

ORIGINAL ARTICLE

Quantifying the systemic and oral symptoms of Long COVID: A comprehensive cross-sectional survey analysis.

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ABSTRACT... **Objective:** To determine the frequency and pattern of systemic and oral manifestations of Long COVID. **Study Design:** Cross-sectional study. **Setting:** The study was conducted in Peshawar, Khyber Pakhtunkhwa, Pakistan. **Period:** January 2023 to June 2023. **Methods:** A total of 344 participants with a history of confirmed COVID-19 infection were included. Data were collected using a structured questionnaire modified from previously published Long COVID symptom checklists and validated through expert review. The questionnaire measured demographic characteristics, presence of persistent post-COVID systemic symptoms, and oral manifestations. Descriptive statistics were used to calculate frequencies and percentages. **Results:** The most commonly reported systemic symptoms were hair loss (48.3%), headache (43.6%), fatigue (38.1%), lack of concentration (34.3%), and muscle pain (33.7%). Common oral manifestations comprised loss of taste (28.8%), dry mouth (20.3%), mouth sores (19.5%), and swollen or bleeding gums (18.9%). Pattern analysis showed a predominance of neuro-systemic and general systemic manifestations, with hair loss, headache, fatigue, and lack of concentration forming the most common systemic cluster. **Conclusion:** Long COVID is associated with an extensive range of systemic and oral manifestations in this population, affecting individuals across different demographic groups. Identification of oral symptoms is also crucial and should be incorporated into post-COVID assessment and care.

Key words: Long COVID, Oral Manifestations, Pakistan, Post-COVID Syndrome, Systemic Symptoms.

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INTRODUCTION

Although the COVID-19 pandemic's effects have gradually subsided, a perplexing phenomenon known as "Long COVID" still persists and has threatened to obstruct many people's path to recovery. At first believed to primarily influence the respiratory system, COVID-19 has proven to have a wide range of effects. Even after the acute stage of the illness has passed, many persons still experience symptoms.¹ Long COVID, also known as post-acute sequelae of SARS-CoV-2 infection (PASC), post-COVID Syndrome (PCS), or COVID haul, was initially reported in the spring of 2020 during a survey of prolonged COVID-19 symptoms conducted by the Patient-Led Research Collaborative, a group of citizen scientists.²

Long COVID involves a variety of symptoms that extend beyond just acute respiratory issues. Multiple reports from several regions globally indicate that COVID-19 has numerous long-term

impacts on nearly all systems, including respiratory, cardiovascular, gastrointestinal, neurological, psychiatric, and dermatological systems.^{2,3} Earlier research indicated that individuals with mild illness or no symptoms during acute infection may still experience long-term symptoms, highlighting that the disease leads to more significant harm than what is evident in infected individuals.^{4,5} The most frequent symptoms following COVID include fatigue, shortness of breath, loss of smell and taste, chest discomfort, muscle pain, and sleep as well as mental health issues.^{4,6} Symptoms can persist for several months and interfere with work tasks and the quality of life for those impacted.⁷ Estimates of prevalence differ, but it is indicated that around 10–30% of non-hospitalized individuals suffer from enduring symptoms, whereas higher rates, reaching 60–70%, have been observed in hospitalized or severe cases.^{4,5,7}

Several oral manifestations have been documented,

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including dryness, ulcers, pigmentation alterations, and bleeding.^{8,9} These oral signs are seen in a notable proportion of patients, particularly among older adults and those with severe COVID-19, who display more extensive lesions.^{10,11} The causes of PCS found in the mouth may arise from several factors, such as stress, poor oral hygiene, vasculitis, systemic diseases, opportunistic infections, reinfection, or immune dysfunction.¹²

In Pakistan, many studies on COVID-19 have been carried out since its initial appearance. Although some recent studies have explored Long COVID, evidence is still scarce and inconsistent, especially concerning ongoing systemic and oral symptoms in the local population, particularly in Peshawar, KPK.¹³ Understanding these long-term consequences is critical, as oral and systemic post-COVID symptoms can significantly affect patients' quality of life, healthcare utilization, and overall recovery. Research in this field is essential for guiding clinical management and informing public health policies tailored to our local population. Furthermore, this study will contribute to the implementation of evidence-based guidelines for the recognition and management of Long COVID in the region. Therefore, we aimed to determine the frequency and spectrum of persistent systemic and oral manifestations of Long COVID among patients in Peshawar.

METHODS

This preformed online Questionnaire based; cross-sectional study was conducted on the population of Peshawar, Khyber Pakhtunkhwa from January 2023 to June 2023. The symptom questionnaire was developed based on previously published Long COVID studies, including the multisystem symptom checklist by Senjam et al. (2022).¹⁴ The tool incorporated questions assessing persistent post-COVID symptoms including the oral cavity, respiratory, cardiovascular, gastrointestinal, neurological, psychiatric, and dermatological systems. Validity of the questionnaire was assessed by relevant experienced clinicians. The questionnaire included a total of 24 questions including questions to measure long covid symptoms related to oral cavity, respiratory, cardiovascular, gastrointestinal, neurological, psychiatric, and dermatological

systems. All respondents provided digital informed consent before participating. Survey responses enclosed no personally identifiable information, and email addresses collected for survey distribution were coded as anonymized participant IDs. Using the WHO sample size calculation formula and assuming a 30% expected prevalence of Long COVID (Chen et al., 2022)¹⁵, with a 95% confidence level and a 5% precision level, the minimum sample size required was 323. Approximately 400 responses were recorded but the final dataset included 344 complete responses, meeting the required threshold. Those who met both clinical and laboratory criteria to diagnose SARS-COV2 and at least 6 weeks have passed since a laboratory confirmed negative result for SARS-COV2 were added in the study. All those who did not meet the inclusion criteria were excluded from this study. Also, the following responses were removed from the dataset: incomplete (those not reaching the end of the survey, $n = 25$), no illness onset date ($n = 8$), duplicate participants ($n = 23$).

All data was entered in the statistical package for social sciences SPSS (version 22) for statistical analysis. Descriptive statistics were applied for continuous variables and frequency and percentages for categorical variables. The ethical approval was obtained from the institution ethical committee under Ref No: RCD-010-22-239.

RESULTS

Table 1 describes the demographics and general characteristics of the participants. A total number of 344 participants completed this online Performa. The mean age of participants in this study was 45 ± 12 . The final analysis included 110 males (32%) and 234 females (68%). The preexisting conditions are mentioned as well. Out of 344 participants, 198 (57.6%) reported persistence of at least one Long COVID symptom following recovery. Among these, 116 (58.6%) were females and 82 (41.4%) were males.

Figure-1 summarizes the frequency and percentage of various systemic post-COVID symptoms reported by patients. The symptoms listed in the Figure-1 include headaches, breathlessness, chest discomfort, fatigue, heart palpitations, joint pain,

skin rashes, and many more. The Fig shows that the most reported post-COVID symptoms are loss of hair (48%), headache (43%) and fatigue, with 38.1% of patients experiencing this symptom.

TABLE-I	
General characteristics and demographics of patients	
General Characteristics and Demographics of Patients	Frequency (n), Percentage (%) Mean+SD (N=344)
Age in years	45+12
Gender	
Male:	110 (32%)
Female:	234 (68%)
Pre-existing conditions	
Asthma	32(9.3%)
Diabetes	11(3.2%)
Hypertension	30(8.7%)
Cardiovascular complications	5(1.5%)
Renal complications	4(1.2%)
Liver complications	2(.6%)
Arthritis	9 (2.6%)
HIV	0(0%)
Malignancy	2(.6%)
None	270 (78.5%)
Level of respiratory support in active phase of COVID	
Intubated/ventilation	1(0.3%)
CPAP	3(0.9%)
IV Steroids	50(14.5%)
None	297(81.3%)

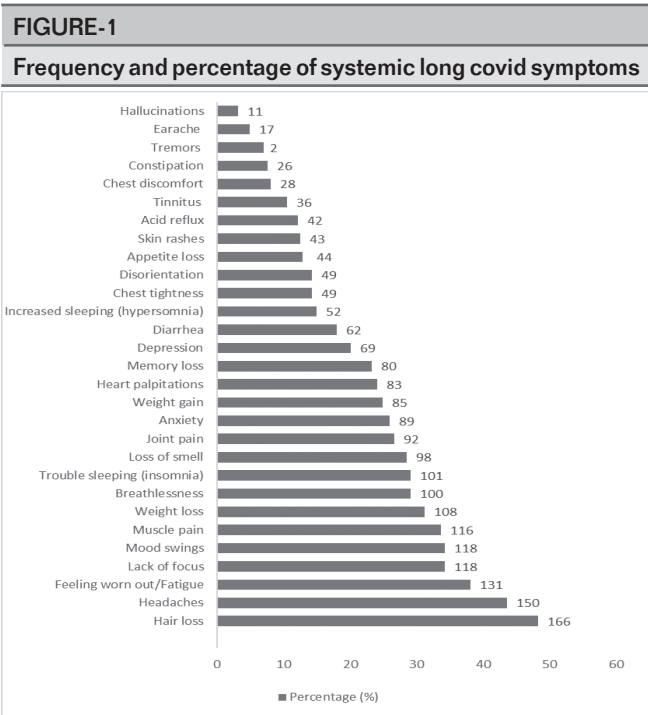
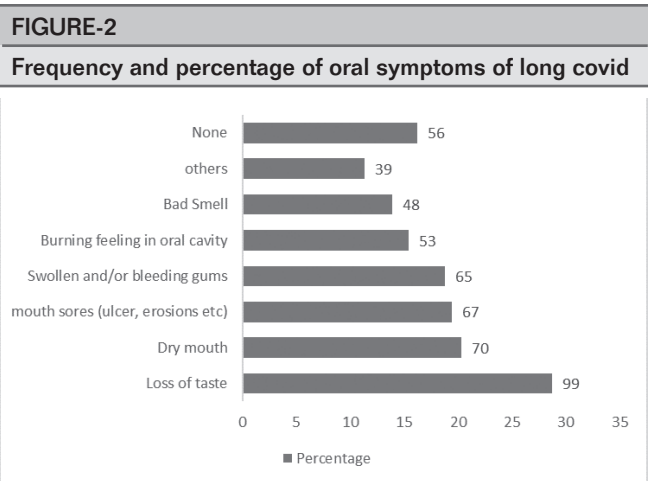


Figure-2 summarizes the oral symptoms of long covid with loss of taste as the most frequent symptom followed by dry mouth, mouth sores and bleeding gums.



*others: white/red patches, fissured tongue, loss of papillae on tongue

Pattern analysis (Table-II) revealed a distinct systemic–oral symptom trend in the post-COVID population. The dominant systemic cluster consisted of hair loss, headache, fatigue, and lack of focus, suggesting a neuro-systemic post-viral fatigue pattern. The oral symptom cluster demonstrated frequent loss of taste, dry mouth, and gingival bleeding, indicating persistent oral mucosal and salivary gland involvement.

TABLE-II	
Pattern Analysis of Long COVID Manifestations in the Study Population	
Pattern Analysis	Key Findings in the Present Study
Most common systemic symptoms	Hair loss → Headache → Fatigue → Lack of concentration
Most common oral symptoms	Loss of taste → Dry mouth → Gingival bleeding
System-based symptom clustering	Predominant involvement of neuro-systemic, general systemic, and oral health domains
Distinct population trends	High frequency of post-COVID hair loss and a notable prevalence of gingival bleeding
Overall pattern message	Long COVID in this population shows a dominant neuro-fatigue pattern with concurrent oral sensory and periodontal manifestations

DISCUSSION

The substantial rise in reported cases of patient COVID-19 symptoms following the resolution of the original infection has drawn significant attention to a condition known as “Post-COVID Syndrome.” PCS can cover a wide range of symptoms, ranging from mild issues like general muscle pain, fatigue, and dry skin to more severe neurological, cardiopulmonary, and musculoskeletal diseases similar as stroke, heart failure, myalgia encephalomyelitis, and habitual fatigue pattern.^{1,16}

The present study displays the frequency of long COVID symptoms, with hair loss, headache, fatigue, and lack of attention among the most repeated complaints. These findings contribute important substantiation from our local cohort and are partly harmonious with global literature. In UK a large analysis of nine public cohorts reported fatigue, shortness of breath, brain fog, memory loss, muscle pain, and difficulty concentrating as main long COVID symptoms.¹⁷ While our results align with these trends, neurological manifestations such as brain fog and memory loss were less noticeable compared to UK data, and headache and hair loss, were more prominent in our study. Such discrepancies may reflect differences in sample size, demographic characteristics, and follow-up duration. Moreover, Post-COVID hair loss is usually attributed to telogen effluvium triggered by systemic inflammation, febrile illness, psychological stress, and nutritional deficiencies following SARS-CoV-2 infection. Persistent headache may reflect ongoing neuroinflammatory changes, stress, and sleep disturbances, which have been broadly reported as common neurological sequelae of Long COVID.^{18,19}

A U.S. study similarly highlighted fatigue, muscle pain, and cognitive dysfunction as common sequelae, but also reported higher rates of mental health disturbances such as insomnia, anxiety, and depression.²⁰ Another study by Saad et al. followed patients after hospital discharge and found that fatigue, dyspnea, and muscle pain were the most persistent symptoms.²¹ The results are somewhat similar to those observed in this study. Furthermore, a survey led by the Patient-Led Research Collaborative identified cognitive dysfunction and sensory issues such as numbness and tingling as

common neurological symptoms, which were not as prominent in this study.²

In addition to systemic manifestations, our study highlights a range of oral symptoms including loss of taste, dry mouth, mouth sores, and gingival bleeding. These findings are consistent with global evidence showing that dysgeusia, xerostomia, and oral ulcerations are among the common oral sequelae of COVID-19.²² Compared to these studies, our findings also emphasize gingival bleeding, which was less frequently highlighted in global reports but may represent an important regional or underexplored feature. This underlines the need for further investigation into the oral health implications of long COVID, especially in dental and primary-care settings.

Overall, while there are differences in the prevalence and types of symptoms reported in different studies of long COVID, there is generally agreement on the most reported symptoms such as fatigue, shortness of breath, and cognitive difficulties (Table-III). It is important to continue studying and understanding the long-term effects of COVID-19 to provide suitable care and support for those who are experiencing ongoing symptoms.

This study is limited by its online, self-reported design, which may introduce selection and recall bias. Being cross-sectional, it reports symptoms at a single point in time and cannot describe their progression. Future research should emphasize on longitudinal follow-up to track symptom progression, include larger and more varied populations to improve generalizability. Also integrate objective clinical assessments (respiratory, neurological, and oral examinations) alongside self-reported data. In addition, developing multidisciplinary rehabilitation plans, covering systemic, psychological, and oral health aspects—will be vital to improve recovery and quality of life in Long COVID patients.

CONCLUSION

This study reveals that a considerable percentage of COVID-19 survivors experience persistent symptoms consistent with Long COVID, involving an extensive range of systemic and oral manifestations.

TABLE-III

Common reported systemic and oral symptoms by other studies

Study (year, location)	Most-common systemic symptoms (reported)	Most-common oral symptoms (reported)	Citation
Sudre et al., 2021 — UK	Fatigue, Headache, Shortness of breath (dyspnea), anosmia; predictors: female sex, older age, higher BMI	Not a focus; anosmia/ageusia (loss of smell/taste) recorded but specific oral lesions not reported	Sudre CH et al., Nature Medicine 2021. ¹⁷
Zhao et al., 2021 — China (hospital survivors)	Fatigue, Dyspnea, Muscle fatigue/myalgia, Insomnia; persistent pulmonary abnormalities reported	Not a primary outcome; taste/smell issues mentioned in some cohorts but oral lesions not emphasized	Zhao Y et al., one-year follow-up (2021). ²³
Darji et al., 2024 (systematic review) — global review on oral manifestations	Confirms systemic symptoms (fatigue, dyspnea, cognitive issues) as dominant features across studies	Reports oral findings across studies: loss of taste, xerostomia (dry mouth), oral ulcers, depapillated tongue, gingival bleeding	Darji Z et al., International Journal / PMC (2024). ²⁴

Hair loss, headache, fatigue, and cognitive difficulties were among the most commonly stated systemic symptoms, while loss of taste, dry mouth, oral ulcers, and gingival bleeding were recurrent oral complaints. These findings contribute important local data from Pakistan and highlight the importance of multidisciplinary approaches, including dental and primary care involvement, for the comprehensive management of Long COVID.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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2	Kanwal Nazir Arbab: Data analysis.
3	Gulmeena Masood: Data collection.
4	Sahibzadi Fatima Tariq: Writing.
5	Aliya Khan: Results, compilation, interpretation.