Prevalence of long COVID-19 syndrome among general population in Diyala, Iraq

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Abstract

Background: Long COVID-19 describes a variety of symptoms and complications that persist beyond 12 weeks continue after contracting COVID-19 develop after recovery. It has become a significant public health concern. **Aims:** This study aimed to investigate the prevalence in Diyala province, and its association with epidemiological and clinical variables. **Methods:** A cross-sectional study was conducted during the period extended between 1st September 2024 to 31st January 2025 in Baquba Teaching Hospital during the period extended between 1st September 2024 to 31st January 2025. The questionnaire designed to assess demographic characteristics, COVID-19 symptoms, and persistent symptoms was used for data collection from participants aged 18 and older who had contracted COVID-19. **Results:** The prevalence of long COVID-19 was found to be 62.82 %. The most commonly reported persistent symptoms were persistent fatigue and exhaustion (33.3%), hair loss (33.3%), difficulty concentrating and mental fog (26.9%), irregular heartbeat (25.6%) and loss or weakness of smell or taste, also (25.6%). Risk factors for Long COVID-19 included female sex (OR=3.375, 95% CI =1.29-8.8, P=0.013), chronic disease (OR=4.7, 95% CI = 1.02-22.3, P=0.047), reinfection (OR=4.521, 95% CI = 1.66-12.29, P=0.003), severe COVID-19 symptoms (OR=6.233, 95% CI = 1.52-25.49, P=0.011), and type of care in previous infection (OR=9.310, 95% CI = 1.98-43.65, P=0.005). Long COVID-19 has significantly impact on the ability to work or study (P=0.42), daily activities such as shopping and self-care (P=0.19) which significantly increased with physical or mental activity (P=0.002). **Conclusion:** This study provides valuable insights into the prevalence, characteristics, and risk factors of Long COVID-19. The findings highlight the need for targeted interventions and support services to manage Long COVID-19. Healthcare providers should be aware of the risk factors and persistent symptoms associated with Long COVID-19 to provide

Keywords: Long COVID-19, Post COVID-19 syndrome, SARS-CoV 2

1. Introduction:

With the emergence of coronavirus disease 2019 (COVID-19) pandemic, caused by the highly contagious severe acute respiratory syndrome coronavirus 2 (SARS CoV-2), the world has faced a public health crisis with millions of infected people and deaths worldwide (Al-Taie *et al*., 2022). The causative virus, SARS-CoV-2, is a novel β-coronavirus (Lu *et al*., 2020). It is a member of the Coronaviridae family, which is known for its capacity to cause a wide range of illnesses, from common colds to severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) (Ishrath *et al*., 2021).

The clinical manifestations of COVID-19 individuals range from asymptomatic to severe pneumonia that may worsen into potentially fatal diseases, particularly in those with comorbidities (Jangnin *et al*., 2024). In several investigations, the acute presentation of a patient infected with COVID-19 has been thoroughly documented (Shi *et al*., 2020). Most of the patients arrived with fever, sore throat, cough, shortness of breath and chest discomfort. Furthermore, multiorgan involvement is documented (Gavriatopoulou *et al*., 2020). The majority of individuals have moderate acute illness. However, around 20% of infected individuals require hospitalization, and approximately 5% need critical care with mechanical or non-invasive breathing (Wu and McGoogan, 2019).

A common misconception is that all COVID-19 patients will recover in two weeks, however this isn't always the true. Nevertheless, even in individuals with modest symptoms who did not need hospitalization, a protracted recovery of symptoms has been reported (Outhoff, 2020; Nath, 2020). Yes, little is known about the long-term effects of COVID-19 infection.

"Long COVID" (LCS) or "Post-acute COVID-19 syndrome," (PACS) as defined by the WHO, is the persistence or development of symptoms in individuals with a history of suspected or confirmed SARS-CoV-2 infection that lasts more than 12 weeks (WHO, 2022a). These symptoms typically begin three months after the onset of COVID-19, persist for at least two months, and cannot be attributed to an alternative diagnosis. However, Multidisciplinary Collaborative Group for the Scientific Monitoring of COVID-19 (GCMSC) proposed the phrase "Post-Acute COVID-19 Syndrome" encompasses two situations that are not mutually exclusive; Long-COVID when symptoms that start or last beyond 4 weeks after infection, and Sequelae which refers to irreversible damage of organs longer than 12 weeks of infection (GCMSC, 2021).

There is a marked variation in the presentation of LCS or PACS syndrome. The commonly reported symptoms include non-specific symptoms such as fatigue, shortness of breath, and headache (Pavli *et al*., 2021). More severe symptoms may involve renal failure, pulmonary fibrosis, myocarditis, and arrhythmia (Kamal *et al*., 2021). Reports also indicate cognitive and psychological effects such as attention deficit, sleep disturbance, depression, and post-traumatic stress disorder (Halpin *et al*., 2021).

This wide range of symptoms made the reported prevalence varied between populations across the globe. Approximately, LCD affects 10-30% of COVID-19 survivors, translating to millions worldwide (WHO, 2022b). More specifically, data on the prevalence of LCD in hospitalized and non-hospitalized patients has been reported in several studies. According to estimates, the incidence is 50–70% of hospitalized patients, 10–30% of non-hospitalized cases (Bull-Otterson *et al*., 2022; Ceban *et al*., 2022), and 10–12% of vaccinated cases (Al-Aly *et al*., 2022; Ayoubkhani *et al*., 2022).

The exact mechanisms of this LCS presentation are obscure. Previous investigators hypothesized alteration of the immune system, prolonged inflammatory response to the SARS-CoV-2 residual, re-infection or reactivation of pre-existing chronic SARS-CoV-2 infection (Peluso *et al*., 2022), and unrepaired tissue damage as possible mechanisms that might explain LCS presentation (Merad *et al*., 2022)

The LCS poses a significant challenge to global healthcare systems and economies, as there are no evidence-based international guidelines to follow yet, emphasizing the need for comprehensive understanding, effective management, and supportive care. In Iraq, studying the prevalence of LCS is crucial for understanding the pandemic's impact on the country's healthcare system and population. Iraq's fragile healthcare infrastructure and limited resources make it essential to identify the scope of the problem. Therefore, this study was designed to assess the prevalence of LCS among Iraqi survivors, associated factors, and comprehensive outcomes.

2. Methods:

2.1. Study design and data collection:

A cross-sectional study was conducted in Baquba Teaching Hospital during the period extended between 1st September 2024 to 31st January 2025. The target population consisted of adults aged ≥ 18 years who had contracted COVID-19 attending Baquba Teaching Hospital for

any cause from the general population. Subjects who met the inclusion criteria were invited to participate.

Data were obtained by a standardized structured interview questionnaire adapted by the supervisor and researcher to ensure validity and reliability through face-to-face interview with participants after obtaining their verbal informed consent.

The questionnaire was composed of three parts, the first part was related to sociodemographic data of participants like gender, age, education level, occupation, residence. second part was COVID-19 history section gathered data on COVID-19 diagnosis, symptom onset, severity of infection, care receiving and hospitalization. The last part was symptom assessment section evaluating the presence, severity, and duration of persistent symptoms.

2.4. Statistical analysis:

Utilizing the statistical software IBM SPSS V 29 (SPSS Inc., Chicago, IL, USA), the data was described and analyzed. Descriptive data were presented in measures of frequency, cross tabs and percentage.

To assess the association between independent factors (demographic characteristics, comorbidities history, and COVID-19 immunization history), with dependent variables (long COVID-19), analytical statistics were performed using the Pearson Chi-square test. Whenever applicable, Fisher's exact test was used; statistical significance was defined as a $P < 0.05$. Finally, analysis was performed by univariable and multivariable logistic regression between independent known variables and development of long COVID-19, a threshold of $P < 0.05$ was deemed statistically significant for the study.

3. Results:

3.1. Sociodemographic distribution of the participants:

A total of 78 participants were enrolled in this study. Of these 44 (56.4%) were females and 34 (43.6%) were males. The distribution of participants by age shows that the majority 34 (43.6%), were in the 18-29 age group followed by 24 (30.8%) were between 30-39 years. Smaller proportions were seen in the older age groups, with (15.4%), (6.4%), (3.8%) were in the 40-49, 50-59, and >60 age groups, respectively.

More than half of the participants had a bachelor's degree 46 (59.0%). The participation rate of those with higher and secondary education is almost equal, reaching 13 (16.7%) and 14

(17.9%) respectively. Furthermore, 2 (2.6%) of them were illiterate and 3 (3.8%) of them had primary education.

In terms of occupation, most participants were employees 47 (60.3%), while 16 (20.5%) being students, 8 (10.3%) working as laborers, and 7 (9.0%) categorized as non-workers.

The residence data shows that the majority of participants 62 (79.5%) reside in urban areas, while the remaining 16 (20.5%) live in rural areas.

The majority 57 (73.1%) of the participants had no chronic disease, table (1).

Table 1: Sociodemographic characteristics of the participants in the study (N=78)

Characteristic		N	%
Age	18-29	34	43.6%
	30-39	24	30.8%
	40-49	12	15.4%
	59-59	5	6.4%
	>60	3	3.8%
Sex	Male	34	43.6%
	Female	44	56.4%
Education level	Illiterate	2	2.6%
	Primary	3	3.8%
	Secondary	14	17.9%
	Bachelors	46	59.0%
	Higher	13	16.7%
Occupation	Student	16	20.5%
	Employee	47	60.3%
	Worker	8	10.3%
	Non-worker	7	9.0%
Residence	Urban	62	79.5%
	Rural	16	20.5%
Presence of chronic disease	Yes	21	26.9%
	No	57	73.1%

3.2. Prevalence of long COVID syndrome (LCS):

The results obtained during this study revealed that the prevalence of LCS was found to be 62.82 %, as shown in (Figure 1). Furthermore, the most commonly reported persistent symptoms were persistent fatigue and exhaustion (33.3%) and hair loss (33.3%), followed by difficulty concentrating and mental fog (26.9%), irregular heartbeat and loss or weakness of smell or taste (25.6%) each, (Figure 2).

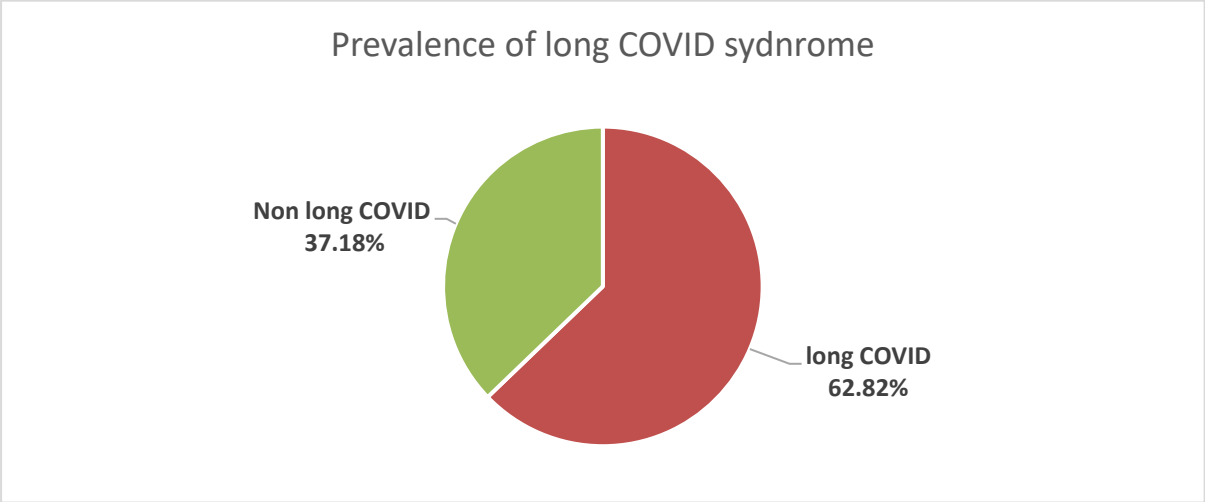


Figure 1: Prevalence of long COVID (LCS)

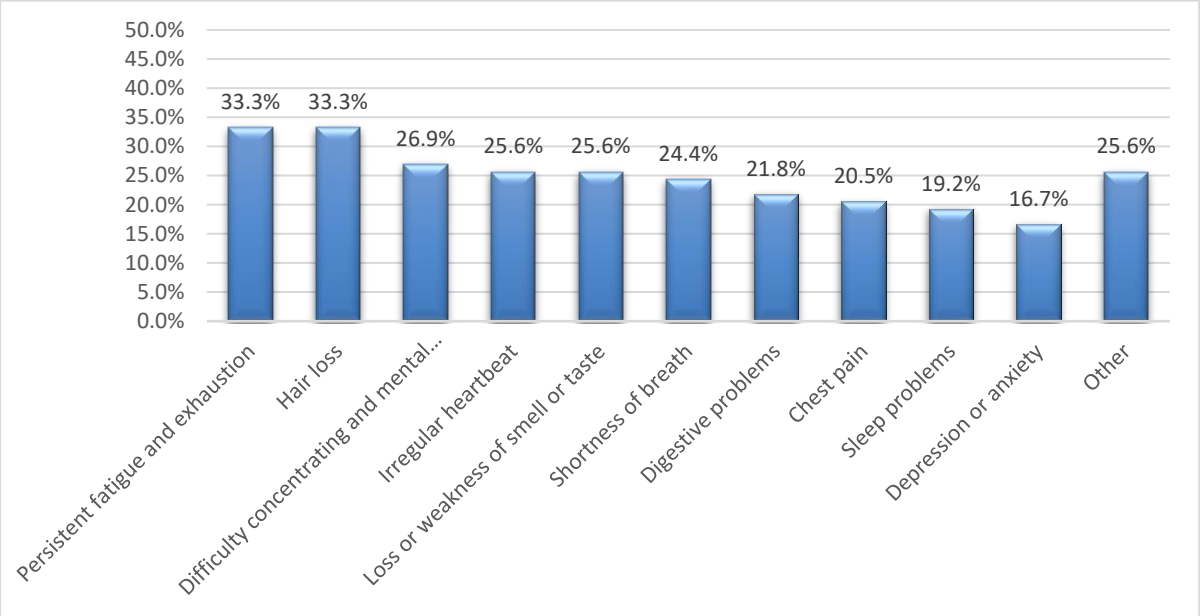


Figure 2: Long-COVID symptoms.

3.3. The distribution of long COVID (LCS) according to demographic and clinical characteristics:

Statistical significance was observed in several variables, including age, sex, chronic disease status, number of COVID infections, severity of previous infection, and type of care received, as denoted by p-values <0.05, as shown in table (2). Among age groups, the highest prevalence was seen among individuals aged 50-59 and above, 5 (100%) and 3 (100%) of participants, respectively, had LCS and none reported being unaffected. The P=0.035 indicated that the difference was statistically significant.

Regarding sex, females showed a significantly higher prevalence, with 33 (75%) participants experiencing LCS, compared to 11 (25%) who did not. while among males, 16 (47.1%) participants had LCS compared 18 (52.9%) who did not, (P=0.011). Although urban residents were more affected, with 39 (62.9%) of participants reporting LCS, compared to 23 (37.1%) without, and 10 (62.5%) of participants from rural area, the difference was statistically insignificant (P>0.9).

A significant association was also found with chronic diseases, since 17 (80.9%) of participants experienced LCS versus 4 (19.1%) did not, and 32 (56.1%) of those who did not suffer from chronic disease, (P=0.44).

The frequency of previous COVID infections were strongly associated with LCS, since 31 (79.5%) of participants experienced LCS after two or more infections, compared to 18 (46.2%) who experienced LCS after one time, (P=0.002). The severity of previous infections was another significant factor, the prevalence of LCS among those who had moderate 26 (66.7%) or severe 17 (77.3%) COVID infections, was significantly higher compared to those with mild infections 6 (35.3%), (P=0.021). The type of care received during the previous infection also played a role. There was highly significant association with increased prevalence of LCS, since 20 (90.9%) of 22 hospitalized participants experiencing LCS, whereas 29 (51.8%) of home-care participants reported having LCS, (P=0.001).

Table 2: Prevalence of long COVID among general population (N=78)

Characteristic		Having long Covid syndrome				P Value
		Yes		No		
		N	%	N	%	
Age	18-29	16	47.1%	18	52.9%	0.035*
	30-39	18	75%	6	25%	
	40-49	7	58.3%	5	41.7%	
	59-59	5	100%	0	0.0%	
	>60	3	100%	0	0.0%	
Sex	Male	16	47.1%	18	52.9%	0.011*
	Female	33	75%	11	25%	
Residence	Urban	39	62.9%	23	37.1%	> 0.9
	Rural	10	62.5%	6	37.5%	
Any chronic disease	Yes	17	80.9%	4	19.1%	0.044*
	No	32	56.1%	25	43.9%	
Covid infection times	Once	18	46.2%	21	53.8%	0.002*
	≥ Twice	31	79.5%	8	20.5%	
	Mild	6	35.3%	11	64.7%	0.021*

Severity of previous covid infection	Moderate	26	66.7%	13	33.3%	
	Severe	17	77.3%	5	22.7%	
type of care did you receive during the previous infection	Home care	29	51.8%	27	48.2%	0.001*
	Hospital admission	20	90.9%	2	9.1%	

3.4. The factors associated with long-COVID symptoms:

Univariable and multivariable logistic regression analyses were performed to identify factors associated with long-COVID symptoms. Table (3) shows that the overall multivariable analysis confirmed the significance of sex, chronic disease, severity of previous infection, and type of care received during the prior infection as predictors of long COVID symptoms

Table 3: The factors associated with long-COVID symptoms using univariable and multivariable logistic regression analyses

Predictors	Univariable Logistic Regression				Multivariable Logistic Regression		
	Reference	OR	P Value	95% CI	OR	P Value	95% CI
Age	> 40	2.118	0.197	0.67-6.61	1.84	0.4	0.43-7.93
Sex	Male	3.375	0.013*	1.29-8.8	4.3	0.038*	1.08-17.09
Chronic disease	None	3.32	0.052	0.99-11.11	4.7	0.047*	1.02-22.3
COVID infection times	Once	4.521	0.003*	1.66-12.29	2.5	0.16	0.68-9.91
Severity of pervious infection (Moderate)	Mild	3.667	0.033*	1.10-12.13	6.27	0.039*	1.09-35.9
Severity of pervious infection (Severe)	Mild	6.233	0.011*	1.52-25.49	10	0.025*	1.34-74.73
Type of care in previous infection (Hospital admission)	Home care	9.310	0.005*	1.98-43.65	10	0.011*	1.6-59.8

3.5. Impact of Long COVID on Daily Life, Psychological, and Social Well-Being Among the General Population:

Results in table (4) shows the impact of LCS on daily life, psychological, and social well-being among the general population. Thirty-three (42.3%) of individuals with LCS reported a notable increase in the worsening of symptoms due to physical or mental activity, compared to 16 (20.5%) them who didn't, and only 9 individuals (11.5%) in the non-LCS group. This difference was statistically significant, with a p-value of 0.002. Regarding the ability to work or study, 28 (35.9%) individuals with LCS reported slight effects, 11 (14.1%) individuals reported moderate effects, and 2 (2.6%) individuals reported high effects. In contrast, among those without

LCS, 15 (19.2%) individuals reported slight effects, 1 (1.3%) individual reported moderate effects, and 2 (2.6%) individuals reported high effects, with a p-value of 0.042.

For daily activities such as shopping and self-care, 32 (41.0%) individuals with LCS reported that chronic fatigue or mental fog affected their ability to perform these tasks, while only 11 (14.1%) individuals without LCS experienced the same difficulty, yielding a p-value of 0.019. Regarding lifestyle changes, 24 (30.8%) individuals with LCS reported slight lifestyle changes, 14 (17.9%) individuals reported significant changes, and 11 (14.1%) individuals did not experience changes. In contrast, in the non-LCS group, 12 (15.4%) individuals reported slight changes, 2 (2.6%) individuals reported significant changes, and 15(19.2%) individuals did not experience changes, with a p-value of 0.011.

Psychologically, 24 (30.8%) individuals with LCS reported mild anxiety or tension, while 8 (10.3%) individuals reported constant depression or tension. A smaller number, 2(2.6%) individuals, reported severe psychological disorder. In the non-LCS group, 7 (9.0%) individuals reported mild anxiety, 3 (3.8%) individuals reported constant depression, and 1 (1.3%) individual reported severe psychological disorder, with a p-value of 0.049. Additionally, 34 (43.6%) individuals with LCS consulted a doctor or specialist regarding their symptoms, compared to 12 (15.4%) individuals without LCS, with a p-value of 0.015, (as shown in Table 3).

Table 4: Impact of Long COVID on Daily Life, Psychological, and Social Well-Being Among the General Population

Effect		Having long-COVID				
		Yes		No		P Value
		N	%	N	%	
Have you noticed that your symptoms get worse with physical or mental activity?	Yes	33	42.3%	9	11.5%	0.002*
	No	16	20.5%	20	25.6%	
How much did the symptoms affect your ability to work or study?	Not affected	8	10.3%	11	14.1%	0.042*
	Slightly affected	28	35.9%	15	19.2%	
	Moderately affected	11	14.1%	1	1.3%	
	Highly affected	2	2.6%	2	2.6%	
Does chronic fatigue or mental fog affect your ability to perform daily activities such as shopping, self-care, etc.?	Yes	32	41.0%	11	14.1%	0.019*
	No	17	21.8%	18	23.1%	
Did you have to change your lifestyle because of the symptoms?	Yes slightly	24	30.8%	12	15.4%	0.011*
	Yes significantly	14	17.9%	2	2.6%	
	No	11	14.1%	15	19.2%	

What is the psychological impact of persistent symptoms?	No psychological effect	15	19.2%	18	23.1%	0.049*
	Mild anxiety and tension	24	30.8%	7	9.0%	
	Constant depression or tension	8	10.3%	3	3.8%	
	Severe psychological disorder	2	2.6%	1	1.3%	
Have you consulted a doctor or specialist about the symptoms you are suffering from?	Yes	34	43.6%	12	15.4%	0.015*
	No	15	19.2%	17	21.8%	

4. Discussion:

This observational study sheds important light on the nature, the prevalence, and impacts of LCS on healthcare system in Iraq. To the best of our knowledge, this study represents the first of its sort in Diyala province.

The study revealed a significant prevalence of Long COVID, with 62.82% of respondents reporting persistent symptoms for 12 weeks or more following the first COVID-19 infection. Our finding was consistent with those obtained by previous studies. Results obtained by Asadi-Pouya *et al.* (2021) and Jangnin *et al*. (2024) showed that the prevalence of LCS was (62.3%) in Iran and (77.7%) in Thailand, respectively. In Iraq, many studies investigated the prevalence of LCS. In Basra the prevalence was 60% (Yousif *et al*., 2021), whereas, another study conducted in Duhok, Kurdistan region, came in contrary to the current results, they found that LCS prevalence was as low as 26.7% (Ahmed *et al*., 2023). Nonetheless, prevalence of LCS was found to be 43% worldwide, according to a meta-analysis and systematic review comprising 41 studies; the included studies varied widely, ranging from 9% to 81% (Chen *et al*., 2022). This variance in prevalence may be caused by the way in which LCS is defined and measured, differences in populations and methods used, and some studies reporting mixed data from hospitalized and non-hospitalized patients.

The most commonly reported persistent symptoms were chronic fatigue, hair loss, difficulty concentrating and mental fog, irregular heartbeat, and loss or weakness of smell or taste. Our findings were supported by previous studies stated that chronic fatigue, dyspnea, shortness of breath, chest pains, headaches, loss of smell or taste, and muscle and joint pain continued to be clinically significant among subjects survived from SARS-CoV infection, followed by

depression, anxiety, insomnia, itchy body, heart palpitations, tachycardia, anorexia, tingling fingertips, and brain fog (Garner, 2020; Bliddal *et al*., 2021; Khalaf *et al*., 2022; Jangnin *et al*., 2024).

Regarding age, our findings identified a significant association between individuals over 50 years of age and LCS (P= 0.035), which were in agreement with studies claimed that age was a significant risk factor for LCS (Yousif *et al*., 2021; Petersen *et al*., 2021). However, our logistic regression analysis identified a non-significant association between individuals over 40 years of age and LCS (P= 0.197). There is a claim says that higher age has been associated with increased severity of COVID-19 and a more prolonged persistence of post-COVID symptoms (Tsampasian *et al*., 2023). This may be due to the weak immune system associated with increasing age. Since, elderly people have unique immunological behavior, during aging their immune systems may experience a condition called "immunosenescence." This makes older people more vulnerable to prolonged COVID since it worsens "inflammaging" and the emergence of many comorbidities (Hu, *et al.,* 2023).

Another potential risk factor linked to increased prevalence of LCS was found to be sex. Compared to males, females had a significantly higher prevalence of LCS (P=0.011), logistic regression analysis revealed significant association (P=0.013). Similar findings have also been reported in the literatures (Yousif *et al*., 2021; Hawar & Dauod, 2022; Ahmed *et al*., 2023). In contrast, several other studies couldn't identify a significant correlation between the likelihood of acquiring LCS and female gender (Petersen *et al*., 2021; Jacobson *et al*., 2021). This may be the result of hormonal fluctuations, genetics, or the increased stress levels experienced by women.

There was a significant association between LCS and comorbidities. Findings of previous studies about the relationship between comorbidities and LCS have conflicted. Some studies have shown an increased in LCS with the presence of comorbidities (Iqbal *et al*., 2021; Ahmed *et al*., 2023), while others have found that comorbidities decrease LCS (Garcia-Pachon *et al*., 2021), Still other studies have found no correlation between the two (Asadi-Pooya *et al*., 2021; Yousif *et al*., 2021). Therefore, we need thorough, logical studies to clarify this correlation.

Finally, findings of table (2) and table (3) determine that there was a significant statistical association between LCS and times of COVID-19 infection, severity of infection and type of care received. These results supported by those obtained by previous study conducted in Baghdad which revealed a highly significant association between COVID-19 reinfection and vaccination with development of LCS (Majid *et al*., 2025). Moreover, early research shows an increasing risk

of long COVID sequelae after the second and third infection (Bowe *et al*., 2022). In the same context, López-López and his colleague (2023) concluded that disabling symptoms are presented in patients with LCS are higher in LCS hospitalized patients compared to LCS non-hospitalized patients.

Regarding the impact of LCS on the daily life of the participants, the results in table (4) reveals a significant effect of LCS on their ability to work or study and their ability to perform daily activities such as shopping and self-care. These findings are consistent with recent studies on individuals with long COVID symptoms. Participants reported that LCS negatively affected their social lives in many ways and made them inactive compared to pre-COVID-19 normal life (Shelley *et al*., 2021; Aghaei *et al*., 2022). In order to cope with the limitations imposed by COVID-19, most COVID-19 survivors developed coping mechanisms. This is frequently done without the assistance of a clinical support, who could have been helpful in offering psychological support and useful advice to improve recovery while avoiding cycles of recovery and exacerbation. Given the wide range of COVID-19 symptoms, including as neurological, gastrointestinal, cardiovascular, and respiratory problems, it is crucial that any future therapies be customized for each instance. However, at this stage, not much was known about COVID-19 recovery, or particular guidelines for physical activity.

Conclusion:

Our study identified a significant prevalence of LCS with chronic fatigue as the most commonly reported symptoms. Notably, LCS was significantly correlated with factors such as age, gender, chronic disease, severity of previous infection, and type of care received during the prior infection as predictors of LCS symptoms. Persistent COVID symptoms can seriously hinder people's ability to return to work, with significant psychological, social, and financial repercussions for the individual, their family, and society as a whole. It is now the time to address and reduce the impact of this second additional burden of COVID-19. Due to gaps in the research base, and the low certainty of the evidence currently available, further research is needed to determine the true burden of post COVID-19 condition in the general population and in specific subgroups.

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