



Research Article

Impact of Post COVID-19 Infection on Human Health at Hyderabad and Adjoining areas

Aneela Ahmed Tagar^{1*}, Mahvish J. Channa², Kanwal Ahmed Tagar³ and Kaka Kainat⁴

¹Institute of Biochemistry, University of Sindh, Jamshoro, Sindh, Pakistan; ²Institute of Biochemistry, University of Sindh, Jamshoro, Sindh, Pakistan; ³Shaheed Mohtarma Benazir Bhutto Medical University Larkana, Sindh, Pakistan; ⁴Institute of Biochemistry, University of Sindh, Jamshoro, Sindh, Pakistan.

Abstract | This study aims to detect the indicators of post-COVID -19 infections among survivors through biomarkers and to assess the impacts of post infections on human health including the malnutrition and mental health of patients. The study was conducted in the civil hospital Hyderabad and LUMHS Jamshoro. A total number of 65 post-COVID-19 patients were selected for the study with negative RT PCR tests. A questionnaire was filled after taking consent of patients whereas blood samples were collected to detect the biomarkers (Ferritin, D-dimer, C- reactive protein, LDH, CBC and troponin). The study reveals the following findings as majority of patients were in age group 37-47 years, male and were married. Moreover, the majority belonged to the medical field. The greater number of the patients were physically active. Only 18.5 % of patients reported co-morbidities such as diabetes in 12.3% with one exceptional case in which Diabetes developed after the occurrence of COVID-19. The majority of the patients were symptomatic categorized as mild, moderate and severe. Consequently, the Isolation period in more patients was 15 to 20 days. It is found that the greater number of patients suffered from loss of appetite. Furthermore, the BMI of the patients before COVID-19 in 3.1% patients was underweight, whereas the BMI of the patients after the COVID-19 in 12.3% was underweight. The major symptoms in patients were Fatigue, headache and Dyspnea. The majority of the patients had emotional problem during COVID-19 including anxiety and depression. Additionally, Biomarkers remained increase in patients (i.e, ferritin, D- dimer, CRP, LDH and CBC was slightly altered in subjects. Lastly, Troponin levels were normal among survivors. The conclusion of present research is that COVID-19 impacts overall health of patients including; long lasting symptoms, malnutrition, anxiety, depression and alterations in Biochemical markers (Ferritin, D-dimer, CRP, LDH, CBC), that was also correlated with age, severity, weight, anxiety, decreased diet, BMI and sex of patients.

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***Correspondence** | Aneela Ahmed Tagar, Institute of Biochemistry, University of Sindh, Jamshoro, Sindh, Pakistan; **Email:** scientistaaneelaahmed@gmail.com

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Keywords | CRP, LDH, CBC, RT PCR, GAD, PHQ, BMI



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Introduction

Coronaviruses (CoV) are a large family of viruses that cause illnesses ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-CoV) and severe acute respiratory syndrome (SARS-CoV). A novel coronavirus (nCoV) is a new strain commonly known as COVID-19. It has killed and infected millions of people all over the globe. Since 2001, three deadly coronaviruses have emerged; SARS-CoV 1 2002-2003, MERS 2012-2013 and the current one SARS-CoV 2. This virus is causing an economic burden and posing a serious threat to the health of the public. Unfortunately, there is no cure for novel coronavirus and no medical treatment till now. Therefore, it is crucial to gain a deeper understanding of coronavirus and prepare a defense line against its deadly impacts of it among survivors (Zhu *et al.*, 2020).

A novel coronavirus belonging to subgenus Beta emerged from Wuhan city of China at the end of December 2019, hence, it is also known as COVID-19. This virus spread quickly throughout the globe. Therefore, the world health organization (WHO) declared COVID-19 as a global pandemic on March 12, 2020. According to WHO the main course of transmission of COVID-19 is person to person, particularly those directly exposed to the virus. Thus, health officials recommend washing hands many times a day and keeping a social distance of at least 1 m (arm's length). Furthermore, the virus is transmitted by direct or indirect exposure.

There are three main ways of virus transmission. At first, a person comes in contact with an infected person or touches a contaminated surface. Another is direct transmission of air droplets containing virus from an infected person. Last, via airborne transmission of droplets and particles present in the air (Jayaweera, 2020).

The affected patients show the highest ferritin, D-dimer, C-reactive protein (CRP) and Lactate Dehydrogenase (LDH) levels (Huang *et al.*, 2020). This work explains variations in complete blood count (CBC) (Palladino, 2021) and their clinical significance in COVID-19 patients. Additionally, Troponin levels remain elevated in patients with COVID-19 and it is linked with fatal results.

Likewise, patients recovering from COVID-19 are at high risk of malnutrition and psychological issues after the condition improves (Ismael *et al.*, 2021). Moreover, there are features observed in COVID-19 patients which lead towards bodyweight loss and eventually results in malnutrition (Bedock *et al.*, 2020).

Materials and Methods

This study is based on patients diagnosed with COVID-19 in the recent past and facing certain health problems even after recovery. It includes a total of 65 patients randomly selected from the Civil hospital Hyderabad and the LUMHS Jamshoro. Then a standard questionnaire was developed containing all necessary items. Including personal information, health history, symptoms of the disease and its severity linked with depression and anxiety.

Patients with positive COVID in the recent past and with age 18 years to 58 years were included in the study. However, the Patients with currently positive COVID-19, subjects less than 18 years of age and above 58 and patients suffering from chronic illnesses such as asthma, cardio vascular disease (CVD), etc were excluded from the study.

The venous blood samples of 3 ml were collected from subjects in EDTA anticoagulant and plain serum tubes. Then the samples were placed in iceboxes and were sent to the laboratory for the detection of Bio-Markers such as Ferritin, LDH, CRP and D-dimer on automated abbot Alinity Elisa and Cobas 6000 through the standard method. The high levels of these markers show severity of the infection and create more chances of health consequences after getting recovered from COVID-19.

Anxiety and depression

Anxiety was detected through GAD (Generalized Anxiety Disorder) scale and for depression PHQ-2 (Patient Health Questionnaire-2) score was used. GAD-7 contained 7 questions with four-point scale: 0: not at all, 1: several days, 2: more than half of the days, and 3: nearly every day. While PHQ-2 contained only 2 questions with same four points as in GAD-7.

GAD-7

- Score 0-4: Minimal Anxiety
- Score 5-9: Mild Anxiety

- Score 10-14: Moderate Anxiety
- Score greater than 15: Severe Anxiety
- PHQ-2 If the score is 3 or greater patient is considered to be depressed (BA, 2020).

Statistical analysis

The data collected from the study were analyzed using statistical package for social sciences (IBM SPSS statistics 20). Absolute frequencies, percentages, mean and standard deviation (SD) were calculated. Moreover, the variables were compared using t-test and to interpret the recovered data. All the variables which were significant at $p \leq 0.005$ were clinically relevant.

Results and Discussion

During study total of 65 patients were diagnosed with COVID-19 in the recent past. Baseline demographic characteristics are summarized in Table 1. In brief, the majority of patients 23(35.4%) were in age group 37-47 years, 37 (58.5%) were male and 50 (76.9%) were married. Moreover, the majority belonged to the medical field 18(27.7 %).

Table 1: Demographic data of survivors frequency (n) and percentage %.

Variables	Number (n)	Percentage of patients (%)
Age group		
15-25	16	24.6
26-36	17	26.2
37-47	23	35.4
Gender (M13, F10)		
Occupation Housewives(8)		
Co-morbidities (7)		
48-58	9	13.8
Gender		
Male	37	58.5
Female	28	41.5
Marital status		
Single	15	23.0769
Married	50	76.923
Occupation		
Medical field	18	27.7
Private workers	11	16.9
Public Workers	9	13.8
Students	11	16.9
Housewives	16	24.6

Moreover, the greater number of the patients were physically active 61.5% with 76.9% having no regular exercise. Only 18.5 % of patients reported co-morbidities such as diabetes in 12.3% with one exceptional case in which diabetes developed after the occurrence of COVID-19. The majority of the patients were symptomatic categorized as mild 35.4% moderate 36.9% and severe 27.7 %. Consequently, the isolation period in more patients (70.8%) was 15 to 20 days (Table 2)

Table 2: Lifestyle, Loss of appetite, loss of weight, and BMI of patients.

Variables	Frequency (n)	Percentage of patients (%)
Lifestyle		
Sedentary	25	38.5
Physically active	40	61.5
Regular exercise		
No	50	76.9
Yes	15	23.1
Loss of appetite		
No	26	37.7
Yes	39	56.5
Loss of weight		
Decreased	48	69.6
Same	7	10.1
Increased	10	14.5
BMI of the patients before COVID		
Underweight	2	3.1
Normal	29	44.6
Overweight	17	26.2
Obese	17	26.2
BMI of patient after COVID		
Underweight	8	12.3
Normal	31	47.7
Overweight	13	20
Obese	13	20

Malnutrition and weight loss

We interviewed patients to search about factors which led towards malnutrition, we found 60 % of patients with loss of appetite. Weight reduced in 30.8 % survivors. Moreover, the BMI of the patients before COVID-19 in 3.1% patients was underweight, whereas the BMI of the patients after the COVID-19 in 12.3% was underweight. Hence, it showed a reduction in weight of the subjects and could be a cause for malnutrition (Table 2).

Symptoms of the infection

The symptoms were divided into three categories; most common symptoms, less common symptoms and severe symptoms. From the most common symptoms 78.5% of patients showed fatigue (Figure 1), whereas for less common symptoms 72.3 % faced headache (Figure 2), however, for severe symptoms 69.2% suffered for Dyspnea (Figure 3).

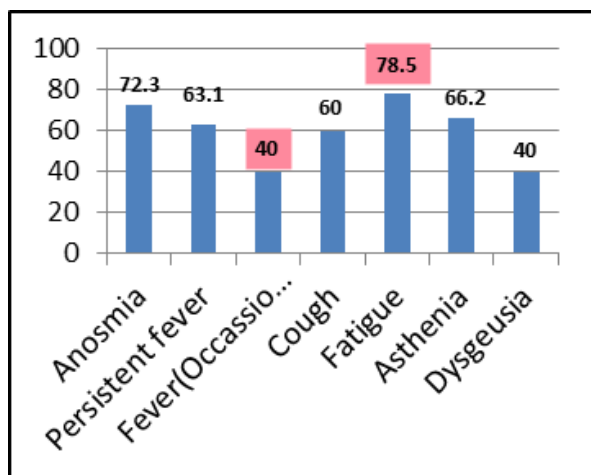


Figure 1: The most common symptoms of COVID.

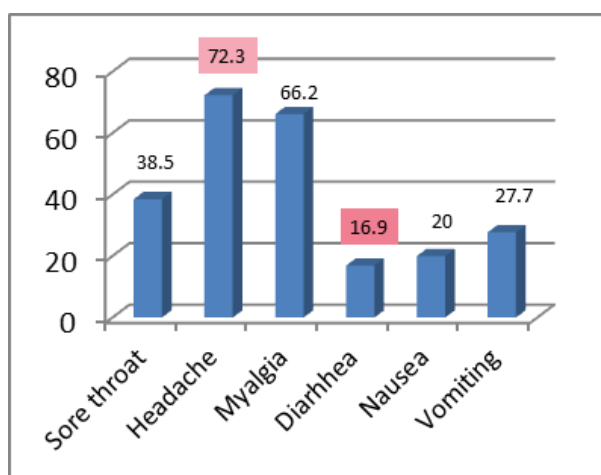


Figure 2: Less common symptoms of COVID.

Emotional problem, anxiety and depression among the patients

There were 69.2 % (Mean±SD = 1.6000±1.36702) of the patients who had emotional problem during COVID-19. Similarly, 81.6 % patients faced anxiety and 32.3% of patients suffered from depression.

Biochemical parameters

In 12.3 % of patients ferritin levels remained increased after the COVID-19, D- dimer also remain increased in 12.3 % of patients, and moreover, CRP levels were raised in 40 % of patients. However, in less number of patients (9.2 %) augmented LDH levels were seen.

CBC was slightly altered in 26 subjects (37.7%) of patients, however, Troponin levels were seen normal among survivors.

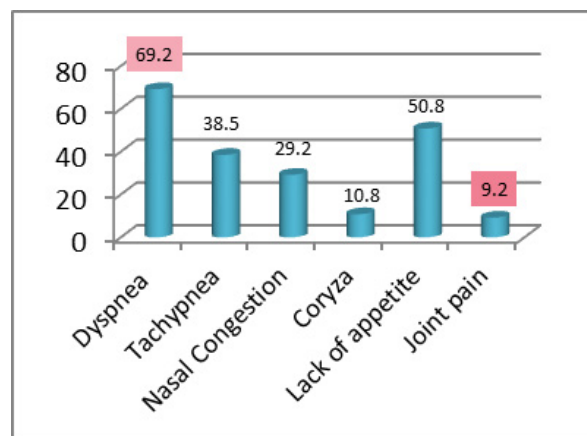


Figure 3: Severe symptoms of COVID.



Figure 4: Anxiety level in patients (%).

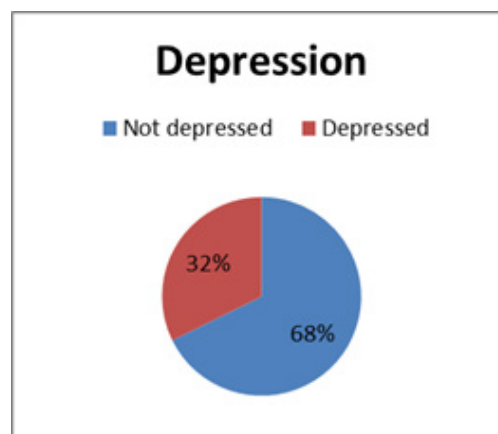


Figure 5: Depression in patients (%).

Comparison of biomarkers with different variables

With the increased age among patients, the C-Reactive Protein was increased. There was also correlation of severity of infection, reduced weight, anxiety levels and decreased diet with all parameters (i.e., Ferritin, D-dimer, CRP, LDH). Similarly, there was correlation of CBC alterations with reduced weight, decreased diet and BMI of the patients.

Table 3: Co-morbidities and severity of infection in COVID-19 patient.

Co-morbidities	Frequency (n)	Percentage (%)
No	53	81.5
Yes	12	18.5
Diabetes		
No	57	87.7
Yes	8	12.3
Diabetes after COVID		
No	64	99
Yes	1	1
Acute COVID-19 severity		
Mild	23	35.4
Moderate	24	36.9
Severe	18	27.7
Isolation time period		
One week or less	16	24.6
15 to 20 days	46	70.8
Above 20 days	3	4.6

Table 4: Biochemical parameters.

Variables	Frequency (n)	Percentage %
Ferritin levels after recovery from COVID?		
Normal	53	76.8
Increased	8	11.6
Decreased	4	5.8
D-dimer levels after recovery from COVID?		
Normal	57	82.6
Increased	8	11.6
C-reactive protein levels after recovery from COVID?		
Normal	39	56.5
Increased	26	37.7
LDH levels after recovery from COVID?		
Normal	59	85.5
Increased	6	8.7
CBC		
Normal	24	34.8
Slight alteration	26	37.7
Severe alteration	15	21.7

We aimed to study whether the symptoms of COVID-19 infection pose health risks such as malnutrition, anxiety, depression or any other. The majority of the patients were from the age group (37-47) years. The present study shows the correlation with the previously conducted research that there was more number of males than females as in other studies (Lipsky and Hung, 2020). The greater number

of the patients belonged to medical profession and they got infected due to their frequent exposure to the virus as was also reported by Bandyopadhyay (2020). The patients, who were physical active did not develop severe COVID-19 infection as compared to physically inactive subjects (Cunningham, 2021).

Table 5: Biomarkers correlated with age, severity, weight, anxiety levels, decreased diet and sex of patients.

Biomarkers	Mean±SD	Significance
Ferritin		
Age	1.2462±0.55988	0.68
Severity	1.2462±0.55988	<0.001
Weight	0.4154 ± 0.74775	<0.001
Anxiety levels	2.0462 ± 1.35128	<0.001
Decreased diet	0.6000 ± 0.49371	<0.001
Sex of patients	1.43 ± 0.499	0.02
D-dimer levels		
Age	1.1231 ± 0.33108	0.27
Severity	1.1231±0.33108	<0.001
Weight	0.4154 ± 0.74775	<0.001
Anxiety level	2.0462±1.35128	<0.001
Decreased diet	0.6000±0.49371	<0.001
Sex of patient	1.43±0.499	<0.001
CRP		
Age	1.4000±0.49371	<0.001
Severity	1.4000±0.49371	<0.001
Weight	0.4154±0.74775	<0.001
Anxiety level	2.0462±1.35128	0.001
Decreased diet	0.6000±0.49371	<0.001
LDH		
Severity	1.0923±0.29171	<0.001
Weight	.4154±0.74775	<0.001
Anxiety level	2.0462 ± 1.35128	<0.001
Decreased diet	0.6000±0.49371	<0.001
Sex of patients	1.43±0.499	<0.001
CBC		
Weight	0.4154±0.74775	<0.001
Decreased diet after COVID?	0.6000±0.49371	<0.001
BMI of patient after COVID?	2.4769±0.95374	<0.001

A great number of patients faced the loss of appetite as reported by the other conducted studies (Alexander, 2021), whereas weight and BMI were also reduced, hence, the subjects suffered from malnutrition after COVID-19, it also showed correlation with earlier published data (Dorothee, 2020). In the current study, the majority of the patients faced fatigue (Iqbal and

Lam, 2021), headache (Tuğçe, 2020) and dyspnea (Iqbal and Lam, 2021) being the most common, less common and severe symptoms, respectively. Findings of the present study revealed that the patients suffered from anxiety (81.6 %) and faced emotional problems as well during the COVID (69.2 %) this is similarly confirmed in the Brazilian study during 2021 (Ismael *et al.*, 2021), the major reason behind the anxiety was associated with isolation and fear created among the masses. Moreover, Biomarkers remained increased [Ferritin, D-dimer, CRP and LDH] in patients and these are correlated with age, severity, weight, decreased diet and BMI of the patients which is similar to the findings of Lino (2021). This rise in biomarkers is due to the inflammatory conditions in the body. Furthermore, this research showed slight alterations in CBC (complete blood count) of the patients as reported by (Palladino, 2021) which are associated with the weight, decreased diet after COVID and BMI of the patients after COVID while it had no link with the severity of infection as reported by the data published in the year 2021 (Palladino, 2021). To some extent all markers are linked to severity of infection. At last, the troponin levels were found normal among survivors as it is linked with severity of infection and mortality due to myocardial injury (Gregorio, 2019).

Conclusions and Recommendations

Coronavirus impacts overall health of patients including; long lasting symptoms, malnutrition, anxiety, depression and alterations in Biochemical markers (Ferritin, D-dimer, CRP, LDH, CBC) correlated with age, severity, weight, anxiety, decreased diet, BMI and sex of patients. The present study shows that there were more male infected than females, the majority of patients were from age group (37-47) years, the greater number of patients belonged to medical field. This study shows that there is significant association of physical activity with the severity of infection, BMI of patients after COVID, anxiety levels, depression and diabetes. Findings of the present study revealed that the patients suffered from anxiety, depression and faced emotional problems as well during the COVID. At last, the Troponin levels remained normal in survivors.

Novelty Statement

This study will be beneficial for medical sciences and awareness among medical staff to know the common

post COVID infections, help in diagnosis and understanding the post COVID related infections eventually the treatment will easily be carried out. The study This study is not being carried out in Pakistan. will.

Author's Contribution

Aneela Ahmed Tagar: Conception, design, data analysis and Interpretation. Drafting and revising of manuscript.

Mahvish J. Channa: Helped in conception and design, drafting of manuscript. Revising of manuscript.

Kanwal Ahmed Tagar: Drafting of manuscript.

Kainat Kaka: Drafting of manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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