

# Study epidemiology and determinants of COVID-19 infection among the population in Jeddah city, Saudi Arabia

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## Abstract

**Background:** Coronavirus disease 2019 (COVID-19) is a global pandemic caused by a highly infectious respiratory virus (SARS-CoV-2). With all these consequences that threaten the health of the individual and society due to this infection, it has become necessary to have a vaccination that limits the spread of this virus. The objective of this study was to study the epidemiological aspects of COVID-19 pandemic in Jeddah, Saudi Arabia.

**Method:** It was a cross sectional study of 405 subjects, who gave their responses through online Google form, as face to face interview of the subjects during outpatient clinic visits was not possible because of the pandemic of COVID-19 infection. Data was analyzed using SPSS software version 23. The level of significance was 0.05%.

**Results:** The prevalence of Covid-19 infection was 23.7%. The vaccination coverage by the Covid-19 vaccine was 90.4%. Those who got the infection before getting the vaccine were 76%; on the other hand those who got the infection after getting one dose were 17.7% of the cases, while 6.3% got the infection after getting two doses of the vaccine. Those with autoimmune disorders, kidney failure and obesity were reluctant to get the vaccine ( $p < 0.05$ ). Married subjects, those with average income, and those who are employed were significantly more infected by COVID-19 ( $p < 0.05$ ). Patients with asthma, with autoimmune disorders,

and those who did not take the COVID-19 vaccine, were significantly more vulnerable to COVID – 19 infection ( $p < 0.05$ ). Post vaccination clinical manifestations were mainly feeling tired (90.2%), pain and swelling at the site of injection (76.9%), fever (65.9%) and headache (61.8%). Clinical manifestations associated with COVID-19 infection included fever (76.0%), headache (72.9%), loss of taste and smell (68.8%), body aches (67.7%), and sore throat (57.3%).

**Conclusions:** Prevalence of COVID-19 infection was 23.7%. About one third of the population did not accept the vaccine. Subjects with asthma, autoimmune disorders, and those who were unvaccinated were more likely to catch the infection. Increasing the knowledge of the people about the clinical aspects, and health impact of the COVID-19 virus on the community are important intervention tools to increase the acceptance rate of COVID-19 vaccination among the population.

**Key words:** COVI-19, clinical aspects and acceptance of COVID-19 infection.

## Introduction

COVID-19 pandemic exposes and amplifies the existing inequalities in society (1-9). There are several risk factors for worse outcomes in patients with coronavirus 2019 disease (COVID-19) (10-20). COVID-19 vaccine is regarded as the most promising means of limiting the spread, or eliminating the pandemic. The success of this strategy will rely on the rate of vaccine acceptance globally (21). Most of the results indicated that most of the subjects agreed to get the vaccine for themselves and people under their care (22, 23). Most of the studies conducted among the general population revealed that gender, age, education, and occupation were some of the socio-demographic variables associated with vaccine acceptance. Variables such as trust in authorities, risk perception of COVID-19 infection, vaccine efficacy, current or previous influenza vaccination, and vaccine safety affected vaccine acceptance (24). Although there are reports of COVID-19 vaccine implementation in real-world populations, most of it came from high-income countries or from those with experience in messenger RNA technology vaccines; however, data on outcomes of vaccine deployment in low- or middle-income countries were lacking (25- 29). Thus, this study aimed to assess the burden and determinants of COVID-19 infection and vaccination in a primary health care setting in Jeddah, Saudi Arabia.

## Methodology

It was a cross sectional study; the sampling method was a non-probability convenient one. Data was collected through online Google form, on 405 respondents residing in Saudi Arabia. Due to the restrictions on face to face interview with the outpatients due to the epidemic measures, data was collected via online route. Sample size was determined using G\*power software, where  $\alpha = 0.05$ , Power = 0.95 effect size = 0.3, and degree of freedom= 5. The minimal sample size required was 277 (30). Data was collected on the respondents using structured questionnaire which provided information on socio-demographic, personal and clinical characteristics, as well as detailed information on COVID-19 infection and vaccination and its clinical symptoms and signs. The software SPSS (IBM compatible version 23), was used to analyze the data. Chi square test was used to analyze the data. The level of significance for the present study was 0.05. Availability of the data: the row data is available at the research center of ISNC and all results of the data are included in the paper.

## Results

This study included 405 subjects with mean age of 30.05 years (SD: 13.536). The proportion of females was greater than that of males in the present study (59% and 41% respectively). The vaccination coverage by the COVID-19 vaccine was 90.4%. However, the occurrence of COVID-19 infection was 23.7%. Those who got the infection before getting the vaccine were 76%; on the other hand those who got the infection after getting one dose were 17.7% of the cases, while 6.3% got the infection after getting two doses of the vaccine.

Table 1 displays the relationship between personal characteristics and COVID-19 vaccine. No significant relationship was found between marital status, gender, nationality, education level, smoking and exercise and getting the vaccine ( $p > 0.05$ ). On the other hand residence in rural areas or high monthly salary were associated significantly with acceptance of the vaccine ( $p < 0.05$ ). Chronic morbidity was not significantly associated with taking the vaccine. On the other hand, those with autoimmune disorders, kidney failure and obesity were less likely to be vaccinated compared to the normal subjects (Table 2). Post vaccination clinical manifestations were mainly feeling tired (90.2%), pain and swelling at the site of injection (76.9%), fever (65.9%) and headache (61.8%), and to a lesser extent nausea (26.6%). Major manifestations like loss of consciousness (2.3%), and severe allergic reactions (4.6%) were also reported (Figure 1). Table 3 reveals that married subjects, those with average income, and those who are employed were significantly infected by COVID-19 compared to others. Table 4 reveals that patients with asthma, with autoimmune disorders, and those who did not take the COVID-19 vaccine, were significantly associated with COVID-19 infection ( $p < 0.05$ ). Clinical manifestations associated with COVID-19 infection included fever (76.0%), headache (72.9%), loss of taste and smell (68.8%), body aches (67.7%), and sore throat (57.3%). Other manifestations included shortness of breath (47.9%), dizziness (37.5%), runny nose (37.5%), chest pain (34.4%), nausea and vomiting (29.2%), abdominal pain and diarrhea (28.1%) (Figure 2). Table 3 displays the relationship between personal characteristics and getting COVID-19 infection. No significant relationships were found between gender, area of residence and education level and getting the infection ( $p > 0.05$ ). Manual workers were more vulnerable to infection ( $p < 0.05$ ). Infection was higher among those with high monthly income ( $p < 0.05$ ). Smoking was significantly associated with COVID-19 infection ( $p < 0.05$ ). No significant relationship was found between exercising and getting the infection ( $p > 0.05$ ). Marital status was significantly associated with getting the infection, ( $p < 0.05$ ). Table 4 displays the relationships between co-morbidities and getting COVID-19 infection. No significant relationship was found between hypertension, ischemic heart disease and getting the infection ( $p > 0.05$ ). On the other hand, autoimmune diseases were significantly associated with getting the infection ( $p < 0.05$ ). The COVID 19 infection was significantly more common among the non-vaccinated subjects ( $p < 0.05$ ).

Table 1: Distribution of studied subjects according to personal characteristics and COVID-19 vaccination

Variable	Category	Covid-19 Vaccine				Total		x2 (p)
		Yes		No		no.	%	
		no.	%	no.	%			
Gender	Female	212	57.9%	27	69.2%	239	59.0%	1.863 0.172
	Male	154	42.1%	12	30.8%	166	41.0%	
Nationality	Saudi	275	75.1%	27	69.2%	302	74.6%	0.648 0.421
	Non-Saudi	91	24.9%	12	30.8%	103	25.4%	
Residence	Rural	336	91.8%	31	79.5%	367	90.6%	6.288 0.012
	Urban	30	8.2%	8	20.5%	38	9.4%	
Education level	Less than University	126	34.4%	11	28.2%	137	33.8%	0.609 0.435
	University And above	240	65.6%	28	71.8%	268	66.2%	
Job	Unemployed	198	54.1%	20	51.3%	218	53.8%	6.682 0.035
	Manual worker	57	15.6%	12	30.8%	69	17.0%	
	Office job	111	30.3%	7	17.9%	118	29.1%	
Income per month	<5000SR	219	59.8%	24	61.5%	243	60.0%	1.333 0.514
	5000- 1000 SR	72	19.7%	5	12.8%	77	19.0%	
	>10000 SR	75	20.5%	10	25.6%	85	21.0%	
Smoker	Yes	73	19.9%	6	15.4%	79	19.5%	0.467 0.494
	No	293	80.1%	33	84.6%	326	80.5%	
Exercise	Yes	104	28.4%	9	23.1%	113	27.9%	0.499 0.480
	No	262	71.6%	30	76.9%	292	72.1%	
Marital status	Single	213	58.2%	20	51.3%	233	57.5%	1.380 0.710
	Married	137	37.4%	16	41.0%	153	37.8%	
	Divorced	12	3.3%	2	5.1%	14	3.5%	
	Widow	4	1.1%	1	2.6%	5	1.2%	

Table 2: Distribution of studied subjects according to co-morbidities and COVID-19 vaccination

Variable	Category	Covid-19 Vaccine				Total		x2 (p)
		Yes		No		no.	%	
		no.	%	no.	%			
Hypertension	Yes	36	9.8%	5	12.8%	41	10.1%	0.345 0.557
	No	330	90.2%	34	87.2%	364	89.9%	
Diabetes	Yes	27	7.4%	5	12.8%	32	7.9%	1.435 0.231
	No	339	92.6%	34	87.2%	373	92.1%	
Ischemic Heart disease	Yes	5	1.4%	1	2.6%	6	1.5%	0.347 0.556
	No	361	98.6%	38	97.4%	399	98.5%	
Allergy	Yes	60	16.4%	7	17.9%	67	16.5%	0.062 0.804
	No	306	83.6%	32	82.1%	338	83.5%	
Asthma	Yes	17	4.6%	3	7.7%	20	4.9%	0.697 0.404
	No	349	95.4%	36	92.3%	385	95.1%	
Autoimmune Disease	Yes	6	1.6%	3	7.7%	9	2.2%	5.943 0.015
	No	360	98.4%	36	92.3%	396	97.8%	
Kidney Failure	Yes	1	0.3%	1	2.6%	2	0.5%	3.764 0.052
	No	365	99.7%	38	97.4%	403	99.5%	
Obesity	Yes	57	15.6%	11	28.2%	68	16.8%	4.025 0.045
	No	309	84.4%	28	71.8%	337	83.2%	
Have you ever Taken any Covid-19 Vaccine	Yes	78	21.3%	18	46.2%	96	23.7%	12.02 0.001
	No	288	78.7%	21	53.8%	309	76.3%	

Figure 1. distribution of patients of covid-19 infection according to post vaccination side effects

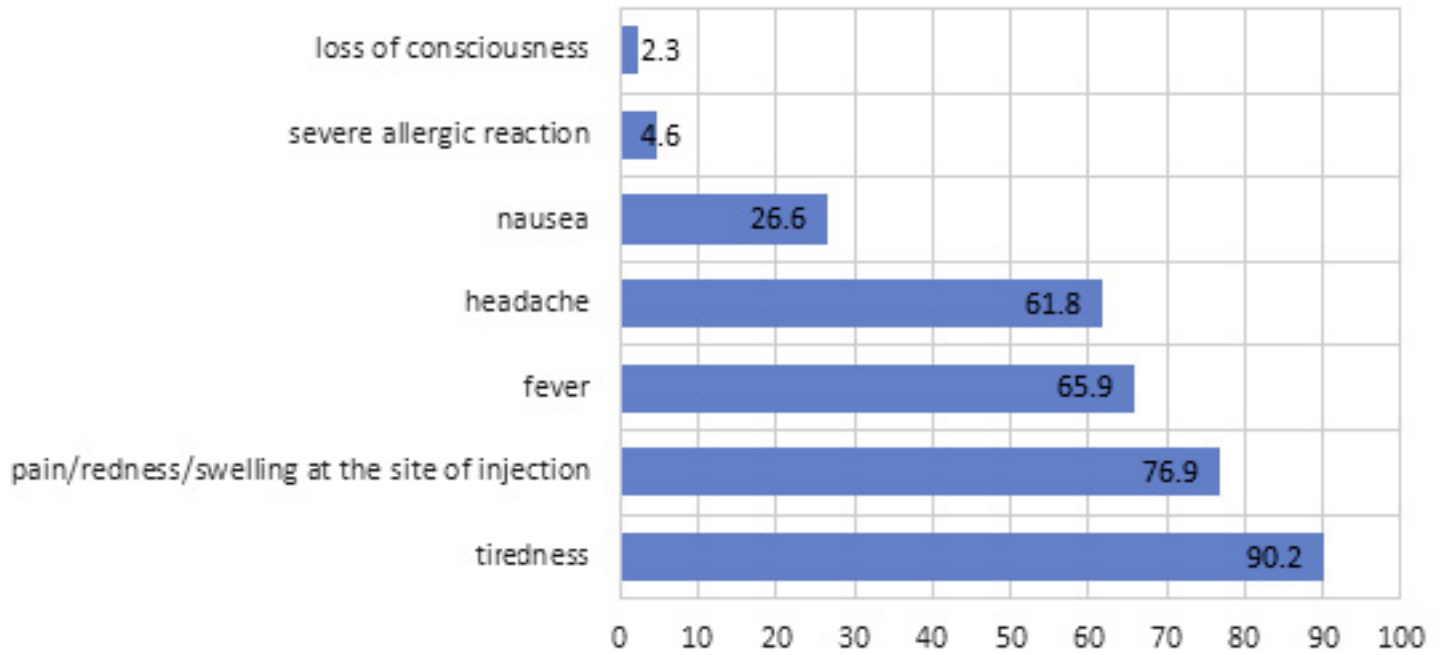


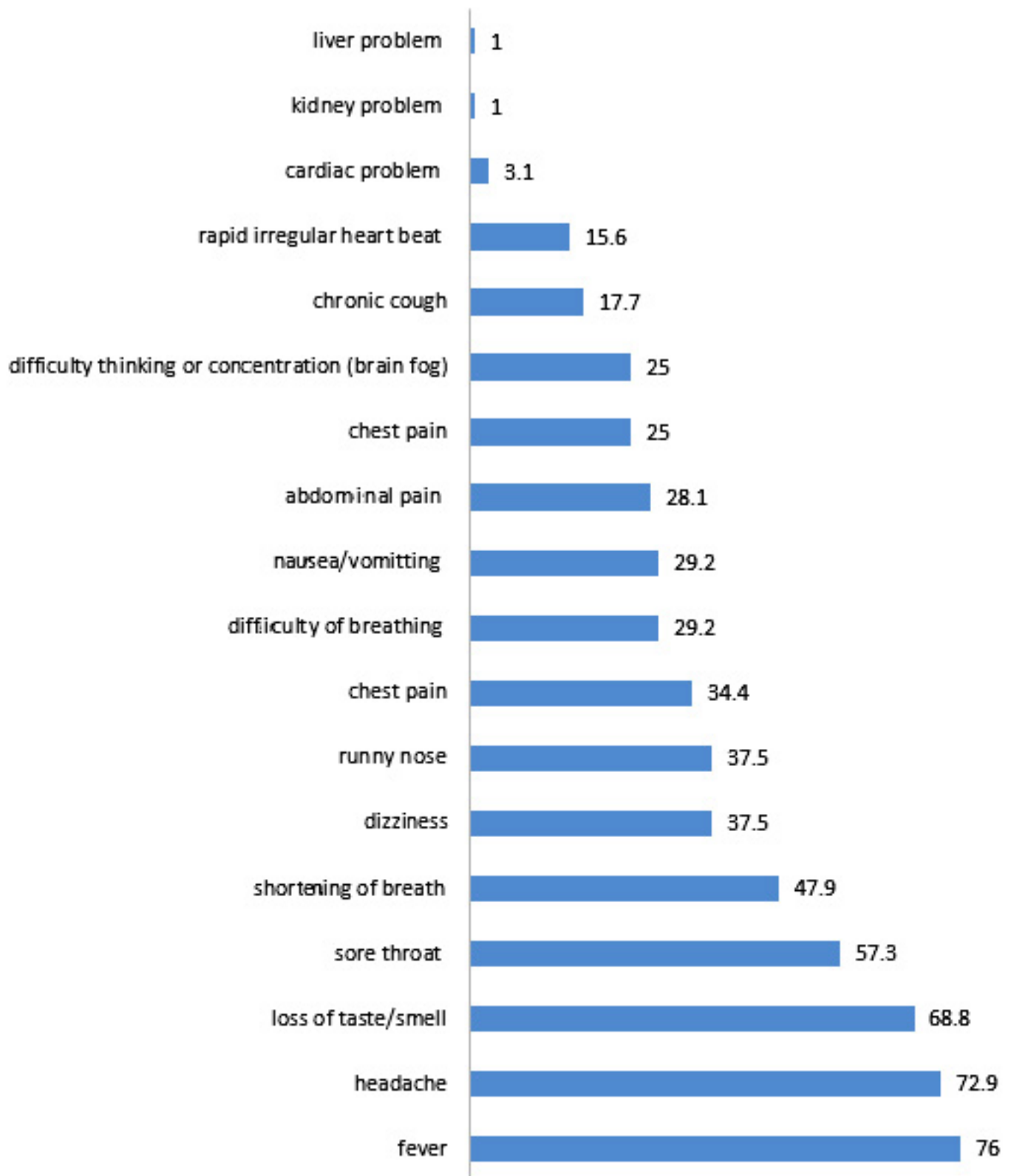
Table 3: distribution of studied subjects according to Personal characteristics and COVID-19 infection

Variable	Category	Covid-19 infection				Total		x <sup>2</sup> (p)
		Yes		No		no.	%	
		no.	%	no.	%			
Gender	Female	54	56.3%	185	59.9%	239	59.0%	0.397 .529
	Male	42	43.8%	124	40.1%	166	41.0%	
Nationality	Saudi	75	78.1%	227	73.5%	302	74.6%	0.840 .360
	Non-Saudi	21	21.9%	38	26.5%	103	25.4%	
Residence	Rural	89	92.7%	278	90.0%	367	90.6%	0.647 0.421
	Urban	7	7.3%	31	10.0%	38	9.4%	
Education level	Less than University	27	28.1%	110	35.6%	137	33.8%	1.828 0.176
	University And above	69	71.9%	199	64.4%	268	66.2%	
Job	Unemployed	39	40.6%	179	57.9%	218	53.8%	9.99 0.007
	Manual worker	18	18.8%	51	16.5%	69	17.0%	
	Office job	39	40.6%	79	25.6%	118	29.1%	
Income per month	<5000SR	42	43.8%	201	65.0%	243	60.0%	21.204 .000
	5000- 1000 SR	33	34.4%	44	14.2%	77	19.0%	
	>10000 SR	21	21.9%	64	20.7%	85	21.0%	
Smoker	Yes	31	32.3%	48	15.5%	96	100.0%	13.100 .000
	No	65	67.7%	261	84.5%	309	100.0%	
Exercise	Yes	21	21.9%	92	29.8%	96	100.0%	2.271 .132
	No	75	78.1%	217	70.2%	309	100.0%	
Marital status	Single	47	49.0%	186	60.2%	233	57.5%	7.808 .050
	Married	41	42.7%	112	36.2%	153	37.8%	
	Divorced	7	7.3%	7	2.3%	14	3.5%	
	Widow	1	1.0%	4	1.3%	5	1.2%	

Table 4: distribution of studied subjects according to co-morbidities and COVID-19 infection

Variable	Category	Covid-19 infection				Total		x2 (p)
		Yes		No		no.	%	
		no.	%	no.	%			
Hypertension	Yes	12	12.5%	29	9.4%	41	10.1%	0.781 0.377
	No	84	87.5%	280	90.6%	364	89.9%	
Diabetes	Yes	11	11.5%	21	6.8%	32	7.9%	2.188 .139
	No	85	88.5%	288	29.2%	373	92.1%	
Ischemic Heart disease	Yes	1	1.0%	5	1.6%	6	1.5%	0.167 .683
	No	95	99.0%	304	98.4%	399	98.5%	
Asthma	Yes	9	9.4%	11	3.6%	20	4.9%	5.276 0.022
	No	87	90.6%	298	96.4%	385	95.1%	
Autoimmune Disease	Yes	5	5.2%	4	1.3%	9	2.2%	5.164 0.023
	No	91	94.8%	305	98.7%	396	97.8%	
Kidney Failure	Yes	2	2.1%	94	97.9%	2	0.5%	6.469 0.11
	No	0	0.0%	309	100.0%	403	99.5%	
Obesity	Yes	21	21.9%	47	15.2%	68	16.8%	2.329 .127
	No	75	78.1%	262	84.8%	337	83.2%	
Have you ever Taken any Covid-19 Vaccine	Yes	78	81.3%	288	93.2%	366	90.4%	12.027 .001
	No	18	18.8%	21	6.8%	39	9.6%	

**Fig 2. Distribution of patients of covid-19 infection according to clinical manifestation**





## Discussion

This study was conducted to study the epidemiological characteristics of COVID-19 infection and vaccination among the population in Jeddah city, Saudi Arabia. The present study found that gender, age, and nationality were not significant determinants of COVID 19 infection or vaccination. This is not in line with previous studies (2-4, 9). However, educational level and occupation and marital status were significant determinants of COVID-19 infection in the present study. This is in line with other studies (3, 4). In the present study well-off subjects were keen to get the vaccine ( $p < 0.05$ ). This is in line with a previous study (6). A previous study revealed that those with central obesity, hypertension, or smokers were associated with lower Ab titers following COVID-19 vaccination. They could benefit from earlier vaccine boosters or different vaccine schedules (7). However in the present study smokers and subjects with hypertension were reluctant to receive the vaccine. Physical exercise performed near the time of immunization may increase antibody response to vaccination (8). In the present study, no significant relationship was found between practicing exercise and getting the vaccine ( $p > 0.05$ ). A previous study revealed that efficacy and safety of COVID-19 vaccination were comparable in patients with endocrine disorders and healthy subjects (12). In the present study no association was found between having diabetes mellitus and getting the vaccine. A previous study revealed that although cardiac complications that are associated with mRNA COVID-19 vaccines are rare, they can be life-threatening; furthermore chest pain should be considered an alarming symptom, especially in those who had received a second dose of the BNT162b2 vaccine in the last 3 days (13). This is not in line with the findings from the present study. Contrary to a previous study (13), no significant association was found between allergy occurrence and vaccination. In the present study getting the vaccine was significantly more common in patients with autoimmune diseases, obesity, or chronic kidney disease. This is in line with other studies (14-17). In the present study smoking, but not gender was significantly associated with COVID-19 infection. This is in line with other studies (23-26). The present study found that only those with autoimmune disorders significantly got the infection more compared to normal subjects. But for the other chronic disorders such as hypertension, diabetes mellitus, asthma and cardiovascular disorders infection was similar to normal subjects. This is not in line with other studies (27 –29). The present study found a significant relation between getting the vaccine and protection from getting infected with COVID-19 virus. This is in line with a previous study (30).

## Limitations

There are some limitations to this study: as this study is cross-sectional, the causal relationship remains unknown, and we do not know if the effects of these variables on acceptance of COVID-19 vaccine during the COVID-19 pandemic will persist in the long term. It is also a nonprobability convenient sample, and its generalization to the population may be defective; however, it is an exploratory study.

## Acknowledgments

We thank all the participants for their cooperation throughout the study.

## Data Availability Statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

## Conclusion

Prevalence of COVID-19 infection was 23.7%. About one third of the population did not accept the vaccine. Subjects with asthma, autoimmune disorders, and those who were unvaccinated were more likely to catch the infection. Increase the knowledge of the people about the clinical aspects, and health impact of the virus of COVID-19 on the community are important intervention tools to increase the acceptance rate of COVID-19 vaccination among the population. Increase the knowledge of the people about the clinical aspects, health impact of the virus of COVID-19 on the population and the community are important intervention tools to increase the acceptance rate of the population.

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