



Cross-Sectional Perspective Study of Post-COVID Syndrome Characteristics in Benghazi, Libya

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Abstract

Post-COVID syndrome (PCS) is associated with symptoms that persist after curing from SARS-CoV-2 infection. According to WHO, it is a disorder that typically requires at least 2 months to manifest before being diagnosed, and occurs 3 months after the initiation of COVID-19. Fatigue, dyspnea, headaches, joints, chest pains, abnormalities of taste and smell, coughing, hair loss, sleeplessness cardiac and gastrointestinal problems are examples of persistent symptoms. A cross-sectional study is with 325 participants from Benghazi. Prior to taking part in the trial, the individuals in this study had been infected with the coronavirus for at least two months. The majority of participants' age was between 40 and 69 years, regarding the symptoms that were reported after infection. Fatigue was the most common response. Also, 71.4% of the participants had a mild infection The majority of patients received vitamins, analgesics, and minerals treatment (37.9%). The results were divided into a strong relationship with a significant p -value of less than (0.05) and a weak or insignificant (p -value > 0.05). In conclusion, fatigue, new loss of sense of taste, and smell and cough were the most common persistent symptoms in patients for a period of more than two months. Age and gender were a predictor for PCS while treatment protocol and symptoms such as cough, diarrhea, and headache were not a sign for PCS.

Subject Areas

Pharmacy Science

Keywords

Comorbidity, Infection, Persist, Symptoms and Treatment Protocol

1. Introduction

Benghazi experienced a Coronaviruses pandemic like every other big city in the world. In fact, according to Benghazi's medical anti-coronaviruses committee, on the seventh of April 2020, documented it was the first case of COVID-19, who was a male aged 55 years old, had lung issues, and arrived in Benghazi from Türkiye via Tunisia.

The severe acute respiratory syndrome coronavirus (SARS-CoV-2), which was originally identified in November 2002, and the Middle East respiratory syndrome coronavirus (MERS-CoV), which was first revealed in September 2012, were both caused by Coronaviruses [1] [2].

Infection occurs by tremendous droplets produced by symptomatic patients coughing and sneezing, but it can also come from asymptomatic individuals and begin before the onset of symptoms [3]. Such diseased droplets can deposit on surfaces and propagate 1 - 2 meters. The virus can survive on surfaces for days, but simple disinfectants like hydrogen peroxide and sodium hypochlorite kill them in just a minute [4]. Therefore, respiratory droplet and contact transmission are the main ways that SARS-CoV-2 spreads from person to person. The virus can be spread by infected people both throughout the incubation period and the recovery period [5].

The majority of SARS-CoV-2 infected recipients are still asymptomatic. However, in symptomatic patients, the disease's clinical manifestations typically take from two to five days or so to manifest themselves. With a median of 14 days, the time from the onset of COVID-19 symptoms to mortality ranged from 6 to 41 days [6] [7]. Fever, cough, and exhaustion are just a few of the many symptoms of COVID-19 that can differ from person to person [7] [8]. Other symptoms include sputum production, tachycardia, headache, hemoptysis, diarrhea, dyspnea, lymphopenia, and depression.

The progression of COVID-19 into a severe and critical stage has been linked to elderly subjects, males, underlying comorbidities like hypertension, diabetes, obesity, chronic lung diseases, heart diseases, liver diseases, kidney diseases, tumors, clinically apparent immunodeficiency, and pregnancy [9].

Several studies have shown a wide range of symptoms associated with post-acute COVID-19 syndrome, according to WHO, it is a disorder that typically requires at least 2 months to manifest before being diagnosed, occurs 3 months after the initiation of COVID-19, and cannot be explained by another illness. The underlying disease's symptoms may return or they may differ from those felt during an acute COVID-19 episode. Over time, symptoms may also shift or come back. Patients who initially only experienced mild to moderate acute symptoms and did not require hospitalization still experience long-term problems. Fatigue and dyspnea are two of these symptoms. Other less common symptoms include mental and cognitive impairments, headaches, myalgia, joint and chest pains, abnormalities of taste and smell, coughing, hair loss, sleeplessness, wheezing, rhinorrhea, sputum, cardiac and gastrointestinal problems. After being re-

leased from the hospital or when the symptoms first appear, they may last up to six months. Long COVID has also been linked to less common symptoms including cold, flushing, earache, and visual impairments. These symptoms are comparable to those of people with prior viral illness epidemics (SARS and MERS) [10] [11] [12].

The purpose of this research was to investigate and get an understanding of the post-coronavirus syndrome (COVID-19) symptoms among Benghazi's city survivors. Factors that aggravate or tag signs and symptoms of post-COVID syndrome (PCS) also evaluate the effective treatment between those patients.

2. Methodology

In across-sectional epidemiological study of 325 Benghazi's residents, Regardless of their gender or age, these patients had been diagnosed with Coronavirus at least two months, prior were asked to complete a specially created questionnaire regarding their current health status and any lingering symptoms, they had after acquiring the virus. More than 200 others also took part in the study by using a special web link and responding to the same survey. Those individuals who completed the survey were asked to indicate their acceptance to participate in the study at the outset of the questionnaire. 24 subjects out of a total of 325 were excluded due to their responses were insufficient. This research was conducted during the period of 10 months from December 2021 to September 2022.

Analogous to the questionnaire, it has eight components, as shown in **Table 1**.

3. Results

3.1. Baseline Characteristics of Study Participants

A total of 301 COVID-19 patients were involved in this study, 236 cases were Males and 65 cases were Females. Meanwhile age of patients were divided into five age groups; the majority of participants were aged between 40 - and 69 years (63.8%). Analogous to the mean length of infection was 3.00 ± 2.181 months, although 55.48 percent of the individuals had non-chronic illnesses. Additionally, it had been noted most common comorbidity was hypertension (11.6%) as shown in **Table 2**. Comparatively to the prevalence rate of Diabetes, Accompanied Disease was (9.6%), followed by (7%) had liver disease. Bronchial Disease was (6.3%), Heart disease and Autoimmune represented (2.7%). However, only (1.3%) of participants had a history of cancer disease.

3.2. Symptoms of COVID-19 and Post-COVID-19

Regarding the signs and symptoms of infection. The most frequent answer given by respondents (56.8%) was fatigue. (**Table 3**) Then came fever, loss of taste and smell, coughing, and headache, with 44.2%, 40.2%, 31%, and 24.9% of those surveyed reporting each, respectively. But only 2.7% were symptom-free. In contrast, people who experienced symptoms that persisted after treatment

Table 1. Questionnaire of the presented study.

Part	Sector	Questions covered in survey
Part I	Demographic information	Age Groups
		Gender
		0 - 19 years old 20 - 39 years old 40 - 69 years old 70 - 89 years old Above 90 years Male Female
Part II	Relevant medical history	Do you have a Liver disease? Are you hypertensive? Are you Diabetic? Are you pregnant? (Females) Do you have any Cardiac problem or disease? Do you suffer from any Respiratory disease or problem? Did you have cancer? Do you have any type of Hepatitis? (Hepatitis B or C) Are you immunocompromised or having any sort of autoimmune disease? Do you have any other medical problem or disease (not mentioned)? Do you have an accompanied Disease?
Part III	Infection date	Since two-months Since three-months Since four-months Since five-months Since six-months More than six months
Part IV	After-infection symptoms	Are you affected by the following conditions?
		Asymptomatic Stomachache Lung problems Fatigue Fever Depression Sore Throat Cough Chronic Sinusitis New Loss of sense of taste and smelling Diarrhea Headaches Other symptoms Hair lost Diabetes Urinary tract infections

Continued

				Asymptomatic Hair lost Hyperglycemia Recurrent urinary tract infections Gastrointestinal problems Lung problems Fever Cough Fatigue Depression Headaches Nasal infections Lost of sense of taste and smelling Other symptoms
Part V	Post-cure symptoms	Do you still have these symptoms?		
Part VI	Disease severity	During onset of active infection, it was		Sever (I needed admission to ICU) Moderate (I needed Oxygen) Mild (I needed drugs only) Very mild (I didn't had drugs) Without symptoms
Part VII	Vaccination	I did get the vaccine	Didn't reserved a vaccine Type	Astra Zeneca Pfizer Moderna Sinopharm BIBP Sputnik V Other type
Part VIII	Treatment			I had reserved treatment in hospital Vitamins and minerals such as Vitamin C, Iron, Zinc and analgesic Vitamins as well as Antibiotics Vitamins, Antibiotics, Anticoagulants and Hydrocortisone Oxygen, Vitamins, Antibiotics, Anticoagulants and Hydrocortisone Home remedies and herbs I didn't had any type of Therapy I had other different protocol

Table 2. Baseline characteristics of study participants.

Characteristics	N (%)	
Gender	65 (21.6%) Females	236 (78.1%) Males
Age group	0 - 19 years old (6.6%)	
	20 - 30 years old (20.9%)	

Continued

	40 - 60 years old (63.8%)
Age group	70 - 89 years old (8.3%)
	Above 90 years (0.3%)
Length of infection	3.00 ± 2.181
Non-chronic disease	167 (55.48%)
Diabetes	29 (9.6%)
Liver disease	2 (7%)
Bronchial Disease	19 (6.3%)
Autoimmune	8 (2.7%)
Heart disease	8 (2.7%)
Cancer	4 (1.3%)
Hypertension	35 (11.6%)
Accompanied Disease	29 (9.6%)

Table 3. The signs of infection both before and after.

COVID-19 Symptom	N (%)	POST COVID-19 Symptom
Stomachache	53 (17.6%)	11 (3.7%)
Lung Problem	21 (7%)	19 (6.3%)
Fatigue	171 (56.8%)	67 (22.3%)
Fever	133 (44.2%)	4 (1.3%)
Symptomless	8 (2.7%)	16 (5.3%)
Depression	62 (20.6%)	23 (7.6%)
Sore Throat	72 (23.9%)	4 (1.3%)
Cough	95 (31.9%)	41 (13.6%)
Chronic Sinusitis	35 (11.6%)	16 (5.3%)
Net Loss of Smell and Taste	121 (40.2%)	53 (17.6%)
Diarrhea	20 (6.6%)	----
Headache	75 (24.9%)	31 (10.3%)
Other Symptoms	19 (6.3%)	34 (11.3%)
Hair Loss	-----	33 (11%)
Diabetes	-----	11 (3.7%)
Urinary tract Infection	-----	5 (1.7%)

included weariness (22.3%), a loss of taste and smell (17.6%), and fever (about 1.3%). 17.6% of respondents reported losing their sense of taste and smell, while little under 1.3% of persons experienced a temperature, as well as it was observed in **Figure 1** that males were exposed to PCS to a higher degree than females.

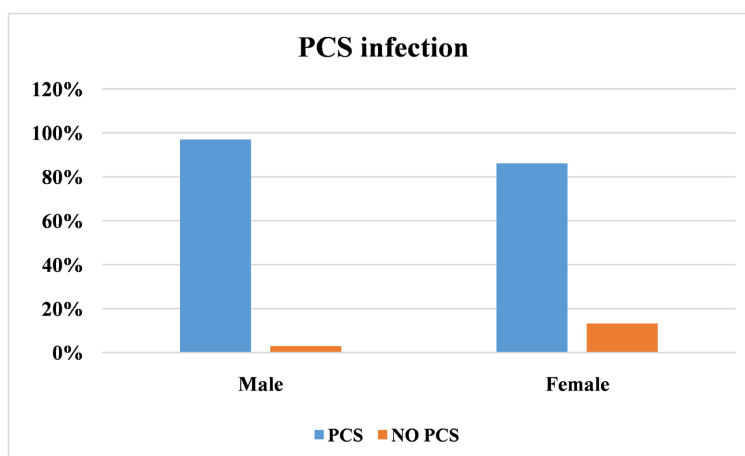


Figure 1. Distribution of PCS among male and female participants.

3.3. Severity of Disease and Treatment

The ramification of disease severity was classified according to symptoms and treatments used, into five categories (ranging from symptoms-less without any medication to very severe for people hospitalized in ICU), 13% of those treated experienced a severe infection, compared to mild infections in 71.4% of individuals. **Table 4** shows that 5% of participants had very severe infections, while 9% of participants had very mild illnesses.

Table 5 reveals that nearly all of the subjects (37.9%) obtained treatment with vitamins, analgesics, and minerals, with 24.6% of participants receiving treatment with vitamins and antibiotics. In severe cases, 5.0% of patients received oxygen therapy, cortisone, and an anticoagulant. Just 5.3% of patients have not received any treatment, to add to that. 5.6% of patients chose home remedies, whereas 6.3% of patients were admitted to the hospital.

3.4. Vaccination

Recipients were questioned regarding the COVID-19 vaccine. In 61.8% of cases, respondents claimed they had not had any vaccinations. The percentage of others who received the various vaccination kinds was as follows: 12.3%, 11%, and 6.6%, respectively, for AstraZeneca, Sinopharm, and Sputnik. (**Table 6**)

3.5. Statistical Analysis

The Pearson Chi-Square and Fisher's Exact test were used to determining the extent of the correlation between the various variables, therefore, the results were divided into a strong relationship with a significant p -value less than (0.05) and weak or insignificant (p -value > 0.05). In this study, we noticed the severity of disease was highly dependent on hypertension and diabetes with 0.003, 0.01 p -values respectively, the same situation with gender, age as well as post covid syndrome (PCS) with p -value (0.002, 0.016) respectively, in addition to Diabetes and cough, with p -value (0.004) respectively. Whereas in the case of cough, diarrhea, headache, age, treatment protocol, and post-COVID syndrome the

Table 4. Severity of disease.

Severity of Disease	Frequency	Percent %
Very Severe	15	5.0
Sever	39	13.0
Mild	215	71.4
Very mild	27	9.0
Symptoms-Less	5	1.7
Total	301	100.0

Table 5. Treatments used during COVID-19 Infection.

Treatment	Frequency	Percent
Vitamins, analgesics, and Minerals	114	37.9
Vitamins and Antibiotic	74	24.6
Vitamins and Antibiotic Cortisone, Anticoagulant	10	3.3
O ₂ and Vitamins and Antibiotic Cortisone, Anticoagulant	15	5.0
Home Remedies	17	5.6
No Treatment	16	5.3
Hospitalization	19	6.3
Different Protocol	36	12.0
Total	301	100.0

Table 6. Description of the type of vaccination.

Type of vaccine	Frequency	Percentage
No-Vaccination	186	61.8
Sinovac	11	3.7
Sinofarm	33	11.0
Sputnik	20	6.6
AstraZeneca	37	12.3
other	14	4.7
Total	301	100.0

correlation was denied depending on their insignificant p -value recorded as follows (0.407, 0.611, 0.052, 0.105).

4. Discussion

In the current study, we focused on the prevalence as well as characteristics of the Post-COVID Syndrome(PCS) in a population consisting of 301 COVID-19 convalescent patients, where, COVID-19 is a new disease with a narrow range of information on the PCS (Galal, *et al.*, 2021) [13]. Based on the current findings,

there were 78.1% more Males than Females in the sample, and 63.8% of participants were between the ages of 40 and 69. This discovery may be related to the fact that chronic diseases begin to manifest at this age, while SARS-CoV-2 infection prevalence peaked at the age of forty. The previous finding was consistent with Kayaaslan's findings (Kayaaslan *et al.*, 2021) [14], but they were in conflict with Galal *et al.*'s findings (Galal, *et al.*, 2021) [13], where a significant portion of their cohort was in the age range of 21 to 40. Compared to M. Augustin *et al.* (2021) [15] almost all of the current cohort (71.04%) had mild COVID-19 infection with mild symptoms, while only 13% and 5%, respectively, had severe and extremely severe SARS-CoV-2 infections. Regarding the mentioned before most of the cohort had mild infections where they were not hospitalized during the acute phase and the mean length of infection was 3.00 ± 2.181 months. Recently, the time span to qualify for the post syndrome was > 28 - 30 days - 60 days (Sudre CH. 2020) [16], or more than 3 months (Townsend L *et al.* 2020 [17], Carvalho-Schneider C, *et al.*, 2020 [18]).

Prior to acquiring COVID-19, 55.48% of participants did not have any chronic diseases, while comparable studies revealed that 75% of patients did not have any comorbid disorders (Hussein *et al.*, 2020) [19]. Conversely, the most prevalent co-occurring diseases in the population were hypertension, bronchial disease, diabetes, and liver disease. On the other hand, heart issues, autoimmune diseases, and cancer diseases, which were consistent with M. Augustin *et al.* (2021) [15], and Lechien JR *et al.* (2020) [20] findings demonstrate the minor frequency of associated illness.

Analogous to COVID-19 infection symptoms 8 (2.7%) patients of 301 their infection was symptomless while more than half of participants (56.8%) had fatigue as an apparent symptom followed by fever, New Loss of sense of taste and smell (44.2%, 40.2% respectively). Whereas, Headache was not the most prevalent symptom (24.9%), which was in contrast with Lechien JR results where they found that headache is the most prevalent symptom at the onset of illness followed by a new loss of sense of taste and smell. on the other hand, our findings were in line with Morgul, *et al.*, (2021) [21] who found that 64.1% of participants suffered from fatigue as an observed symptom.

Recently, it has become clear that some SARS-CoV-2 infection convalescent patients continued to have some symptoms for a period reached to months after the onset of COVID-19 infection without considering the severity of the disease (Chopra V *et al.*, 2020) [22]. Up to now, there is no exact terminology to define this case, there for, this clinical case may expressed as long COVID (Mandal S, *et al.* 2021) [23], chronic COVID syndrome (Baig AM, 2020) [24], post-acute COVID-19 syndrome (IDSA, 2020) and post-COVID syndrome (Goertz YMJ *et al.*, 2020) [25]. In the current study, we choose Post-COVID Syndrome (PCS).

We found that whereas 94.7% of the population had PCS and fatigue was the most commonly reported persistent symptom with the findings of Townsend L *et al.* (2020) [17] and Marshall M *et al.* (2020) [26], just sixteen (5.3%) of the COVID-19 treated patients had no post-COVID symptoms. One of the most

recurrences of COVID-19 lasting symptoms was fatigue, which may be caused by brain capillary endothelial dysfunction, as reported by Nauen DW *et al.* in 2021 [27]. Fatigue was followed by a fresh loss of taste and smell, followed by a persistent cough in 13.6% of participants, which was the post-symptom, the outcomes were consistent with an Italian study. (Angelo Carf *et al.* 2020) [28]

Synonymous to vaccinations, 61.8% of participants rejected to take advantage of the available COVID vaccine, which may have been because they had sufficient knowledge about the vaccine or were reluctant to have one. The adverse effects of the vaccinations and the lack of confidence in their efficacy may also be contributing factors to the population's resistance to the vaccine. This finding was consistent with a related Ethiopian study (Delelegn Yehualashet, *et al.*, 2022) [29] Other participants were given vaccines from Sinovac, Sinofarm, Sputnik, AstraZeneca, as well as additional manufactured vaccines. Astrazeneca's percentage was larger than the others because it is suggested for older age groups.

Corresponding to our research 37.9% received oral vitamins, minerals and analgesics as a treatment for COVID-19 infection, while 24.6% of the contributors used oral antibiotics over the vitamins, minerals, and analgesics. However, only 5% of the patients received oxygen therapy, cortisone, and anticoagulant, and 6.3% of contributors were hospitalized. The results mentioned previously confirm that mild cases were prevalent in general and that serious instances were extremely uncommon in the cohort. Thus only 5.3% did not receive any therapy which in contrast with Lechien JR finding where they revealed that about 29% of the patients did not receive any drug and about 7% had antibiotics.

In the current study, PCS was independently predicted by diarrhea, cough, and headache following acute COVID-19 infection (p -values 0.611, 0.407, and 0.052 respectively). While diarrhea at the time of disease onset was an independent predictor for PCS, gender was a dependent indicator for PCS with a p -value of 0.002, which was consistent with research by M. Augustin *et al.* from 2021 [15]. In contrast, men are more likely than women in our research to be accepted for PCS. Furthermore, age is a dependent predictor for long-term COVID-19 symptoms, they revealed that cases older than 65 have more acceptability to have PCS than people aged from 18 to 64. The p -value for this relationship was 0.016, which was in accordance with Bull-Otterson *et al.*'s findings in 2022 [30].

Considering the comorbidities of the cohort applicant, diabetes and hypertension were associated with an increased risk of having a severe condition, with a p -value of 0.05 indicating a relationship between the severity of the disease and them. Also Peng, M., *et al.* (2021) [31] reported that myocardial damage from COVID-19 infection and long-term hypertension may both cause organ damage, including heart injury. Similarly, they demonstrated that hypertension has a crucial role in controlling the immune system, the gastrointestinal system, and inflammation, which shows the severity of the COVID-19 disease in hypertensive patients. Sen, S., *et al.* [32], further indicate that diabetes is linked to decreased body immunity and increased SARS-CoV-2 replication, which may be an indicator of the severity of COVID-19 disease. On the other hand, there was a

significant correlation between diabetes as a comorbid condition and cough as a PCS (p -value = 0.004), which was consistent with Li, G., *et al.*'s (2020) [33] finding that the cough may be a more prevalent feature of SARS-CoV-2 infection in diabetic patients than in non-diabetic patients. Finally, the treatment approach that had been used in Libya to treat Covid-19 infected patients had no effect on preventing PCS in those who survived, where the p -value was 0.105 which was contraindicated with Xie Y., *et al.* (2023) [34] results, based on findings showed that utilizing the antiviral drug (nirmatrelvir) is linked to a decrease in the long-lasting Covid-19 effects.

Our study discussed PCS in the population who were not admitted to or attended by hospitals, and we concentrated on all PCS rather than just two or three, from which participants may select the recurrent symptoms they experienced. However, smoking was not considered a characteristic of PCS in the current investigation. Alternatively, comorbidity was evaluated as a criterion for SARS-CoV-2 convalescent patients. Further, the questionnaires were assigned at random throughout the city using several techniques, including in-person and online. In comparison, the males were quite more than females in our cohort.

5. Conclusion

The COVID-19 disease and Post-COVID Syndrome (PCS) were reviewed in the present research, which revealed many criteria that had an impact on them. The most frequent persistent symptoms (PCS) reported by patients for longer than two months were fatigue, new loss of taste as well as smell, and cough. Less frequently reported PCS included lung problems, headaches, and diabetes. In Benghazi's population, the symptoms were more persistent in the males than the females, Additional signs like diarrhea and headaches did not point to PCS. It should confirm that PCS can manifest even in those with moderate SARS-CoV-2 infections.

Acknowledgments

To all Benghazi COVID-19 survivors.

Ethics Statements

The team had verbal consent from subjects before answering questionnaire.

Author Contribution

The authors confirm contribution to the paper as follows: study conception and design: Asma M. Buzgeia, Nazik M. Hamad; data collection: Asma M. Buzgeia, Nazik M. Hamad; analysis and interpretation of results: Nuri H. Badi.; draft manuscript preparation: Fatma Mohamed Ali. All authors reviewed the results and approved the final version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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