pandemic of COVID-19 has definitely challenged the scientific community worldwide to develop therapeutic measures and vaccines to prevent COVID-19 infections. Mankind never had more urgent task than creating broad immunity for Corona virus infection within the shortest span of time possible. This urgent need of COVID-19 vaccine throughout the world has led to the development of various vaccines. Any COVID-19 vaccine that evokes the production of neutralizing antibodies in the individuals is the primary target of all the COVID-19 vaccination programs[7]. The first mass vaccination program had been started in early December 2020 [8].

Pfizer / BioNTech comirnaty vaccine, SII / Covishield and Astrazeneca / AZD1222, Janssen/Ad26.Cov2.S, Moderna COVID-19 (mRNA 1273) vaccine and Sinopharm COVID-19 vaccines are the leading vaccines listed for WHO

Emergency Use Listing (EUL) [8]. In India, three Covid-19 vaccines have been authorized for immunization to combat COVID-19 infection: Covaxin, developed and manufactured by Bharat Biotech; Covishield, developed by Oxford/ Astrazeneca and manufactured by Serum Institute of India and Sputnik V, developed by Gamaleya Research Institute of Epidemiology & Microbiology, Russia.

Covishield is a recombinant vaccine and is being manufactured using viral vector platform. A chimpanzee adenovirus-ChAdOx1 vector has been modified to carry the COVID-19 spike protein into the human cells[9]. Once the viral vector vaccine carrying the gene encoding S protein on the surface of SARS-CoV-2 is delivered inside the human cells, the inoculated gene is transcribed resulting in the synthesis of the S protein. This particular protein boosts the immune system of the individual by producing antibodies against specific S proteins.

The Covishield vaccination course consists of two separate doses of 0.5 ml each. The second dose needs to be administered between 4-6 weeks according to the latest factsheet of Serum Institute of India. The manufacturer of ChAdOx1 nCov-19 Corona virus vaccine, Serum Institute of India, documents the efficacy rate to be 81.3% [10].The actual effectiveness of these vaccines in terms of efficacy and control in the spread of the disease is still a subject of debate requiring further analysis, documentation and confirmation. The present study intends to analyze the antibody titres post 1st dose and post 2nd dose Covishield vaccination and to assess the safety and efficacy of ChAdOx1 nCov-19 (Recombinant) Covishield vaccine. In the present study, there will be an attempt to find out other common variables which might have an impact on performance in terms of efficacy, safety & immunogenicity of Covishield vaccine.

2. MATERIALS AND METHODS

2.1 Study Design

This was a hospital based Descriptive Study.

2.2 Subject Selection and Sample Collection

Serum samples of 215 subjects of different age groups and their demographic, lifestyle habits, Covid-19 history, comorbidity history and drug history were collected to assess the IgG seroprevelance post Covishield vaccine inoculation in the Department of Medicine, Teerthanker Mahaveer Hospital (TMH), Moradabad, Western UP, India. The participants of age 19 years and above who had taken the Covishield vaccine dose were enrolled as a study sample [10]. Subjects who were administered with anti SARS-CoV-2 monoclonal antibodies or convalescent plasma (passive immunization) were excluded from the study.

Two different samples were taken from the enrolled subjects on two occasions, details of which are as follows;

1st Sampling (Group I): After 4 weeks of 1st dose of ChAdOx1 nCoV-19(Recombinant) Covishield vaccination
2nd Sampling (Group II): After 4 weeks of 2nd dose of ChAdOx1 nCoV-19(Recombinant) Covishield vaccination

The following investigation was carried out in both the samples:

IgG Antibodies using commercially available Enzyme Linked Immunosorbent Assay (ELISA) kit (DIAPRO).

A coating of spike antigens and recombinant nucleocapsid which are specific to COVID-19 were coated on the microplates. The sample which is diluted was applied with the solid phase with an aim to capture IgG by the antigens. After this washing was done and then in the second incubation process polyclonal specific anti h IgG antibodies labelled with horse radish peroxidase (HRP) were used to detect the bound antibodies. Optical signal was generated due to the enzyme being captured on the solid phase which acted on the mixture (substrate/chromogen) was used for calculation of cut off value and interpretation of results[11].

Interpretation of test results[11]

- A cut-off value was decided and test results were calculated by using the following formula on the mean Optical density 450nm/620-630nm value of the Negative Control (NC):
- NC + 0.250 = Cut-Off (Co)
- In the follow-up of COVID-19 vaccination participants, following interpretation as indicated on manufacturer's test details were applied and interpreted.

• S/Co	• Interpretation
• < 0.9	• Negative
• 0.9 - 1.1	• Gray-zone
• > 1.1	• Positive

- A negative result value of less than 0.9 suggested IgGantibodies to COVID-19 were not developed in the subjects after the administration of Covishield vaccination
- A positive value of more than 1.1 signified developments of IgG antibodies after the administration of vaccine

2.3 Statistical Analysis

The data collected was tabulated and statistical calculations were done using SPSS version 23. Frequency distribution of variables was determined and presented in tabular and graphical form. Association of lifestyle habits, COVID-19 status and adverse effects post vaccination with seroprevalence was done by chi-square test. The p value < 0.05 was considered statistically significant.

3. RESULTS AND DISCUSSION

Table 1. Demographic characteristics of the subjects

Parameters	Mean + S.D	Minimum	Maximum
Age (years)	33.69 + 12.65	19	75
Height (cm)	164.8 + 11.69	141	190
Weight (kg)	66.59 + 12.32	39	105
BMI (kg/m^2)	24.44 + 3.58	16.71	35.91

Table 2. Frequency distribution of lifestyle habits, COVID-19 status & post vaccination side effects

Variables	Frequency (n)		Percentage	
	Yes	No	Yes	No
Tobaco intake	17	198	7.91	92.09
Alcohol intake	36	179	16.75	83.25
Comorbidity	25	190	11.63	88.37
Drug history	21	194	9.77	90.23
Supplement intake	39	176	18.12	81.88
Covid status [RT PCR+ve(Yes) & RT PCR -ve(No)]	23	192	10.70	89.3
Adverse effects (after 1st dose)	154	61	71.63	28.37
Anaphylactoid reactions	46	169	21.40	78.60

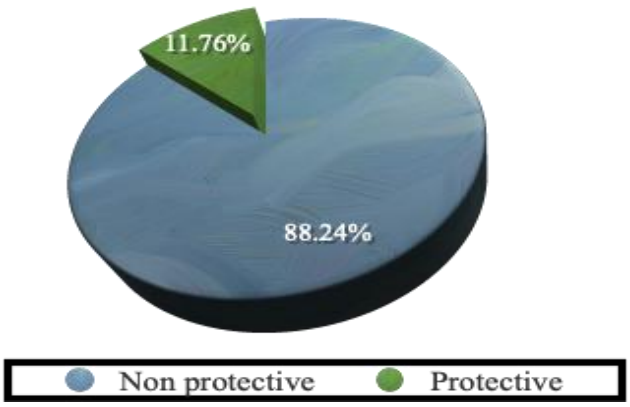

Fig. 1. Anti-COVID 19 IgG Seroprevalence status in tobacco Users after first shot

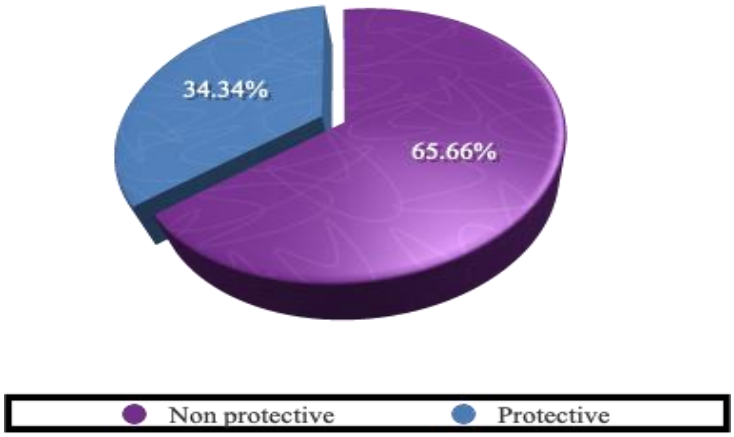

Fig. 2. Anti COVID19 IgG Status in Non Tobacco users after First Shot

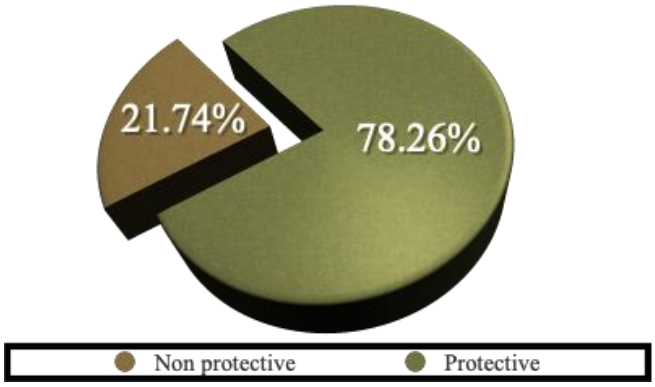

Fig. 3. Anti-COVID 19 Igg Seroprevalence for covid-19 positive after 1st shot

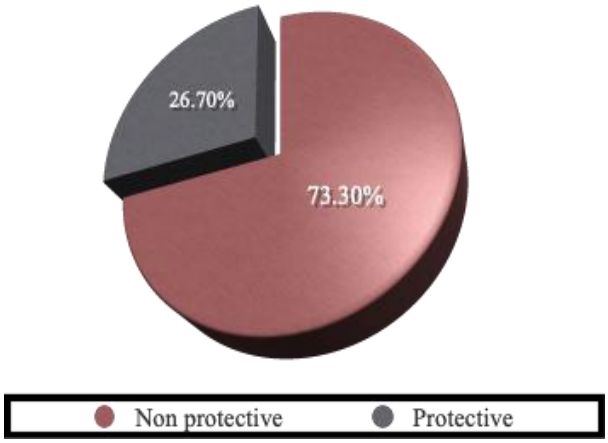

Fig. 4. Anti-COVID 19 IgG seroprevalence For Covid-19 negative after 1ST shot

Table 3. Seroprevalence for anti Covid-19 IgG antibody of subjects after 1st dose of Covishield vaccination

	Frequency(n)		Percentage	
	Non protective	**Protective**	**Non protective**	**Protective**
Immunogenicity (after I dose)	145	70	67.40	32.60

Table 4. Association of lifestyle habits, Covid-19 status & post vaccination side effects with IgG antibody titer after 1st dose of Covishield vaccination

Variables		Antibody titre after I dose		Percentage		Pearson Chi-Square Value	p-value
		Non protective	Protective	Non protective	Protective		
Tobacco intake	Yes	15	2	88.24	11.76	3.64	0.06
	No	130	68	65.66	34.34		
Alcohol intake	Yes	32	4	88.89	11.11	9.06	0.03
	No	113	66	63.13	36.87		
Comorbidity	Yes	17	8	68	32	0.004	1
	No	128	62	67.37	32.63		
Drug history	Yes	15	6	71.43	28.57	0.17	0.81
	No	130	64	70.65	29.35		
Supplement intake	Yes	29	10	74.36	25.64	1.04	0.35
	No	116	60	65.91	34.09		
Covid status [RT PCR +ve(Yes) & RT PCR -ve (No)]	Yes	5	18	21.74	78.26	24.50	0.00
	No	140	51	73.30	26.70		
Adverse effects	Yes	98	56	63.64	36.36	3.58	0.075
	No	47	14	77.05	22.95		
Anaphylactoid reactions	Yes	28	18	60.87	39.13	1.15	0.29
	No	117	52	69.23	30.77		

Table 5. Anthropometric measures of subjects enrolled after 2nd dose of Covishield vaccination

Parameters	Mean ± S.D	Minimum	Maximum
Age (years)	38.72 ± 15.45	19	75
Height (cm)	164.47 ± 9.03	141	182
Weight (kg)	65.80 ± 11.98	39	98
BMI (kg/m^2)	24.25 ± 3.52	16.71	32.74

Table 6. Frequency distribution of lifestyle habits, Covid status & post vaccination side effects of subjects enrolled after 2nd dose of Covishield vaccination

Variables	Frequency (n)		Percentage	
	Yes	No	Yes	No
Tobaco intake	5	96	5.00	95.00
Alcohol intake	15	86	14.90	85.10
Comorbidity	18	83	17.80	82.20
Drug history	14	87	13.9	86.10
Supplement intake	21	80	20.80	79.20
Covid status [RT PCR +ve (Yes) & RT PCR -ve (No)]	16		15.8	84.20
Adverse effects (after 1st dose)	74	27	73.3	26.70
Anaphylactoid reactions	20	81	19.8	80.20

Table 7. Seroprevalence of neutralizing IgG antibody in Group II subjects after 2nd dose of Covishield vaccination

	Frequency (n)		Percentage	
	Non protective	Protective	Non protective	Protective
Immunogenicity (after II dose)	62	39	61.4	38.6

Table 8. Association of lifestyle habits & Covid-19 status with IgG antibody titre after 2nd dose of Covishield

Variables		IgG Antibody titre after II dose		Percentage		Pearson Value	Chi-Square
		Non protective	Protective	Non protective	Protective		
Tobacco intake	Yes	4	1	80	20	1.06	0.40
	No	58	38	60.42	39.58		
Alcohol intake	Yes	11	4	73.33	26.67	1.06	0.40
	No	51	35	59.30	40.70		
Comorbidity	Yes	10	8	55.56	44.44	0.31	0.60
	No	52	31	62.65	37.35		
Drug history	Yes	10	4	71.43	28.57	0.70	0.56
	No	52	35	59.77	40.23		
Supplement intake	Yes	10	11	47.62	52.38	2.120	0.21
	No	52	28	65	35		
Covid status [RT PCR +ve (Yes)	Yes	4	12	25	75	1.26	0.36
& RT PCR -ve (No)]	No	58	27	63.24	31.76		

4. DISCUSSION

COVID-19, a zoonotic disease caused by Severe Acute respiratory Syndrome Coronovius-2 (SARS-Cov-2) has emerged as a worldwide infection and has been declared pandemic since March, 2020, by WHO[12]. This has brought about tremendous burden on the health care systems of not only the developing or the third world countries but also that of affluent counties of the world. Nonetheless, economic activities have been jeopardized to a great extent all over the world[13]. WHO has since then, emphasized on curtailing the progression of COVID-19 pandemic by advocating judicious use of the existing drugs, discovery and use of newer drugs and providing a definitive approach to eradicate the disease by vaccine development[14]. In order to retard the spread of COVID-19, WHO has proposed the acceleration in attainment of effective vaccines by researchers from various countries from all around the world by using varied technologies, both classical (protein based) as well as novel (mRNA based). Since then, various studies have been undergoing to ascertain the efficacy and safety of these vaccines. In India, one of the vaccines being exclusively used to combat future episodes of COVID-19 is being manufactured by Serum Institute of India, Pune under the trade name 'COVISHIELD' which is a live attenuated viral Vaccine after completing 3 phases of clinical trials with the aim to restrain and limit the spread of COVID-19[15].

In our institute, Teerthanker Mahaveer Hospital, Moradabad a vaccination drive of ChAdOx1 nCov-19 (Recombinant) Covishield vaccine was conducted after which the Serum level of neutralizing IgG antibodies (anti-spike + anti-nucleocapsid) after 1st and 2nd dose of vaccine was determined in the study sample, recruited as being the representative of population in this geographical area. Results and outcomes obtained from this study are as detailed further in this section.

Group I result and outcomes: As depicted in Table 1, 215 participants were récruited for the first dose of ChAdOx1 nCov-19 (Recombinant) Covishield Vaccination from 19-75 years (Mean ± S.D = 33.69 ±12.66 years), height and weight of all subjects were measured and BMI was calculated which ranged from 16.71 kg/m^2 to 35.91 kg/m^2 (Mean ±S.D = 24.44 ± 3.58 kg/m^2). Out of the total 215 subjects who received 1st dose of ChAdOx1 nCov-19 (Recombinant) Covishield Vaccine, 33% (n=71) were female and 66.98% (n=144) were male participants. After taking duly filled informed consent, each participants 'blood sample was drawn to test for the neutralizing IgG antibodies exactly after 28 days of 1st dose of vaccine.

Shown in Table 2, are various lifestyle predispositions like tobacco & alcohol intake, comorbidities, drugs and supplements intake in the recruited subjects for 1st dose of ChAdOx1 nCov-19 (Recombinant) Covishield vaccine (n=215). Previous COVID-19 status was confirmed and recorded in which 10.3% (n=23) of the enrolled participants were having a previous history of suffering and successfully recovering from COVID-19. It was also seen that 71. 63% (n=154) had trivial or minor adverse effects, (after 1st dose) and 21.4% (n=46) had some anaphylactoid reactions which were easily managed through medical intervention and no catastrophe or mortality was recorded. As highlighted in table 3, immunogenicity was checked after 1st dose of vaccination. After testing serologically for neutralizing IgG antibodies, the titre was found to be below the threshold level of 1.1 in 67.40% of the recruitees in the study group, whereas 32.60% (n=70) were found to be in the seroprotective range (i.e IgG titre > 1.1) [irrespective of Covid status]. Lowest value recorded for serum IgG neutralizing antibodies was 0.069 and highest was 8.40. Comparatively higher titres were encountered in subjects with COVID-19 positive history. But the titres couldn't be compared with the duration, stage, or severity of the disease. This could be labelled as early immunogenic response seen as high IgG titre just after taking mere 1st dose of vaccine.

Further, on contemplating over all the data depicted in table 2, it was seen that out of 215 participants who had received the 1st dose of Covishield vaccine, 23 participants who had positive covid-19 status 78.26% (n=18) were showing seroconversion for neutralizing IgG antibodies in the protective range (i.e ≥1.1) whereas, in participants having negative COVID-19 history, seroprotection by neutralizing IgG antibodies was seen in only 26.70% of the participants, clearly pointing towards the role of previous positive COVID-19 status as a possible factor responsible for modulating the immune response in those patients. Thus, heralding the fact that a previous encounter with Corona virus might have stimulated the host's immune response by varied mechanisms. On the first

entry, virion particle surface proteins like S, N, and others might have acted as haptens or antigens and must have evoked primary immune response by stimulating the memory B and T cells or by stimulating class switching of antibodies. Possibly, it can be inferred from this that for previous COVID-19 sufferers, the 1st dose of ChAdOx1 nCov-19 (Recombinant) Covishield Vaccine might act as a booster dose and suffice for substantial immune response even by a single shot of vaccine[16].

In table 4, further depiction of influence of lifestyle factors on immune response is seen. Out of the 215 participants in Group I, 17 individuals were consuming tobacco either in the chewable or inhalational form. 88% (n=15) of tobacco users were in seronegative/non-protective range after 1st dose of ChAdOx1 nCov-19 (Recombinant) Covishield Vaccine indicating that tobacco might hinder immune responses of the body possibly by generation of oxygen derived free radicals, build up of metabolic toxins, etc. This might also interfere with the detoxification process, by interfering with the functions of mixed function oxidases, hydroxylase system or cytochrome P450 enzyme system of the cells[17].

On the other hand, in non tobacco users (n=198), 34.34% were found to be in the seroprotective range, reinforcing the negative influence of tobacco usage in eliciting immune response. Apparent difference was found in seroprevalence of IgG neutralizing antibodies with alcohol consumption but, no firm grounds could be established regarding the effect of alcohol consumption on immune response of the participants[18]. Coexisting morbidities, although numerically had shown to negatively influence the generation of protective secondary immune response, but the results obtained are statistically not significant ($p>0.05$). Further, drug intake and supplement intake have shown apparently more individuals to be in serologically non protective zone but, statistically the results obtained were not significant, ($p= 0.81$) and ($p=0.35$) respectively. This further demands the determination of the nature of the drug and/or supplement consumed by the participants.

In table 4, COVID-19 status has proved to be a strong predictor of increased future immune response. 78.26% (n=18) were seroprotective with the production of significant amount of IgG antibodies as compared to Covid non-sufferers where 26.70% (n=5) were in seroprotective range ($p=.001$). The mechanisms may be manifold and far more complex than assumed, as described earlier in this section.

Out of 215 participants perceiving adverse effects of any kind like fever, malaise, myalgia, headache, etc were 154, out of which 36.36% (n=56) were found to have high IgG antibody titre in comparison to participants those not experiencing any adverse/side effects were 61 participants, of which only 22.9% (n=14) were in seroprotective range. This possibly indicates that occurrence of minor transient adverse effects are nothing but the indication that the immune response is being stimulated and active immune response is coming into play to build up of long term immune response[19].

As shown in table 4, Anaphylactoid reactions were seen in 46 candidates (21.40%). Out of whom, 39.13% (n=18) had protective IgG antibody titre and those not suffering from any kind of anaphylactoid reactions, 31% (n=52) were in the protective range[20]. Thus, statistically anaphylactoid reactions did not seem to play any role in building up of protective antibody titre of immune response ($p=0.29$).

Group II result and outcomes: Study participants having received both the shots of ChAdOx1 nCov-19 (Recombinant) Covishield Vaccine (n=101) were considered to have completed the entire vaccination regimen and were grouped in the Group II. Table 5 depicts the demographic profile of the individuals included in the 2nd group which are almost comparable to that of the 1st group except that the compliance of male participants 61.4% (n=62) was better for 2nd dose of ChAdOx1 nCov-19 (Recombinant) Covishield vaccine which is pointing towards some socio-demographic factor in this geographical area in particular, resulting in hesitancy or abstinence for 2nd dose of vaccine amongst female counterparts. This emphasizes the need for spreading more awareness among the female participants for completion of vaccination protocol.

Participants those complying for the inoculation of 2nd shot of ChAdOx1 nCov-19 (Recombinant) Covishield vaccine were also found to have difference in IgG seroprevalence i.e, immunogenicity in terms of COVID-19 history. Out of the total 101 participants who were compliant to take 1st as well 2nd doses, 38.6% participants (n=39) were found to be in the seroprotective range after 28 days of 2nd shot of

vaccine. 16 participants from 2nd group were having the history of positivity for COVID-19 history out of which 75% (n=12) were having seroprotective range of IgG antibodies. Form the 2nd group, 85 participants who had never suffered from COVID-19, about 32% (n=27) participants were found to have protective neutralizing IgG antibodies.

In accordance to the findings obtained from group I and group II outcomes, it can be inferred that in future the duration and frequency of the booster doses can be deduced from the statistical results thus, obtained.

5. CONCLUSIONS

Thus, in this study the mainstay of study areas were the assessment of efficacy and safety ChAdOx1 nCoV-19(Recombinant) Covishield vaccine. Efficacy of the vaccination may be deduced from the fact that there is a significant increase of IgG antibodies titre (Neutralizing Antibodies) against S protein and N protein both after 1st dose and 2nd dose of vaccination (8 weeks). However, earlier increase in protective IgG antibody titre was seen in COVID-19 positive patients indicating that in such individuals a single dose might suffice and act as a booster as the active immunity has already been acquired by naturally acquired corona virus/incidental infection and that, it has already evoked the activation of memory B and T cells which on receiving the 2nd dose generates secondary immune response.

5.1 Future Implications

- Based on our research findings, it can be inferred that after an episode of COVID-19, single dose of ChAdOx1 nCov-19 (Recombinant) Covishield Vaccine may suffice for seroprotection by IgG neutralizing antibodies titre obtained. This would be especially of utmost importance in case of current scenario of scarce and limited resources hinder to cater to the needs of huge population.
- Neutralizing antibodies in the form of monoclonal bodies (which are presently being tried in western world), administration in active Covid-19 cases may be advocated in patients, especially in cases of borderline oxygen saturation to minimize the chances of hospitalization or at least in part to reduce the duration of stay in hospital. Thus, saving a lot of resources like manpower, hospital expenses etc, and minimizing the chances of nosocomial infections simultaneously.
- Trials for monoclonal IgG neutralizing antibodies can also be done for contacts and frontline workers/healthcare professionals as prophylaxis to limit the transmission of viruses among the caretakers of COVID-19 patients.
- As evidenced by our study findings, lifestyle modifications may be emphasized to the patients to get better immune response post vaccination regimen.
- Another mainstay application of the research findings of this study may at least in part, help to decide the duration and frequency of booster dose(s) of ChAdOx1 nCov-19 (Recombinant) Covishield Vaccine in future.

5.2 Limitations of the study

- Findings and outcomes of the present study may be confirmed on a larger size to increase the generability and external validation.
- COVID-19 infected participants infected with different strains might elicit different degree and nature of immune response post vaccination. So, a molecular analysis of the Corona virus strains may be considered as an adjuvant piece of information in determining the immunogenicity of ChAdOx1 nCov-19 (Recombinant) Covishield vaccine.
- Study on adolescents and children which couldn't be made possible in this study needs to be done for wholesome assessment across all age groups.
- Segregation of study groups on the basis of type of comorbidities, drugs and supplements needs to be done for enhancing the capability of this study across varied medical scenario.
- Long follow up couldn't be done in this study which needs to be done for further validation of research outcomes.

SUMMARY

Various scientists and researchers across different regions of the world have advocated the administration of vaccination to permanently get rid of the pandemic caused by SARS-CoV2. Inspired by the current evidences, an attempt has been made in the study to assess the

immunogenicity, safety and variables association with current proposed ChAdOx1 nCov-19 (Recombinant) Covishield vaccine regimen in India. This study has been done specifically on a cohort of North Indian population of Western UP reporting to our tertiary care hospital, who had consented in writing for their immunoglobulin levels in blood to be assayed quantitatively. Results after dosage 1 (post 28 days) and after dosage 2 (post 28 days of dose I) were analyzed extensively and at large the vaccine has been found to be effective, safe, well tolerated and protective in statistically significant number of participants. Furthermore, it has also been deduced from the findings obtained that the constraints or burden on the health care systems might be reduced at least in Covid positive patients (i.e., RT PCR positive-6 months prior) by administering only a single dose of vaccine, as single dose was seen to be sufficient to generate appreciable immune response in these category of participants.

Similar findings may be extrapolated on larger population to increase the generalizability of the study outcomes by extending a similar kind of study on children and adolescents. This approach might increase the accountability and applicability of the findings of the study across all strata of age groups of Indian population.

DISCLAIMER

Authors have declared that the products used for this research are commonly and predominantly used in our area of research. We do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by the institute.

CONSENT

Enrolled participants had signed a duly filled consent form stating the sampling and usage of clinical data.

ETHICAL APPROVAL

The present study was conducted under the guidelines laid down by given Institutional Ethical Committee.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ou X, Liu Y, Lei X, Li P, Mi D, Ren L et al.Characterization of spike glycoprotein of SARS-CoV-2 on virus entry and its immune cross-reactivity with SARS-CoV. Nat Commun. 2020;11(1):1620.
2. Worldometer. Covid-19 Corona virus Pandemic[Internet].2004[Cited 2021 June 8].
Available:https://www.worldometers.info/coronavirus/
3. Xu Z, Shi L, Wang Y, et al. Pathological findings of COVID-19 associated with acute respiratory distress syndrome. Lancet Respir Med. 2020;8:420–2.
4. Cascella M, Rajnik M, Cuomo A, et al., Features, evaluation and treatment coronavirus(COVID-19). Stat pearls [internet]. Treasure Island (FL): Stat Pearls Publishing; 2020.
5. Bosch BJ, van der Zee R, de Haan CA, et al. The coronavirus spike protein is a class I virus fusion protein: structural and functional characterization of the fusion core complex. J Virol 2003;77:8801– 11.
6. Carter JB, Saunders VA.Virology: Principles and Applications.2nd ed.New Jersey:Wiley;2007. Virology: Principles and Applications; 382 p.
7. Kaur SP, Gupta V. COVID-19 Vaccine: A comprehensive status report.Virus Res. 2020;288:198114.
8. World Health Organization.Coronavirus disease (COVID-19): Vaccines [Internet]. WHO; 2020 [cited 2021 June 11].
Available: https://www.who.int/news-room/q-a-detail/coronavirus-disease-(covid-19)-vaccines
9. Voysey M, Clemens SA, Madhi SA, Weckx LY, Folegatti PM, Aley PK 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.2020;397(10269): 99-111.

10. Serum Institute of India. Fact Sheet for Vaccine Recipient approved for restricted use in Emergency situation of ChAdOx1 nCoV-19 Corona Virus Vaccine (Recombinant)[Internet]. Pune: SII; 2021 [cited 2021 June 11].
Available: https://www.seruminstitute.com/pdf/covishield_fact_sheet.pdf.
11. COVID-19 IgG [package insert].Milano: DIA. PRO Diagnostic Bioprobes S.r.l.;2020
12. Mackenzie J, Smith D. COVID-19: a novel zoonotic disease caused by a coronavirus from China: what we know and what we don't. Microbiol Aust. 2020;41(1):45.
13. COVID-19 significantly impacts health services for noncommunicable diseases [Internet]. Who.int;2021 [cited 16 June 2021].
Available:https://www.who.int/news/item/01-06-2020-covid-19-significantly-impacts-health-services-for-noncommunicable-diseases.
14. COVID-19: What we know about the future of COVID-19 vaccines [Internet]. Who.int;2021 [cited 16 June 2021].
Available:https://www.who.int/china/news/feature-stories/detail/covid-19-what-we-know-about-the-future-covid-19-vaccines.
15. Serum Institute of India. News [Internet]. Seruminstitute.com; 2021 [cited 16 June 2021].
Available:https://www.seruminstitute.com/news.php.
16. Khalaj-Hedayati A. Protective Immunity against SARS Subunit Vaccine Candidates Based on Spike Protein: Lessons for Coronavirus Vaccine Development. J Immunol Res. 2020;2020:1-11.
17. Strzelak A, Ratajczak A, Adamiec A, Feleszko W. Tobacco Smoke Induces and Alters Immune Responses in the Lung Triggering Inflammation, Allergy, Asthma and Other Lung Diseases: A Mechanistic Review.Int. J. Environ. Res. Public Health. 2018;15(5):1033.
18. Kadkhoda K. COVID -19: are neutralizing antibodies neutralizing enough?. Transfusion. 2020;60(7):1602-3.
19. Sah R, Shrestha S, Mehta R, Sah S, Rabaan A, Dhama K et al. AZD1222 (Covishield) vaccination for COVID-19: Experiences, challenges, and solutions in Nepal. Travel Med Infect Dis. 2021;40:101989.
20. Turner P, Ansotegui I, Campbell D, Cardona V, Ebisawa M, El-Gamal Y et al. COVID-19 vaccine-associated anaphylaxis: A statement of the World Allergy Organization Anaphylaxis Committee. World Allergy Organ J. 2021;14(2):100517.

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