MEDICAL SCIENCE

Prevalence and clinical aspects of post COVID-19 infection complications among population of Jeddah, Saudi Arabia

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ABSTRACT

COVID-19 could lead to several extra-respiratory system specific manifestations and complications. This study aimed at exploring the occurrence and determinants of post COVID-19 infection complications among the population in Jeddah city. It was a cross section study where a convenient sample of 367 subjects from the population of Jeddah city was selected. They were asked a questionnaire which provided responses on personal and socio-demographic characteristics, as well as on clinical aspects and complications of post COVID-19 infection. The SPSS (IBM, P/C, ver 25) was used to analyze the data. Logistic regression and Chi square tests of significance were employed. The level of significance was 0.05. Although 96% of the subjects were vaccinated by COVID-19 vaccinations, 50% got the infection. Having chronic morbidity was significantly associated with catching the infection. Those with hypothyroidism were about 3times more likely to catch COVID-19 infection (OR= 3.297; 95 CI: 1.062, 10.237 and p<0.039). Vaccination by Pfizer vaccine gave more protection than other vaccine types. Completion of vaccine doses was significantly associated with decreased occurrence of COVID-19 infection. Majority of the cases were diagnosed by PCR analysis. Post COVID-19 infection complications were persistent fatigue, arthritis, headache and loss of smell and taste. Depression, anxiety, brain fog, dysrhythmia and dyspnea and lung fibrosis were also reported by older subjects. COVID-19 is a highly contagious disease. The available vaccines do not confer solid protection against it.

Keywords: COVID-19, Saudi Arabia, Post infection complications

1. INTRODUCTION

The Corona virus spreads by droplet transmission and causes acute upper respiratory syndrome. It caused pandemic, which had started in China in the year 2019 (Mukherjee et al., 2021). It produces variable symptoms such as

cough, fever and difficulty of breathing. Less commonly, it is associated with body aches, sore throat and anorexia. However, COVID-19 infection can lead to extra-pulmonary effects on other organs such as the heart and the kidney (Nkire et al., 2022; Falco et al., 2021). Several personal factors such as gender, smoking habit, as well as the sociodemographic characteristics, increase the susceptibility of the subjects to COVID-19 infection and post infection morbidity and fatalities (Ahmed et al., 2020; Wien, 2021).

COVID-19 infection can be prevented by factors such as Vitamin D supplement (Dufour et al., 2022; Michienzi and Badowski, 2020). Several vaccines against COVID-19 infection were authorized globally (Edwards and Orenstein, 2023; MOH, 2020). Although, these vaccines were effective in preventing COVID-19 infection, however, few side effects following vaccination were reported globally such as fainting attacks, blood clots formation, body ache, headache, chills and swelling and redness at the site of injection (WHO, 2023; Canning et al., 2020; Syed-Khaja et al., 2022; Elsayed et al., 2023). Sever affection could lead to cognitive deterioration (Healthcare in Europe, 2022; Mohammadyari et al., 2021).

Need for temporary circulatory support and acute myocarditis were also reported in hospitalized patients with COVID-19 infection (Ashrafi et al., 2020). Post COVID -19 infection manifestations are significantly associated with the chronic morbidity state as well as the sociodemographic state of the subject (Jdiaa et al., 2022; Hama-Amin et al., 2022). The occurrence of chronic renal affection is linked with increased age (Costa et al., 2021; Asadi-Pooya et al., 2021). Thus, the aim of the present study was to determine the occurrence and determinants of post COVID-19 complications among population of Jeddah city.

2. METHODOLOGY

It was a cross-sectional study; the sampling method was a non-probability convenient one. Data were collected on Jeddah population, through electronic platform using Google form during the period August 2022 to January 25th, 2023. Sample size was determined using G*power software, where α = 0.05, Power = 0.95 effect size = 0.3 and degree of freedom= 5. The minimal sample size required was 277 subjects.

A predesigned questionnaire was used to collect the data on the subjects. It provided information on: 1-Socio-demographic and personal characteristics such as age, gender, educational level, occupation and smoking habit; 2- Clinical morbid history including diabetes mellitus, cardiovascular disease, asthma, autoimmune diseases and endocrine disorders; 3- COVID-19 vaccination history of type, nature, doses and place of vaccination, in addition to post vaccination side effects; 4- COVID-19 infection history including method of diagnosis, clinical picture, course of the infection, prognosis of the infection and hospital and ICU admission due to the infection; and 5- history of post COVID-19 infection manifestations such as fatigue, cough, loss of smell and taste, cardiovascular and pulmonary disorders as well mental disorders.

The SPSS software (IBM version 25) was used. Data were typed onto SPSS files and were checked for typing errors. Different tests of significance were used to study the association between the variables such as the Chi square test of significance. Logistic regression was also used and 95% CI, as well as OR were used. The level of significance for this study was 0.05.

3. RESULTS

This study enrolled 367 subjects (17.8% males and 82.2% were females). Those who had COVID-19 infection were 50.5% of the studied subjects. COVID-19 infection was reported among different sociodemographic groups ($p > 0.05$). On the other hand, COVID-19 infection was significantly more common among unemployed subjects where $p< 0.000$ (Table 1).

Table 1 Association between COVID-19 infection and socio-demographic status

Variable	Categories	COVID 19 Infection				Total		X2 (p)
		Yes		No		No	%	
		No	%	No	%			
Gender	Male	32	21.1%	33	15.4%	66	17.8%	1.930 (.165)
	Female	120	78.9%	181	84.6%	301	82.2%	
Education level	≥ University	118	77.6%	166	77.6%	248	77.6%	.000 (.989)
	< University	34	22.4%	48	22.4%	82	22.4%	
Job	Student	64	42.1%	122	57.0%	186	50.8%	12.135 (.007)
	Unemployed	36	23.7%	25	11.7%	61	16.7%	
	Manual worker	36	23.7%	43	20.1%	79	21.6	
	Clerical	16	10.5%	24	11.2%	40	10.9%	

Marital status	Single	81	53.3%	133	62.2%	214	58.5%	5.246 (.155)
	Married	65	42.8%	70	32.7%	135	36.9%	
	Divorced	2	1.3%	7	3.3%	9	2.5%	
	Widow	4	2.6%	4	1.9%	8	2.2%	
Nationality	Saudi	147	96.7%	207	96.7	354	96.7%	.000 (.992)
	Non-Saudi	5	3.3%	7	3.3%	12	3.3%	
Income	< 5000 SR	90	59.2%	133	62.1%	223	60.9%	3.813 (.149)
	10,000-5000 SR	31	20.4%	28	13.1%	59	16.1%	
	>10,000 SR	31	20.4%	53	24.8%	84	23.0%	
Smoking	Yes	21	13.8%	22	10.3%	43	11.7%	1.071 (0.301)
	No	131	86.2%	192	89.7%	323	88.3%	

COVID-19 infection was 1.2 times more common in younger subjects compared to older ones where the p value was <0.039. Those with hypothyroidism were about 4times more likely to catch COVID-19 infection compared to the healthy ones where OR= 3.297; 95 CI: 1.062, 10.237 and p<0.039 (Table 2).

Table 2 Logistic regression relationship between socio-demographic and morbidity variables and COVID-19 infection

COVID-19 infection	B	Sig. (p-value)	Exp (B)	95% Confidence Interval for Exp(B)	
				Lower Bound	Upper Bound
Intercept	1.537	.328			
Age	-.045	.037	.956	.916	.997
Gender					
Male	.398	.223	1.490	.785	2.827
Female	0				
Educational level					
Below University	.151	.602	1.163	.660	2.048
University of higher	0				
Occupational level					
Student	-.730	.198	.482	.158	1.466
Unemployed	.631	.231	1.880	.669	5.284
Manual work	.409	.363	1.505	.624	3.627
Clerical	0				
Marital status					
Bachelor/bachelorette	-1.559	.094	.210	.034	1.306
Married	-.908	.257	.403	.084	1.941
Divorced	-1.630	.186	.196	.018	2.189
Widow	0				
Nationality					
Saudi	.377	.586	1.458	.375	5.675
Non-Saudi	0				
Income					
Less than RS 5000	.442	.341	1.556	.627	3.864
RS 5000 - 10,000	.657	.105	1.929	.872	4.266
More than RS 10,000	0				
Smoking habit					
Smoker	.362	.339	1.436	.684	3.014
Non-smoker	0				

Diagnosed with Diabetes Mellitus					
Yes	-.415	.499	.660	.198	2.197
No	0				
Diagnosed with Hypertension					
Yes	.099	.859	1.104	.369	3.306
No	0[b]				
Diagnosed with Vitamin D deficiency					
Yes	-.015	.954	.985	.592	1.640
No	0				
Diagnosed with Thyrotoxicosis					
Yes	.250	.773	1.285	.234	7.046
No	0				
Diagnosed with Hypothyroidism					
Yes	1.193	.039	3.297	1.062	10.237
No	0				
Diagnosed with Bronchial asthma					
Yes	-.104	.876	.901	.245	3.316
No	0				
Diagnosed with Heart Disease					
Yes	.330	.756	1.391	.173	11.206
No	0				
Diagnosed with Chronic kidney disease					
Yes	-.554	.650	.574	.052	6.310
No	0				
Diagnosed with Allergy disorder					
Yes	-.310	.294	.734	.412	1.309
No	0				
Take Vitamin D					
Yes	.139	.625	1.149	.658	2.007
No	0				
Take multi-vitamins					
Yes	-.297	.289	.743	.429	1.287
No	0				

No significant association was found between having chronic diseases such as Diabetes, vitamin D deficiency, hyperthyroidism, heart diseases, CKD, taking multivitamins and COVID-19 infection ($p > 0.05$). On the other hand, COVID-19 infection was significantly more associated with autoimmune disease, asthma, liver disease or chronic allergy (Tables 3).

Majority of the enrolled subjects received COVID-19 vaccination (95.9%). COVID-19 infection was significantly more common among non-vaccinated subjects ($p<0.002$). Pfizer vaccine gave significantly more protection than other types ($p <0.05$). Completion of vaccine doses was significantly associated with decreased infection with COVID-19 virus. Greater proportion of the subjects had got the vaccine after they got infected with COVID-19. Side effects after vaccination were discomfort at the site of inoculation (91.6%), fever (48.7%), muscle aches (55.9%) and Joint pain (43.5%) (Table 4).

Table 3 Association between COVID-19 infection and having chronic diseases

Variable	Categories	COVID 19 Infection				Total		X2 (p)
		Yes		No		No	%	
		No	%	No	%			
Diabetes	Yes	6	3.9%	14	6.5%	20	5.5%	1.158
	No	146	96.1%	200	93.5%	346	94.5%	(.282)

High blood pressure	Yes	9	5.9%	17	7.9%	26	7.1%	.551
	No	143	94.1%	197	92.1%	340	92.9%	(.458)
Vitamin D deficiency	Yes	89	58.6%	122	57.0%	211	57.7%	.087
	No	63	41.4%	92	43.0%	155	42.3%	(.768)
Hyperthyroidism	Yes	3	2.0%	3	1.4%	6	1.6%	.180
	No	149	98.%	211	98.6%	360	98.4%	(.671)
Hypothyroidism	Yes	13	8.7%	8	3.7%	21	5.8%	3.940
	No	137	91.3%	206	96.3%	343	94.2%	(.047)
Asthma	Yes	4	2.6%	11	5.1%	15	4.1%	1.423
	No	148	97.4%	203	94.9%	351	95.9%	(.233)
Heart diseases	Yes	2	1.3%	3	1.4%	5	1.4%	.005
	No	150	98.7%	211	98.6%	361	98.6%	(.944)
Auto-immune diseases	Yes	0	0.0%	6	2.8%	6	1.6%	4.333
	No	152	100.0%	208	97.2%	360	98.4%	(.037)
Chronic kidney disease	Yes	1	0.7%	4	1.9%	5	1.4%	.968
	No	151	99.3%	210	98.1%	361	98.6%	(.325)
Liver diseases	Yes	4	2.6%	0	0.0%	4	1.1%	5.694
	No	148	97.4%	214	100.0%	362	98.9%	(.017)
Allergy	Yes	26	17.1%	55	25.7%	81	22.1%	3.810
	No	126	82.9%	159	74.3%	285	77.9%	(.051)
Vitamin D taking	Yes	51	33.6%	77	36.0%	128	35.0%	.231
	No	101	66.4%	137	64.0%	238	65.0%	(.631)
Multivitamins or supplements pills taking	Yes	41	27.0%	69	32.2%	110	30.1%	1.174
	No	111	73.0 %	145	67.8%	256	69.9%	(.279)

Table 4 Relationship between Covid-19 infection and Vaccination

Variable	Categories	COVID 19 Infection				Total		X2 (p-value)
		Yes		No		No	%	9.533 (0.002)
		No	%	No	%			
Vaccination	Yes	140	92.1%	211	98.6%	351	95.9%	
	No	12	7.9%	3	1.4%	15	4.1%	
Type of the vaccine	Pfızer	104	74.8%	172	82.3%	276	79.3%	
	Oxford astrzeneca	19	13.7%	9	4.3%	28	8.0 %	
	Moderna	1	0.7%	0	0.0	1	0.3%	16.292 (0.012)
	Moderna + AstraZeneca	1	0.7%	0	0.0%	1	0.3%	
	Pfizer + Moderna	6	4.3%	7	3.3%	13	3.7%	
	Pfizer + Astrazeneca	8	5.8%	16	10.1%	29	8.3	
Country of vaccine	KSA	138	98.6%	208	99.5%	346	99.1%	0.888
	Other	2	1.4%		0.5 %	3	0.9%	(0.346)
Completion of vaccination doses	Yes	87	62.1%	173	84.0%	260	75.1%	21.282
	No	53	37.9%	33	16.0%	86	24.9%	(0.000)
Vaccinated after or before catching COVID-19	After	77	55.0%	2	1.0%	79	23.1%	
	Before	62	44.3%	33	16.3%	95	27.8%	240.751 (0.000)
	I dıd not get infected wıth COVID-19	1	0.7%	167	82.7%	168	49.1%	
Pain at site of injection after vaccination	Yes	128	91.4%	190	91.8%	318	91.6%	0.014
	No	12	8.6%	17	8.2%	29	8.4%	(0.906)
Chills after vaccination	Yes	33	23.6%	40	19.3%	73	21.0%	0.907

	No	107	76.4%	167	80.7%	274	79.0%	(0.341)
Fever after vaccination	Yes	71	50.7%	98	47.3	169	48.7	0.380
	No	69	49.3%	109	52.7%	178	51.3%	(0.538)
Nausea after vaccination	Yes	39	27.9%	49	23.7%	88	25.4%	0.773
	No	101	72.1%	158	76.3%	259	74.6%	(0.379)
Vomiting after vaccination	Yes	11	7.9%	7	3.4%	18	5.2%	3.401
	No	129	92.1%	200	96.6%	329	94.8%	(0.065)
Muscle ache after vaccination	Yes	78	55.7%	116	56.0%	194	55.9%	0.004
	No	62	44.3%	91	44.0%	153	44.1%	(0.952)
Joint pain after vaccination	Yes	64	45.7%	87	42.0%	151	43.5	0.461
	No	76	54.3%	120	58.0%	196	56.5%	(0.497)

Majority of the COVID-19 cases were diagnosed by PCR analysis (57.4%), particularly among those who were less than 40 years of age ($p<0.05$). A small proportion of the infected subjects (9.6%) needed admission to hospital, mainly those over 40 years or those less than 20 years of age ($p <0.05$). A very small proportion of the studied subjects mainly among those aged 40 years or more needed admission to ICU (Table 5).

Table 5 Association between age in years and method of diagnosis and fate of the infection

Variable	Categories	Age in years						Total		X2 (p-value)
		< 21		21- 40		>40		No	%	
		No	%	NO	%	NO	%			
Method of diagnosis	Self-diagnosis	12	27.9 %	15	21.4%	5	14.3%	32	21.6%	10.842 (0.028)
	Clinical diagnosis	6	14.0%	11	15.7%	14	40.0%	31	20.9%	
	PCR	25	58.1%	44	62.9%	16	45.7%	85	57.4 %	
Cured from COVID-19	Yes	39	90.7%	69	95.8%	33	94.3%	141	94.0%	1.266
	No	4	9.3%	3	4.2%	2	5.7%	9	6.0%	(0.531)
Admission to Health center	Yes	7	16.7%	2	2.9%	5	14.7%	14	9.6%	7.113
	No	35	83.3%	68	97.1%	29	85.3%	132	90.4%	(0.029)
Admission to ICU	Yes	0	0.0%	0	0.0%	1	11.1%	1	4.0%	1.852
	No	8	100.0%	8	100.0%	8	88.9%	24	96.0%	(0.396)

Persistent fatigue (55.9%), arthritis (47.6%); headache and loss of smell (42.8% and 42.1% respectively) were some of the post COVID-19 infection complications. These symptoms were similar among all age groups except for headache which was significantly more in those younger than 20 years old ($p <0.05$). Loss of taste (30.3%) was also present in all groups of age ($p> 0.05$).

Depression and anxiety (35.2% and 26.2% respectively), as well as post-traumatic stress (11%) were found among all age groups. Dyspnea and cough (25.5% and 22.8% respectively) and fever (11%), were also reported by all age groups. Dysrhythmia was reported by 12% of the subjects mainly those older than 40 years of age. Lung fibrosis was reported by 1.4% of the subjects mainly among those who were over 40 years of age (Figure 1). Coughing, blurring of vision and lung fibrosis was significantly more encountered among older subjects where the p value was less than 0.05 (Table 6).

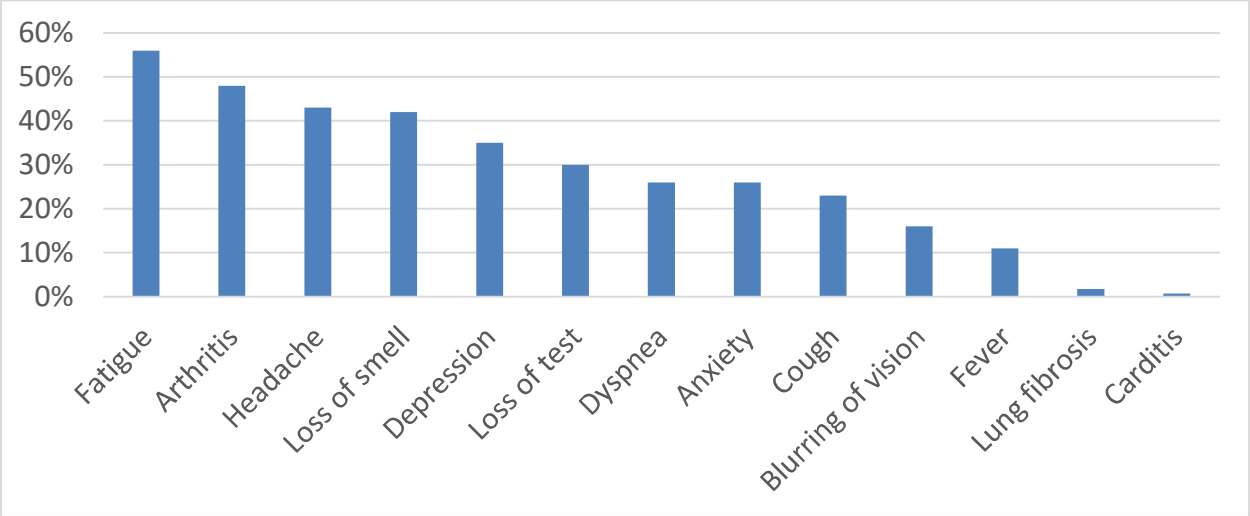

Figure 1 Post COVID-19 infection complications

Table 6 Relationship between Post- COVID complications and age groups

Variable	Categories	Age in years						Total		X2 (p-value)
		>21		21- 40		>40				
		No	%	NO	%	NO	%	No	%	
Fatigue	Yes	24	58	38	55.1	19	54.3	81	55.9	0.17
	No	17	41.5	31	44.9	16	45.7	64	44.1	(0.9918)
Arthritis	Yes	20	48.8	30	43.5	19	54.3	69	47.6	1.120
	No	21	51.2	39	56.5	16	45.7	76	52.4	(0.571)
Headache	Yes	23	56.1	25	36.2	14	40.0	62	42.8	4.290
	No	18	43.9	44	63.8	21	60.0	83	57.2	(0.117)
Fever	Yes	7	17.1	6	8.7	4	11.4	17	11.7	1.748
	No	34	82.9	63	91.3	31	88.6	128	88.3	(0.417)
Coughing	Yes	4	9.8	21	30.4	8	22.9	33	22.8	6.256
	No	37	90.2	48	69.6	27	77.1	112	77.2	(0.044)
Dyspnea	Yes	12	29.3	17	24.6	8	22.9	37	25.5	0.462
	No	29	70.7	52	75.4	27	77.1	108	74.5	(0.794)
Blurry vision	Yes	6	14.6	7	10.1	10	28.6	23	15.9	5.972
	No	35	85.4	62	89.1	25	71.4	122	84.1	(0.050)
Brain fog	Yes	9	22.0	14	20.3	8	22.9	31	21.4	0.102
	No	32	78.0	55	79.7	27	77.1	114	78.6	(0.950)
Loss of smell	Yes	18	43.9	26	37.7	17	48.6	61	42.1	1.209
	No	23	56.1	43	62.3	18	51.4	84	57.9	(0.546)
Loss of taste	Yes	12	29.3	19	27.5	13	37.1	44	30.3	1.045
	No	29	70.7	50	72.5	22	62.9	101	69.7	(0.593)
Anxiety	Yes	11	26.8	15	21.7	12	34.3	38	26.2	1.902
	No	30	73.2	54	78.3	23	65.7	107	73.8	(0.386)
Depression	Yes	17	41.5	23	33.3	11	31.4	51	35.2	1.029
	No	24	58.5	46	66.7	24	68.6	94	64.8	(0.589)
Post Traumatic Stress	Yes	5	12.2	8	11.6	3	8.6	16	11.0	0.295
	No	36	87.8	61	88.4	32	91.4	129	89.0	(0863)
Dysrhythmia	Yes	3	7.3	9	13.0	5	14.3	17	11.7	(1.107)
	No	38	92.7	60	87.0	30	85.7	128	88.3	(0.575)
Heart	Yes	0	0.0	0	0.0	1	2.9	1	0.7	3.165

Inflammation	No	41	100.0	69	100.0	34	97.1	144	99.3	(0.205)
Lung Fibrosis	Yes	0	0.0	0	0.0	2	5.7	2	1.4	6.374
	No	41	100.0	69	100.0	33	94.3	143	98.6	(0.041)
Diabetes	Yes	0	0.0	0	0.0	1	2.9	1	0.7	3.136
	No	41	100.0	58	100.0	34	97.1	143	99.3	(0.208)

4. DISCUSSION

The aim of the present research was to explore the burden of COVID-19 infection among the population of Jeddah city, SA. COVID-19 infection is more common in males than in females (Mukherjee et al., 2021). This is not in line with findings from the present study. Low economic status has been highlighted as a factor affecting vulnerability to COVID-19 infection. Patients with a low economic status are more likely to reside in unhealthy environments with poor hygiene. However, in the present study we found no such an association. In the present study unemployed subjects were more vulnerable to infection (Nkire et al., 2022).

This is not in line with previous study. Smoking tobacco produces exhaled smoke, coughing or sneezing, aerosols containing SARS-CoV-2 in the surroundings and contaminating surfaces (Falco et al., 2021). However, in the present study smoking was not associated with COVID-19 infection. The prevalence of DM is high among hospitalized COVID-19 (Healthcare in Europe, 2022). This is not in line with the present study. COVID-19 exaggerates cardiovascular complications by promoting arterial and venous thrombosis through inducing inflammation, activating platelets and causing vascular dysfunction and blockade (Ashrafi et al., 2020).

In the present study hypertension was not associated with increased COVID-19 infection. Vitamin D is important for increasing the immunity of the body for COVID-19 infection (Ahmed et al., 2020). There is no scientific evidence that patients with poorly controlled thyroid disorders are more likely to contract COVID-19. However, those with uncontrolled thyroid dysfunction and particularly those with thyrotoxicosis are likely to be at higher risk of infection-related comorbidities, for example, a cytokine storm (Wien, 2021).

This is in line with findings from the present study. Several bodily systems are under the control of the thyroid gland hormones, so viral infection could adversely affect its functions and hence function of many human cells, such as the receptors of the olfactory nerve (Dufour et al., 2022). Hypothyroidism was significantly associated with COVID-19 infection. The impact of acute COVID-19 on people with asthma appears complex, being moderated by multiple interacting disease-specific, demographic and environmental factors. Research regarding longer-term effects in this group is limited (Michienzi and Badowski, 2020).

Asthma in the present study predisposed to infection with COVID-19. Majority of the subjects in our study received COVID-19 vaccine. The WHO, (2023), Edwards and Orenstein, (2023) and MOH, (2020) maintains an updated list of vaccine candidates under evaluation. The common reported adverse effects of COVID-19 vaccination consist of the injection site's local reaction followed by several non-specific vague symptoms. However, cerebral venous sinus thrombosis and immune thrombotic thrombocytopenia after vaccination were reported (WHO, 2023; Canning et al., 2020). This is in line with findings from the present study.

In the present study fatigue, arthritis and headache, fever and coughing were commonly encountered among the patients. This is in line with other studies (Healthcare in Europe, 2022; Jdiaa et al., 2022). Poor mental health such as depression, anxiety, post-traumatic stress, low motivation, fatigue, low mood and disturbed sleep usually accompany having severe COVID-19 infection (Mohammadyari et al., 2021). This is in line with findings from the present study.

Blurry vision, dysrhythmia and dyspnea and lung fibrosis were found in post COVID-19 infection. This is in line with other studies (Ashrafi et al., 2020; Jdiaa et al., 2022). Previous studies revealed that COVID-19 infection was associated with loss of taste and/or smell. This is in line with other studies (Costa et al., 2021; Asadi-Pooya et al., 2021).

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 post COVID-19 infection 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.

5. CONCLUSION AND RECOMMENDATIONS

COVID-19 is characterized by post infection both pulmonary and extra-pulmonary complications. Although there are several vaccines developed against it; these vaccines do not give solid protection; therefore, personal hygiene and measures to prevent airborne transmission are mandatory to be adopted.

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Author Contributions

FG contributed to study design, analyzing data and writing the first original draft. AJ, MA, HA, AF and NA contributed to collecting data and writing the draft.

Institutional Review Board Statement

The study was approved by the Institutional Review Board of Ibnsina National College for medical studies (No.: H-07-09062021, approval date: 9 – 6- 2021).

Informed Consent Statement

All enrolled subjects gave their consent to participate in the study

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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