

Understanding and side effects of COVID-19 vaccines among Rajshahi university students: A cross-sectional study

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Abstract

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. Vaccination is a way to prevent any pandemic disease like COVID-19. So that several vaccines have been approved by different countries to control the COVID-19 outbreak. The main aim of the study was to find out the understanding of vaccination for COVID-19 and its possible side effects and the co-morbidity status of the students of the University of Rajshahi, Bangladesh. It was a cross-sectional study carried out from January 2022 to April 2022 at different residential Halls of the Rajshahi University Campus and some student mess next to the university near Binodpur, Meherchandi and Kazla area. The study was done among 507 students. Where 289 were male and 218 were female. The minimum age of the study population was 18 years. Most of the students 245 (48.32%) were from the science group, 185 (36.49%) from the arts group and 77 (15.19%) from the BBA faculty. It was found that 114 (22.49%) were infected with COVID-19 among 507 students, and 492 (97.04%) got both two doses of the vaccine. The majority of 370 (72.98%) of the study population received Sinopharm (Verocell) vaccine, 98 (19.33%) Moderna, 19 (3.75%) Pfizer and 20 (3.94%) Astra-Zeneca vaccines. In this study, 130 (25.64%) were afraid to take the vaccine or had vaccine hesitancy. Only 25 (4.93%) had co-morbidity in the past, and asthma is the most common among them. 160 (31.55%) faced some side effects after being vaccinated with 1st dose whereas 125 (25.41%) of the total population faced some side effects after getting their 2nd dose. The descending order of the most common side effects was fever > muscle pain > swelling and pain at the injection site > headache > joint pain. Half of the students 241 (47.54%) believe vaccination could control the COVID-19 outbreak. Only 21.10% (n=107) of students didn't think vaccination could prevent COVID-19, and 159 (31.36%) did not know about the vaccination result. 197 (38.86%) of the total population faced COVID-19 like symptoms, although they were vaccinated. These data can be used to conduct future research on COVID-19 in the study region.

Keywords: COVID-19; SARS-CoV-2; Vaccine; Side effects; Students; Vaccine hesitancy; Rajshahi.

Introduction

Infectious disease outbreaks have recently had a substantial influence on the lives of millions of people [1,2]. At the end of 2019, just before the most fantastic Chinese festival, one such viral disease occurred in China [3]. It has been declared as COVID-19 disease and believed that the origin of COVID-19 was a shellfish retail market in Hunan that also offers a variety of wild animals, such as snakes, birds, bats, rabbits, and frogs. SARS-CoV-2 is a recombinant virus between the bat Coronavirus and a Coronavirus of an unknown source, which is suspected to be the pangolin, according to the sequencing analysis of several species of Coronavirus [4]. The World Health Organization (WHO) declared the COVID-19 pandemic on March 11, 2020, after it was the first discovered in Wuhan, China [5-7]. On March 8, 2020, the first three cases of COVID-19 were discovered in Dhaka, Bangladesh [8]. To avoid the pandemic, people have been hoping for the discovery of an effective COVID-19 vaccine. Several vaccines have already been rollout [9]. At the end of November 2020, two American pharmaceutical companies revealed the development of two COVID-19 vaccines with 90%–95% efficacy [10,11]. The vaccine campaign's success, however, is dependent on its effectiveness as well as community acceptance [12].

Two doses of intramuscular injections of the BNT162b2 (Pfizer) vaccine, each containing 30 µg and 0.3 ml, are given three weeks apart [13]. According to a significant population-based study, allergic reactions to vaccines usually occur at a rate of 1.31 without any fatalities [14]. A recent survey on the self-reported side effects of the mRNA-1273 (Moderna) vaccine among Health Care Workers revealed a wide range of symptoms, with most of them being non-life threatening, and high acceptability of the vaccine among healthcare professional [15]. On the other hand, Tenderness, Fatigue and headache were the most usually reported systemic reactions were reported in the ChAdOx1 nCoV-19 (AstraZeneca). Muscle aches and feeling feverish were also the mild or nonfatal side effects of ChAdOx1 nCoV-19 (AstraZeneca), which is a chimpanzee adenovirus-vectored Vaccine [16].

The Asian-origin vaccine was developed jointly by the China national pharmaceutical group corporation, Beijing Institute of Biological Products, Wuhan Institute of Biological Product, and named BBIBP-CorV (Sinopharm/Verocell). BBIBP-CorV is an inactivated vaccine (the killed form of pathogens incapable of replication or infection [17]). Mild to severe fever and cough were the most prevalent systemic effects reported after each vaccine among people younger than 18 years (<18y). But the intensity of fever was lower after the second and third doses compared with the first dose. Cough was the second most prevalent systematic response, and during follow-up, no evidence of upper respiratory tract infection was seen [18]. Bangladesh's government began a vaccination program by giving the Oxford AstraZeneca vaccine to the general public on January 27, 2021, and other vaccines like Moderna, Pfizer, and Sinopharm have also been launched (free of cost) for the people of Bangladesh [19,20]. However, similar to many other countries, the government focused vaccination efforts on a small group of individuals (frontline medical staff, government employees, private officials working on pandemic issues, and people aged 40 and higher), with the expectation that the remaining portion of the population would be immunized later [20]. According to Worldometer, in Bangladesh the total number of reported COVID-19 cases was approximately 1,948,798, with 29,100 mortalities linked to the disease and recovery of 1,855,249 individuals as of March 10, 2022 [21].

However, the physiology of every single person is different from others, so the side effects of vaccines may vary from person to person. The primary objective of this study was to determine the status and perceptions regarding the available COVID-19 vaccines in Bangladesh, vaccine hesitancy, number of vaccine doses taken, and possible side effects of the accepted vaccine, among the students of the University of Rajshahi, Bangladesh. Keeping these views, a cross-sectional study was done on the understanding and side effects of COVID-19 vaccines among Rajshahi University students.

Case Study

It was a cross-sectional study carried out from January 2022 to April 2022 at different residential halls of Rajshahi University and some private messes next to the University near Binodpur and Meherchandi, Kajla area. We also collected opinions from participants by visiting various departments under different faculties and face-to-face interviews. All of the participants were Students of RU. A total of 507 students were enrolled in this study. The participants were selected based on several conditions, such as being a student at Rajshahi University, over 18, and willingly agreeing to join in interviews. To collect the primary data (socio-demographic data), a meticulously constructed questionnaire was designed and circulated to the students by a trained interviewer. Those data are related to their age, gender, Department, Year/session, address, BMI, etc. The data were input and analyzed with the SPSS statistical software version 26. Summary statistics were computed. A student t-test was done to analyze some factors between the two groups. All statistical analyses were significant at 5% ($P < 0.05$). The summarized data were presented as tables and graphs with interpretation Microsoft Excel 2019.

Ethical approval: Written permission was taken in the questionnaire form from the participant students. The examination committee of the Department of Zoology, University of Rajshahi, Bangladesh, also approved the research proposal.

Results and Discussion

In this study, the total number of respondents was 507. The number of male individuals was 289 (57%) and the total number of females was 218 (43%). The majority, i.e., 216 (74.75%) of the male individuals, were in the age group of 23-27 years and 73 (25.25%) were in the age group of 18-22 years. Where in the case of females, 143 (65.60%) of the female individuals were in the age group of 23-27 years and 75 (34.40%) were in the age group of 18-22 years. The average age of males was 23.21 and the average of females was 22.87 (Table 1). The significance level was $p = 0.021$ ($P < 0.05$) for the age of the male and female students. The majority of the students ($n = 421$, 83.04%) were normal body weight ($BMI \leq 25$), 39 (7.69%) were overweight ($BMI \leq 29$), 35 (6.9%) were underweight ($BMI \leq 18$), and lastly only 12 (2.36%) students were obese ($BMI \geq 29$). The average BMI was 21.99 ($P < 0.05$) (Table 1).

It was found that most of the students ($n = 245$, 48.32%) were from the science group, 185 (36.49%) from the Arts and 77 (15.19%) of the total population from the BBA faculty (Table 1). In this study, most of the respondents ($n = 167$, 32.93%) were 4th-year students, 137 (27.02%) were graduates and followed by 110 (21.70%) from 3rd year, 65 (12.82%) from 2nd year, and only 28 (5.52%) from 1st-year students.

Most of the students (n=377, 74.36%) of this study population were resident students of RU, 121 (23.87%) students were living in Mess located next to the campus, and only 9 (1.77%) were staying at home (Table 1).

Table 1: Distribution of study population according to socio-demographic variables (n=507).

Variables		n	Percentages (%)	
Gender	Male	289	57	
	Female	218	43	
Age	Male	18-22	73	25.25
		23-27	216	74.75
	Female	18-22	75	34.40
		23-27	143	65.60
BMI	Underweight	<=18	35	6.9
	Normal	<=25	421	83.04
	Overweight	<=29	35	7.69
	Obesity	>=29	12	2.36
Faculty	Science		245	48.32
	Arts		185	36.49
	BBA		77	15.19
Year/Semester	1 st		28	5.52
	2 nd		65	12.82
	3 rd		110	21.70
	4 th		167	32.93
	Graduate/MS		137	27.02
Address	Hall		377	74.36
	Mess		121	23.87
	Home		9	1.77

In this study, we found that 393 (77.51%) of the study population had never been infected with COVID-19 whether 114 (22.49%) had been infected with COVID-19 before (Table 2). The total population has been vaccinated (at least a single dose). 492 (97.04%) have both vaccine doses, and only 15 (2.95%) have only a single shot of COVID-19 vaccine. It is found that the majority of 370 (72.98%) of the study population have received Sinopharm (Verocell) vaccine, 98 (19.33%) Moderna and 19 (3.75%), 20 (3.94%) have got Pfizer and AstraZeneca respectively. Most of the students in the study population 377 (74.35%), weren't afraid of vaccination and have taken the vaccine without hesitancy, while 130 (25.64%) were afraid of vaccination (Table 2). It is also noted that most of the students, 482 (95.07%) of the total study population, stated that they had no co-morbidity before getting the vaccine, and only 25 (4.93%) had co-morbidity in the past. This study also showed that among 25 individuals who had co-morbidity before getting the vaccine, 4% had high blood pressure, 48% were affected with asthma, 4% had liver disease, 8% had a heart condition, and 36% were smokers and had a smoking-related issue (Table 2).

The present study found that there was a time gap between the two groups to get doses of the vaccine. Under the 1st group, some people got their 2nd dose within 30 days of getting the 1st dose, and another group who got their 2nd dose more than 30 days later from the date of obtaining the 1st dose. It is shown that there were 374 (76.02%) individuals in the 1st group and 118 (23.98%) in the 2nd (n=492). This study showed that the majority of the students 241 (47.54%) thought vaccination could control the COVID-19 outbreak. Only 21.10% (n=107) of student doesn't believe that vaccination can prevent COVID-19, and 159 (31.36%) have no idea about the result of vaccination. This investigation found that 197 (38.86%) of the total population faced COVID-19 like symptoms though they were vaccinated, and 310 (61.14%) of the people haven't faced any COVID-19 like symptoms after getting the vaccine (Table 2).

Table 2: Distribution of the study population according to records of COVID-19 infection and taken vaccines (n= 507).

Variables	n	Percentages (%)	
Previous records of COVID-19 infection	Yes	114	22.49
	No	393	77.51
Vaccinated	Yes	507	100
	No	0	0.00
Doses of vaccine	1 dose	15	2.95
	2 doses	492	97.04
Taken vaccine brand	Pfizer	19	3.75
	Moderna	98	19.33
	AstraZeneca	20	3.94
	Sinopharm	370	72.98
Vaccine hesitancy	Yes	130	25.64
	No	377	74.35
Co-morbidity	No	482	95.07
	Yes	25	4.93
	High Blood Pressure	1	4
	Asthma	12	48
	Liver Disease	1	4
	Heart Condition	8	8
	Smoking related issues	9	36
The gap between the two doses	30 days	374	76.02
	>30 days	118	23.98
Opinion/trust on vaccination	Yes	241	47.54
	No	107	21.10
	Don't know/not sure	159	31.36
Re-symptoms of COVID-19 after vaccination	Yes	197	38.86
	No	310	61.14

The present study showed that most of the students, 347 (68.45%) of the study population, weren't face any side effects after getting the first dose of the vaccine, but 160 (31.55%) met some side effects after being vaccinated with the first dose (Table 3). The present study found that each vaccine brand showed few side effects in the study population. In the present study, we found that in the percentage of students who got the Pfizer vaccine (n=19), 5 (26.31%) faced few side effects, but 14 (73.69%) didn't face any side effects after the first dose. In the case of the number of students who got Moderna (n=98) as the first dose

of vaccine, 54 (55.10%) faced few side effects, but the other 44 (44.90%) weren't met any side effects. Also, among students who got AstraZeneca (n=20) as the first dose, 16 (80%) faced some side effects, but the other 4 (20%) didn't face any possible side effects. And students who got Sinopharm/Verocell as the first dose (n=370) among them, 85 (22.97%) people faced some side effects, but the majority, 285 (77.03%), weren't faced any side effects (Table 3). In this study, we found that the maximum number of students mainly faced only one possible side effect; among those students, 76 (47.5%) faced one side effect after getting the first dose of the vaccine (n=160). 46 (28.75%) faced two side effects, 18 (11.25%) faced three side effects, 11 (6.88%) faced four side effects, and only 9 (5.63%) students faced five or more than five side effects after the first dose of vaccine (Table 3).

In the present study, we found that 492 students got the second dose vaccine because 25 persons weren't getting the second dose. So, it was found that 367 (74.59%) of 492 individuals didn't face any side effects from the second dose of the vaccine, but 125 (25.41%) of the total population faced some side effects after getting the second shot (Table 3). This study also showed that every vaccine brand showed few side effects in the study population. Percentage of people who got the Pfizer vaccine (n=19), 7 (36.84%) faced few side effects, but 12 (63.16%) didn't face any side effects after the second dose. In the case of the number of students who got the Moderna (n=95) as the second dose of vaccine, 34(35.79%) people faced few side effects, but the other 61 (64.21%) didn't face any side effects. Also, of students who got AstraZeneca (n=16) as the second dose, 11 (68.75%) faced some side effects, but the other 5(31.25%) didn't face any possible side effects. Of individuals who got Sinopharm as the second dose (n=362) among them, 73 (20.17%) people faced some side effects, but the majority, 289 (79.83%), didn't face any side effects (Table 3).

In this study, we found that the maximum number of students mainly faced only one possible side effect; among those students, 73 (58.4%) met side effects after getting the second dose of the vaccine (n=125). 32 (25.6%) faced two side effects, 11 (8.8%) faced three side effects, 5 (4%) faced four side effects, and only 4 (3.2%) students faced five or more than five side effects after the second dose of vaccine. This study showed that students who got the first dose and the second dose met some common side effects each time. The following tables will offer the most common and frequent side effects and the number of people facing these complications (Table 3).

Table 3: Distribution of study population according to vaccine side effects (SE) for single or both doses.

Variables		n	Percentages (%)	
Side effects after the first dose	Yes	160	31.55	
	No	347	68.45	
Side effects for specific vaccine brand (the first dose)	Pfizer (n=19)	Yes	5	26.31
		No	14	73.69
	Moderna (n=98)	Yes	54	55.10
		No	44	44.90
	AstraZeneca (n=20)	Yes	16	80
		No	4	20
	Sinopharm (n=370)	Yes	85	22.97
		No	285	77.03

Side effects (SE) after the first dose based on the number of side effects (n=160)	Single SE		76	47
	Two SE		46	29
	Three SE		18	11
	Four SE		11	7
	>= Five SE		9	6
Side effects after the second dose (n=492)	Yes		125	25.41
	No		367	74.59
Side effects for specific vaccine brand (the second Dose)	Pfizer (n=19)	Yes	7	36.84
		No	12	63.16
	Moderna (n=95)	Yes	34	35.79
		No	61	64.21
	AstraZeneca (n=16)	Yes	11	68.75
		No	5	31.25
	Sinopharm (n=362)	Yes	73	20.17
		No	289	79.83
Side effects after the second dose based on the number of side effects (n=125)	Single SE		73	58
	Two SE		32	26
	Three SE		11	9
	Four SE		5	4
	>= Five SE		4	3

We tried to collect comments about the ten most frequent and adverse effects, which other researchers found to be more common in their papers [16,18,26]. But in this research project, most respondents didn't face more than five side effects after both doses. So, we select the most common and frequent side effects among students and have tried to make a comparison of those side effects. In this study, it is evident that fever was the most common for both the first and the second doses of the vaccine (Table 4). One hundred thirty-one students were feeling feverish (low or moderate fever) after the first dose, and for the second dose, 87 students felt feverish. Muscle pain is the second most common side effect for both doses. In the case of the first dose, 99 students, and after the second dose, 60 students had muscle pain. It was also found that swelling and pain on the injection site was third frequent complication. For both two doses, 33 students faced this side effect. Headache was the fourth most common side effect, and 31 after the first dose and 14 after the second dose had a low or moderate headache. And Joint pain is the least common side effect among the five common side effects for both the first and the second doses. Eighteen students after the first dose and 11 after the second dose feel slight joint pain in their bodies (Table 4).

Table 4: Most frequent side effects after the first and the second dose of vaccination and for specific vaccines.

Side effects	Vaccine Brands	After 1 st dose		After 2 nd dose	
		n	No. of students	n	No. of students
Fever	Pfizer	131	6	87	4
	Moderna		55		23
	AstraZeneca		14		6
	Sinopharm		56		54
Muscle Pain	Pfizer	99	6	60	0
	Moderna		31		25
	AstraZeneca		8		4
	Sinopharm		45		31

Joint Pain	Pfizer	18	0	11	0
	Moderna		5		3
	AstraZeneca		1		1
	Sinopharm		12		7
Headache	Pfizer	31	1	14	1
	Moderna		13		6
	AstraZeneca		5		1
	Sinopharm		12		6
Swelling and pain at the injection site	Pfizer	33	2	33	1
	Moderna		11		9
	AstraZeneca		3		4
	Sinopharm		17		19

COVID-19 is a global pandemic since the end of 2019. Various vaccines were invented to combat with COVID-19. But those vaccines tend to cause mild to moderate side effects among people. However vaccination plays a vital role in preventing the spreading of all infectious diseases, but the success rate of a vaccine depends on various factors. People's acceptance and the least adverse side effects are the primary criteria for assessing a vaccine's efficacy. The present study was designed to investigate the concept of vaccination, the side effects of taking vaccines, and students' trust in vaccination as a weapon against COVID-19 disease among Rajshahi University students.

In this study, there were two age groups for both male and female students. (18-22 and 23-27) and all students of the study population have been vaccinated. 97.04% of students got two vaccine doses; the rest had to get a single dose. Our investigation results indicate that this vaccination's potential side effects are negligible. 68.45% of the participants reported no symptoms after the first shot of vaccination, while 31.55% had minor symptoms for the first vaccination. For the second dose, 74.59% of students did not report symptoms; however, the majority only had minor, expected side effects. There were no serious adverse effects or hospitalizations necessary.

This study showed that 114 (22.49%) students were infected with COVID-19. 130 (25.64%) students had hesitancy against vaccines, and they feared vaccination because no stable and 100% effective and tested vaccine was relatively unavailable then. A recent study showed that one student out of 10 (13.9%) offers a low intention to vaccinate (vaccine hesitancy) [22]. Another study showed that vaccine hesitancy was found among 113 medical students (10.6%) [23].

This study found that people who got the Pfizer vaccine (n=19) faced some side effects for both doses. 26.31% of students who got the Pfizer vaccine met some mild side effects after having their first dose, while 36.84% faced side effects after the second dose (Table 3). A recent study in Saudi residents revealed that of people who got Pfizer for both doses, 237 (52%) individuals faced the presence of the side effects after receiving their first dose of the vaccine, 124 (27.3%) after receiving the second dose [24].

People who got Moderna vaccine among them (55.10%) had moderate side effects for first dose, and after second dose (35.79%) faced some mild side effects (Table 4). According to Baden *et al.*, 2021 [25] this

mRNA vaccine has an unprecedented 94.1% efficacy in preventing COVID-19 infections among adult participants.

This study also showed that among students who got AstraZeneca (n=20), a majority of them faced some side effects for both the first and the second doses. After the first dose, 80% of the total population who got AstraZeneca faced common, non-life-threatening complications. But after the second dose, this number decreased to 68.75% (Table 3). A recent study conducted by group of researchers [16] reported that tenderness, fatigue, and headache were AstraZeneca's most usual side effects. Muscle aches and feeling feverish are also mild or nonfatal side effects of ChAdOx1 nCoV-19 (AstraZeneca) [16]. Also, one study [26] stated that 510 (75.8%) of healthcare workers who took the vaccine reported injection site symptoms of pain (65.48%); among them, 60% experienced injection site symptoms within 12 hours of vaccination and also revealed that 93.3% of respondents had no co-morbidity, which is nearer to our study population of 95.07% who had the absence of co-morbidity before taking a vaccine [26].

Sinopharm, the Asian-origin vaccine taken among students, showed fewer side effects than others (compared to the number of doses taken). Three hundred seventy students took this vaccine both as the first and the second dose, but only 22.97% of them faced some side effects after the first dose, but after the second dose, the percentage decreased to 20.17% (Table 3). According to Xia *et al.*, 2022, mild to severe fever and cough were the most prevalent systemic effects reported after each vaccine among people younger than 18 years (<18y). But the intensity of fever was lower after the second and third doses compared with the first dose [18]. According to the report on the Sinopharm/ BBIBP COVID-19 vaccine released by the WHO, the most known side effects of the Sinopharm vaccine were dizziness, fatigue, headache, nausea, vomiting, and fever [27].

This study also revealed that among students who faced some side effects after vaccination, the majority of them faced only one possible side effect. After the first dose, 76(47%) respondents reported at least one post-vaccination symptom; after the second dose of the vaccine, 73 (58%) faced a single side effect. Also, for the students who faced more than one side effect, all complications were non-life threatening, and no need for hospitalization (Table 3). A recent study showed that 56.2% of the respondents who faced systemic side effects occurred after the second dose, only 16.4% of students after the first dose and 27.4% were affected by both doses [28].

This study also found that fever was the most known side effect after both the first and the second doses. But for the second dose (n=87), the number was less than the first dose (n=131). Muscle pain was the second common side effect for both doses and swelling and pain at the injection site were the third common side effect among students (Table 4). A recent study from Saudi Arabia showed that the participants experienced fatigue, aches at the injection site, fever, and headache; these problems were more prevalent in those who had received the second dosage of the vaccines [29].

Some students, 197 (38.86%), faced COVID-19 like symptoms and even got both doses of the vaccine. So, a fewer portion of the students, 107 (21.10%), don't believe that vaccination could prevent COVID-19 (Table 3). 47.54 % of the total population (students) feel that vaccination is effective against the

COVID-19 pandemic. A recent study evaluated by Saied *et al.* also showed that a significant number of the study population believed that the only way to overcome the COVID-19 pandemic is through mass vaccination (67.9%) [30]. The WHO Global Advisory Committee recommended that vaccine recipients seek urgent medical attention if the severe symptom continues four to twenty days after vaccination [31].

Conclusion

As the COVID-19 disease is a global pandemic, millions of people's lives are threatened. Several vaccines have been rollout around the world to prevent COVID-19 disease. However, vaccines have some side effects, which are very simple and nonfatal, also no need to get hospitalized. So, everyone should take the COVID-19 vaccine without hesitancy as early as possible. Our study found that 310 (61.14%) of the total population who have taken the vaccine didn't face COVID-19 symptoms again. So, vaccination can control COVID-19 outbreaks or reduce the hospitalization rate with COVID-19 complexity. Participants in our study who received the Oxford-AstraZeneca, Pfizer-BioNTech, Moderna, and Sinopharm vaccines reported side effects identical to those observed during clinical trials, demonstrating that all four vaccinations have safe safety profiles. More research is required to determine how well the current vaccines work in preventing SARS-CoV-2 reinfections.

Declarations

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