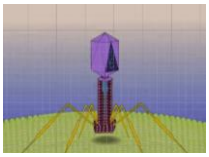

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A PERSPECTIVE OF POST COVID-19 SYMPTOMS AND MENTAL HEALTH

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ABSTRACT: *The symptoms of COVID-19 are acute and mostly people recovered from these after a specific time period. Although, a considerable percentage of patients around the globe were affected but Per our knowledge, study of post covid-19 associated mental health symptoms found scarce. The present study was organized to inspect the frequency of long-term anosmia, parosmia, odynophagia and associated mental health issues in the Pakistani population. A 5-month study was collected via an online questionnaire and phone calls among patients infected from March 2020 to February 2021. This study included a total of 124 patients with COVID-19 RT-PCR positive test. It was recorded by this survey that almost 13% of cases were with long-term anosmia, 81% with parosmia after short-term anosmia, and 79%with odynophagia. The level of depression and anxiety among patients suffering from long-term parosmia was significantly higher in participants than in anosmia. Most shockingly, a large fraction of respondents showed self-medication during the COVID-19 infection leading to the misuse of antibiotics, especially azithromycin, as medical treatment. To summarize, anosmia, parosmia and odynophagia are prominent, persistent symptoms of COVID-19 disease in the Pakistani population leading to associated mental health issues. There's a dire need for detailed research and proper awareness campaigns through different platforms about long-covid and medical treatment to avoid further health and psychological problems.*

Keyword: *Anosmia, long-COVID, Mental health issues, Odynophagia*

INTRODUCTION

The pandemic of coronavirus disease 2019 (COVID-19), triggered by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). This pandemic caused the most dramatic and devastating event of the century. Though another illness has erupted dramatically, it involves those suffering from post-covid symptoms, i.e., long haulers (Marshal, 2020; Outhoff,2020). The rate of long haulers is increasing daily as millions of people have been infected by SARS-CoV-2, and many more will continue to suffer it (Rubin, 2020).“Long COVID” is a disorder in which patients with COVID-19 have symptoms that last for a long time. The signs and symptoms can include tiredness, and breathing difficulties. The word “long COVID” for the post-covid symptoms is regarded as the first illness word patients devise through social media (Callard and Perego, 2021).

For months, patients who have recovered continue to experience various symptoms. Persistent symptoms of long COVID include: (i) Neurocognitive post-COVID symptoms: brain fog, cephalgia, delirium, peripheral neuropathy symptoms, dizziness, lack of devotion and confusion. (ii) Autonomic post-COVID symptoms: chest pain, tachycardia and palpitations. (iii) Gastrointestinal post-COVID symptoms: diarrhea, stomach/abdominal pain, nausea, anorexia. (iv) Respiratory post-COVID symptoms: general exhaustion, asthenia, dyspnea, cough, odynophagia, coryza. (v) Musculoskeletal post-COVID symptoms: myalgias, arthralgias. (vi) Psychological-related post-COVID symptoms: anxiety, post-traumatic stress disorder, insomnia and depression (Hao et al., 2020). (vi) Other symptoms: ageusia, anosmia, parosmia, phantosmia, skin rashes etc.

These post-COVID symptoms were recorded in both hospitalized and non-hospitalized patients. Both groups showed different ranges, which indicated that the symptoms started to appear after up to 1-3 months of COVID-19 infection (Carfi et al., 2020; Garrigues et al., 2020; Fernández-de-las-Peñas, 2021). All around the globe, a few studies have been conducted on long COVID so far, although most involve limited datasets, case studies, or depend solely on self-reports. In Italy, 179 hospitalized COVID cases were investigated using a questionnaire survey at an average of 60 days after the onset of symptoms. Only 12.6% were devoid of all COVID-19 signs, whereas 55% had more than three symptoms. Tiredness, breathlessness, joint

discomfort, and chest pain were the most prevalent complaints. However, one of the study's flaws was that it did not include any confirmed test cases (Carfi et al., 2020). The post-COVID syndrome has also been related to neurological and immunologic manifestations (Novak,2020). Recovered instances of COVID-19 have also been identified in Greece, with common recurrent symptoms, anosmia and dysgeusia (Konstantinidis, 2020). A survey study is carried out that showed prevalence of long covid symptoms among the patients such as disturbance in sleep, anxiety, muscle weakness, depression, distorted sense of smell or taste and fatigue (Huang et al., 2021).

In this study, we will focus on anosmia, parosmia, odynophagia and associated mental issues reported as the long COVID symptoms. In the presence of a real olfactory stimulus, parosmia is characterized as a change in olfactory perception. Patients with parosmia sometimes report smelling something burnt, nasty, or unpleasant (Bitter et al., 2011). The distortion typically occurs with familiar smells. Changes in taste and odor caused by Covid-19 cause significant disruptions in everyday life, affecting emotional well-being and health. Another condition, anosmia, is the medical term used to describe the absence of smell. “Long-term anosmia” can be defined as loss of smell for more than four weeks after the onset of symptoms and can persist for more than six months. Post-viral anosmia has been reported after HCoV-229E infection, and olfactory dysfunction continued for more than six months (Suzuki et al., 2007).Permanent anosmia has also been reported in patients who recovered from herpes simplex encephalitis (HSE) (Landis et al., 2010).Moreover, odynophagia refers to pain during some part of the swallowing process. Malignancies, foreign body absorption, mucosal inflammation and ulceration have all been linked to pain experienced during the oropharyngeal phase of swallowing (Resuli and Bezgal, 2022).

Self-medication, persistent symptoms, and associated mental health in patients infected with COVID-19 in Pakistan have never been studied. Due to the possible effects of long-term viral infection on mood, understanding the factors associated with depression and how people react to long COVID-19 is critical. This type of data could aid policy, prevention, and therapy endeavors. As a result, this study aims to investigate the long-term effects of COVID-19 infection on olfactory and gustatory functions in Pakistan. Moreover, odynophagia, depression and

anxiety related to long covid were also studied in this research.

MATERIALS AND METHODS

Study Participants

The clinical data of the patients who got recovered from the COVID-19 infection have been collected from different cities and areas of Pakistan. For the data collection, an interview via phone call and an online survey form/ questionnaire were conducted so that everyone could access it easily. Mainly major cities of Pakistan like Lahore, Faisalabad, Multan, Karachi, and Islamabad were targeted for the data collection as the recorded infection rate was high in these cities. However, we also received responses from other cities, which helped a lot in results prediction.

Inclusion Criteria

In this study, mainly those patients were included who got recovered from COVID-19 at least one month ago. As long covid is considered if symptoms persist for more than 4 weeks. In this study the inclusion criteria were age, ethnicity, previously confirmed SARS-CoV-2 infection (at least one month ago), positive RT-PCR test (if presenting within 7-10 days of symptoms onset) and a worldwide method of diagnosis of COVID-19,whose sample was taken specifically from upper respiratory tract or interior nasal swab was used for sampling, positive antibodies test after recovery (if presenting after 10 days), anosmia, parosmia and odynophagia.

Exclusion Criteria

Patients suffering from olfactory and gustatory dysfunction before COVID-19 infection, patients who were suffering from infection or were still admitted to hospital and ICU at the time of study were not considered, patients without laboratory-confirmed test or self-reported and those who were recovered just less than 3 weeks ago.

Study Design

The data were collected from the patients who could not fill out the form/read and write via phone calls through interviews. An online survey was created through Google Survey Forms, and a link was shared through different social media platforms so everyone could access it easily. In the questionnaire, different questions related to age, ethnicity, long term/acute anosmia, severity of taste disorder (parosmia), odynophagia, anxiety, depression due to olfactory dysfunction and duration and treatment received (multivitamins, antibiotics, and other medicines), other ENT (ear, nose, and

throat) symptoms were included to check the severity of long covid in study population.

Participants were queried about how many days they had been undergoing COVID-19 symptoms in relation to their COVID-19 disease course. The participants were then questioned to rank their symptoms of reduced sense of smell and taste, change in olfactory perception, painful swallowing and blocked ears on a scale from 0-5. Six different options from 0 to 5 representing level of severity of the symptom/ disorder were given in the questionnaire for each question. 0 (no),1 (mild), 2 (mildly moderate),3 (moderate),4 (moderately severe), 5 (severe). According to this scale, responses were then categorized into two groups i.e., cases and controls. Cases were considered those rated symptoms from 1-5, while those rated 0 were taken as non-cases/controls.

Moreover, the study participants with the symptoms of long covid (anosmia, parosmia and odynophagia) were separated from those individuals who did not report any symptoms mentioned above although they suffered through the COVID and dually proved by PCR test; these study participants were labeled as controls. In the survey, questions related to parosmia, and anosmia were added to check the level of persistence of parosmia and anosmia and level of anxiety and depression due to this persistence in patients. Questions related to odynophagia were added to check its persistence level only. Different questions related to medical treatment were also added to find medicines used by the patients during infection and mode of prescription (prescribed by a doctor or self-taken.

Statistical Analysis

The results were analyzed with student's t-test and analysis of variance (ANOVA) for different study population groups, where applicable. P values of 0.05 were considered statistically significant. All these statistical analyses were performed using Graph Pad Prism 6.0 software.

RESULTS

For the presented study, a total of 124 patients with suspected COVID met the inclusion criteria and were recruited. The study participants with the symptoms of long covid (anosmia, parosmia and odynophagia) were separated from those individuals who did not report any symptoms as mentioned above. However, they suffered through the COVID and dually proved by PCR test, and these study

participants were labeled as controls. The male and female ratio of study participants was 47% and 53%,respectively. These study participants were stratified into three age groups, i.e., 18-35 years (80%), 36-50 years (13%) and above 50 years (6%). Study participants were included from different localities; however, 80% of participants were based in the Punjab province (Table I) – which was severely affected by Covid-19.Theratio of male and female study participants with the significant difference among different age groups is shown below in fig. 1. The number of female participants is more than males in the 18–35-year age group than in other age groups.

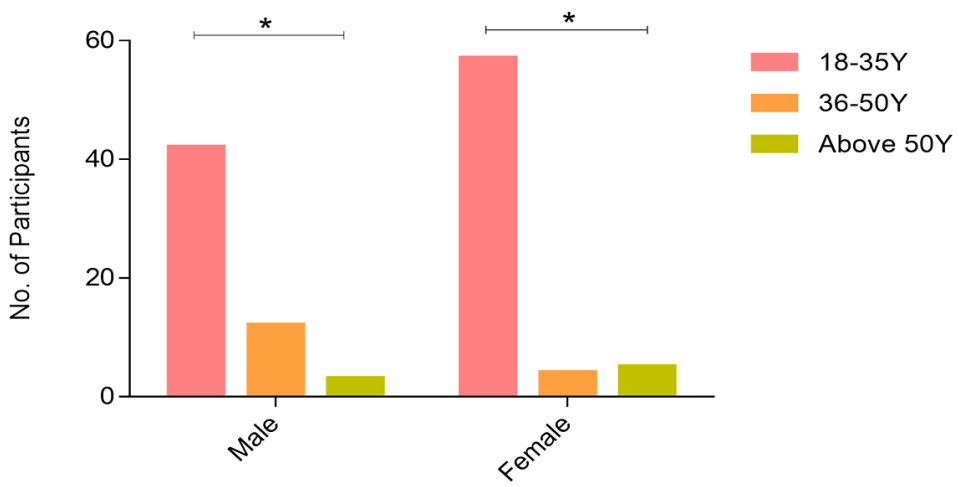

Fig. 1. A Ratio of male and female study participants among different age groups. Significance was determined by One-Way ANOVA * significant difference ($p<0.01$).

The characteristics of the study population are summarized in Table I. Per the survey questionnaire; diabetes was the most prevalent comorbidity reported by the study participants i.e., 5%. Followed by hypertension, as 2% of study participants reported chronic kidney disease (CKD-2%) and acute bronchitis (1%). Although obesity is an important factor to induce anosmia and parosmia, however, due to certain limitations regarding the study population, unfortunately we could not consider obesity as a prevalent comorbidity factor. A higher percentage was suffering from pollen allergy (6%).

Table I: Population characteristics.

No. of total participants	N= 124 (%)
Gender	
Male	47%
Female	53%
Age Grouping	
>18 Y	1%
18 – 35 Y	80%
36 – 50 Y	13%
Above 50 Y	6%
Province	
Punjab	80%
Sindh	11%
Baluchistan	3%
KPK	3%
Gilgit Baltistan	2%
Co-morbidities	
Hypertension	5%
Diabetes	2%
Chronic Kidney Disease (CKD)	2%
Acute Bronchitis	1%
Others	3%
Allergies	
Pollen Allergy	6%
Acute Rhinitis	1%
Hypo-Lactasia	1%
Senses Regaining Groups	
7 days – 1 month	61%
1 month – 2 months	3%
Not regained yet	13%
Partially regained senses	3%

Those who did not feel anything or were asymptomatic or covid positive at the time of study	19%
Onset of Parosmia Groups	
After 1 – 3 weeks of recovery	46%
After 1 – 2 months of recovery from infection	10%
Who felt Parosmia for less than 1 week	44%
Kinds of Smell felt by patients during Parosmia	
Rotten onion, rotten meat, burning smell and petrol like smell	40%
Other non-specified smells	38%
Without Parosmia	22%
Parosmia felt by	
Occasional	35%
During Specific Events	46%
Without Parosmia	19%

Anosmia (Loss of smell and taste) Vs Parosmia (Change in olfactory perception)

We first determined the depression level due to anosmia; study participants were categorized into controls (non-cases), and cases were compared. The degree of depression was assessed by asking direct questions related to depression regarding long-term anosmia and parosmia in patients. As this was a small-scale pilot study, simple questions were asked by participants. As well as the study questionnaire was discussed with the team of medical doctors from the Allama Iqbal Memorial Teaching Hospital, Sialkot, Pakistan and Fatima Jinnah Medical University, Lahore, Pakistan. The cases with anosmia showed significantly higher depression levels than the control group (Fig. 4a). However, according to Table I, 13% of the participants are those who did not regain their sense of smell yet and suffering from long-term anosmia. The level of anosmia was higher in females, although it was non-significant. Still, the overall analysis showed that more male participants were suffering from long-term anosmia than females (Fig. 2a) and depression due to the persistence of anosmia (Fig. 2b).

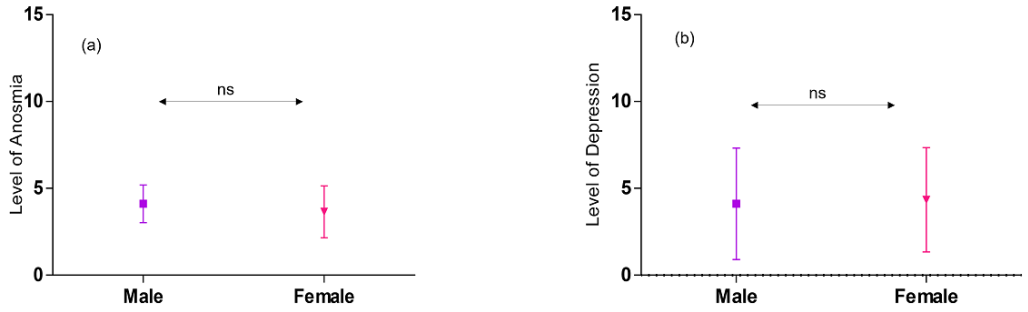

Fig. 2:Effect of anosmia in Covid-19 recovered patients. (a) Level of anosmia among male and female participants (b) Effect of anosmia on depression level among male and female participants. Significance was determined by unpaired t test showing non-significant results.

Next, we sought to determine the effect of parosmia on depression levels. The participants with parosmia showed significantly higher depression levels due to long-term post-parosmia than the control group (Fig. 4b).Among male and female participants, the statistical analysis showed a non-significant result for the level of parosmia. However, the level of parosmia among male participants (Fig. 3a) was higher than that of females, and the depression level was also higher in males non-significantly than in females (Fig. 4b).

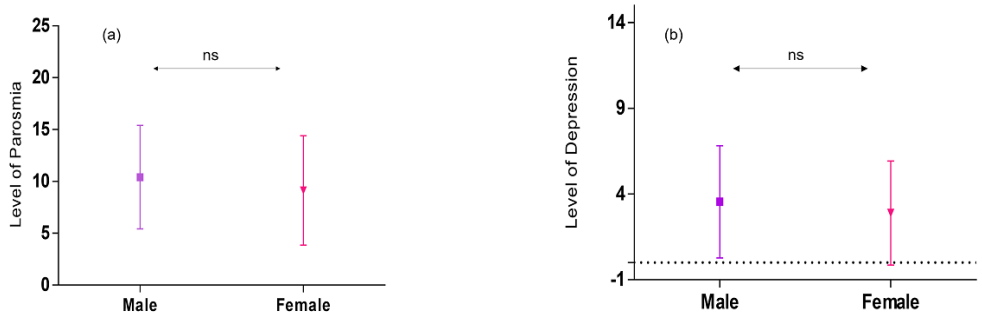

Fig. 3. Effect of parosmia in Covid-19 recovered patients. (a) Level of parosmia among male and female participants (b) Effect of parosmia on depression level among male and female participants. Significance was determined by unpaired t test, showing non-significant results

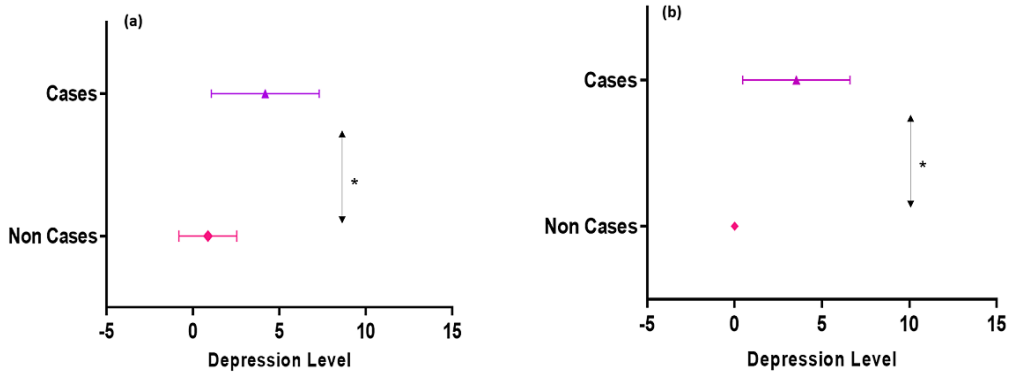

Fig. 4. Effect of olfactory dysfunction on mental health in Covid recovered patients. (a)Effect of post-COVID anosmia on depression level. (b) Effect of post-COVID parosmia on depression level. Significance was determined by unpaired t test * significant difference ($p<0.01$).

It is also worth mentioning that 13% of patients showed long-term anosmia, and 81% of patients showed long-term parosmia just after short-term anosmia as shown in Table I. Patients who initially had anosmia had lower odds of developing parosmia when their RT-PCR test was positive. By comparing the depression level among case groups of both parosmia and anosmia, the depression level among patients suffering from anosmia is significantly higher than those in parosmia patients. In case-group patients, anosmia (olfactory dysfunction)was the first symptom in our population. The timing of parosmia's onset coincided with other symptoms in the subjects. The mean time of parosmia onset concerning other symptoms was after 1-3 weeks ($\pm$ 5). 40% of the patients were suffering from different kinds of smell i.e., rotten onion, rotten meat, burning smell, petrol-like smell due to long-term parosmia in specific timing (Table I), which is playing an important role to increase depression.

1.4 Odynophagia (Painful swallowing, itchy and blocked ears)

To analyze the level of long-term odynophagia among recovered covid 19 patients, Covid-19 recovered patients were compared with the control group. 20% were in the control group, and 80% were reported as cases. Out of these 80% cases, 39% were male, and 41% were female participants suffering from odynophagia as a long covid symptom (Fig. 5b).The recovered patients showed a significantly higher rate of odynophagia compared to the control

group (Fig. 5a). The level of depression due to odynophagia was not analyzed in the study participants due to lack of awareness regarding odynophagia in study population.

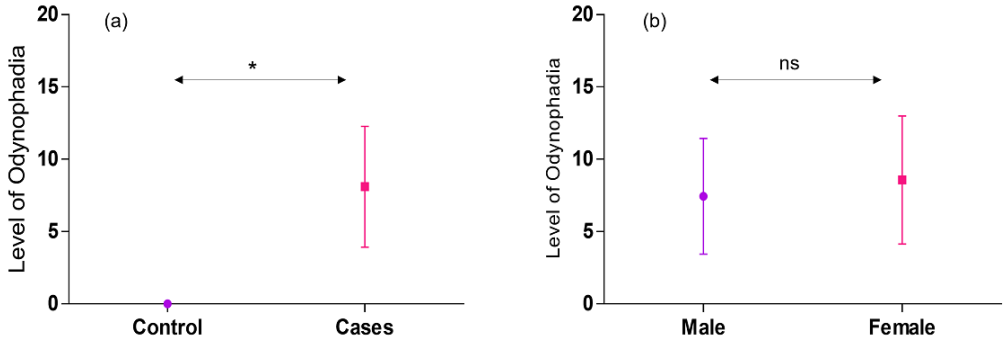

Fig. 5. Level of post-covid odynophagia in covid recovered patients. (a) Level of post-COVID odynophagia among control and cases participants. Significance was determined by unpaired t test * significant difference ($p<0.01$). (b) Level of odynophagia among male and female participant. Significance was determined by unpaired t test * showing non-significant results.

1.5 Treatment

The study participants for this particular analysis are different from the previous one as only 68 participants reported using antibiotics and multivitamins as treatment as shown in Fig. 6. Out of these 68 participants, 91% were those who used WHO (world health organization) recommended antibiotics (Azithromycin and Amoxicillin) (shown in fig. 6) as a treatment of COVID-19 infection for 3-7 days when after the onset of symptoms (56%) but 35% were those who used these antibiotics more than 7 days. 87% of patients used multivitamins (Cac1000 plus, Surbex-Z) for 3-15 days (46%) and 10% used more than one month as shown in Table II. The treatment was taken by patients during the first days of COVID-19 and this treatment was taken to avoid chest infection and to reduce the chances of secondary infections.

Table 2II: Treatment for Covid-19 patients

	N=68 (%)
Used Antibiotics?	
Yes	91%
No	9%
Duration of taking antibiotics	
3-7 Days	56%
More than 7 days	35%
Used Multivitamins?	
Yes	87%
No	13%
Duration of taking multivitamins	
3-15 days	46%
Up to 1 Month	35%
More than 1 month	10%

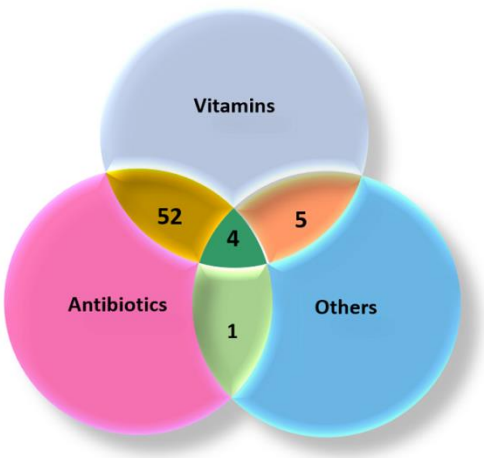

Fig. 6: WHO recommended medical treatment taken by covid-19 patients during infection

DISCUSSION

Anosmia (loss of smell and taste) is a proven indicator of the COVID-19 infection for the diagnosis of infection. Most of the patients suffering from olfactory and gustatory dysfunction due to COVID-19 infection recovered within four weeks, i.e. 79% of total participants (Hopkins et al., 2020). However, some patients reported long term COVID-19 smell and taste disorders months after getting infected (Hopkins et al., 2020). In this perspective, we organized this study to inspect the frequency of long term olfactory and gustatory dysfunctions (anosmia and parosmia), laryngeal disorders (odynophagia), and check the level of depression in Pakistani population due to these long-term disorders. A 5-month study was organized via online questionnaire and phone calls among those patients who got infected from March 2020 to February 2021. During this period, a high rate of COVID-19 has been detected among the patients reporting sudden loss of smell and taste (Lechien et al., 2020; Li et al., 2021). Based on survey results, patients with mild to moderate infection showed anosmia, parosmia and odynophagia as prevalent long-term symptoms. Counting anosmia, parosmia and odynophagia as prevalent symptoms of COVID-19 infection in Asia, only a few studies have been found so far. In Asia, only one study reported hyposmia (reduced sense of smell and taste) as a symptom of COVID-19 infection (Mao et al., 2020).

Loss of smell and taste drastically influences the patient's life. For an average person it is very difficult to imagine life without the sense of smell and taste (Hummel and Nordin, 2005). Post viral loss of smell and taste can be caused by different viruses like rhinovirus, parainfluenza virus and coronavirus (SARS CoV-2) (Mao et al., 2020). This post viral loss of smell can be due to different processes other than impediment of olfactory tissues by suggesting a particular empathy for olfactory neuroepithelium of these viruses. Our data showed that 13% of the patients were suffering from long-term anosmia i.e., they have not regained their senses of smell and taste yet showing a higher rate of depression due to continuous loss of senses of smell and taste. As per negative impacts of anosmia on the study participants lives, 10% showed reduced interest in food and drink. Different researchers have reported the long term anosmia in their 21%, 15% and 69% study participants (Blomqvist et al., 2004; Nordin et al., 2011). The key risk linked with the loss

of smell is failure to detect the smell of gas, fire or smoke which can affect a patient's safety. Furthermore, other than infection of olfactory neurons, olfactory dysfunction (reduced sense of smell) in COVID-19 might be mediated by inflammatory blockage of the olfactory cleft or infection of non-neuronal supporting cells of the olfactory epithelium, and any such etiology for smell loss might produce depressive symptoms. However, as the global health community is working to identify and understand the pathophysiology of COVID-19, one fascinating possibility of worth mentioning is whether chemosensory impairment and depressed mood are strongly influenced by direct viral pathogenesis.

Long term COVID-19 in participants higher rate in youngsters (as shown in Fig. 1) also have been observed in this study. Our data showed that 81% of the participants suffered from long-term parosmia. In a recent study, parosmia has been listed in category of long COVID which is increasing in patients so rapidly (Di et al., 2022).The sparking effects of parosmia in participants recorded were mainly cooking, eating hot meals, change in bathroom smells and body smell illustrating unbearable smells like burning smell, petrol like smell, rotten onion, rotten meat etc. As a result, a severely reduced quality of life was recorded as study participants with parosmia moaned of anxiety, depression, impairment of eating experiences, loneliness, and relationship problems. Interestingly, as per survey results, the level of depression was higher in patients suffering from parosmia than anosmia (Fig. 4). Moreover, a study from Europe has revealed that parosmia is causing distress in people's lives in different ways including change in lifestyle, perception to food and increased anxiety due to not being able to eat finely (Walker et al., 2022).Most reports have concentrated on quantifying olfactory impairment irrespective of the fact that there have been numerous studies on COVID-19-related olfactory impairment. Anecdotal reports of parosmia documented in numerous investigations estimated the prevalence of COVID-19-related parosmia during the course of the disease range from 7.8% to 32.4%. In comparison to patients with quantitative olfactory impairment only, individuals with parosmia have more severe symptomatology, a longer time course, and implications for quality of life. This information is lacking in prior investigations (Lerner et al., 2022; Parma et al., 2020).

Together with anosmia and parosmia patients could be frightened regarding consuming risky nutrients. The better standard to assess for depression involves neuro imaging and possible changes in the brain during the pandemic. This can be a future research direction. This study did not use a validated questionnaire to assess depression such as the depression, anxiety and stress scale (DASS-21) that was used by a study in Asia (including Pakistan) (Wang et al., 2021). This study mainly used self-reported questionnaires to measure psychiatric symptoms and did not make a clinical diagnosis. The gold standard for establishing psychiatric diagnosis involved structured clinical interview and functional neuroimaging (Husain et al., 2020; Husain et al., 2020; Ho et al., 2020).

Odynophagia is also one of the persistent symptoms of Covid-19. Different symptoms like ear blockage, sore throat, painful throat, difficult swallowing, and itchy ears showed persistence over 4 weeks in 80% of study participants (Fig. 5). In a Mexican population-based study, odynophagia was listed as primary long term covid-19 symptom as almost 35.2% study population reported this symptom (Martinez-Fierro et al., 2021). However, due to lack of awareness in our study population, participants revealed that they did not take it seriously and related these symptoms with the seasonal changes.

According to our survey results, the high percentage of relatively young participants with higher percentage of females than males with persistent anosmia, parosmia and odynophagia specifically in the absence of nasal blockage is important to note. Although our results were insignificant, the number of infected female study participants was higher than that of males (Fig. 1). The age group reported in our study was younger (mean age 35 years) than patients in the past reported for having post viral olfactory dysfunction, as the 56.7-58.5 years was the mean age in earlier reports (Whitcroft et al., 2017). It shows that anosmia and parosmia related to COVID-19 seems more common among the younger population (Haehner et al., 2020). By evaluating results, this was noticed that young age had no impact over recovery time. One more thing important to note is that mostly participants were from Punjab showing a higher rate of long term COVID-19 infection symptoms (Table I). One of the reasons for this could be the highest

number of populations in Punjab compared to other regions in Pakistan.

The recovery of anosmia, parosmia and odynophagia is one of the hottest questions of the day. Though our findings are still preliminary, but it is it is worth noting that at least 46%-50% of participants managed to recover from anosmia, parosmia and odynophagia within two weeks after the onset of common symptoms (fever, dry cough, loss of smell and taste, sore throat, headaches, body pain, fatigue etc.). By survey results, we have assessed that almost 64% of patients have persistent long-COVID-19 symptoms. Correspondingly, some patients have reported recovering their sense of smell but not their sense of taste and likewise. Logically, as per previous observations, there is an expectation that many of these patients will recover from the persistent symptoms over the weeks or years (Lerner et al., 2022).To sum up, this study evidently endorses the latest statements of many doctors across the world that in COVID-19 patients, olfactory and gustatory functions might be impaired due to infection causing long term symptoms.

Antibiotic misuse during the COVID-19 pandemic can be characterized in several forms: overuse, inappropriate dosage, wrong combination, and incorrect diagnosis. World health organization (WHO) has recommended the medical treatment to treat covid-19 infection for a specific period (3-7 days). But as per survey results, 56% of participants used medication (antibiotics and multivitamins) without any doctor's prescription (Table II). As per result, 35% of participants used antibiotics (especially azithromycin) for more than 7 days, leading to adverse side effects including anosmia and parosmia. A survey has shown the chemosensory side effects of azithromycin as anosmia and parosmia in COVID-19 patients. They also reported that the excessive use of anti-depressants like ACEIs and ARBs are also leading cause of worsening the anosmia and parosmia in COVID patients. Another study revealed that 13% of their study participants were suffering from long term anosmia and parosmia due to misuse of drugs and medicines during covid infection (Ahmed et al., 2022, Fang et al., 2020; Ferraro et al., 2019). As per our survey results, the issue of self-medication (antibiotics) is common among our population, leading us towards many other upcoming health issues, including antibiotic resistance against microbial diseases, long term anosmia and parosmia. Furthermore, in the early period of the current crisis,

social media promoted azithromycin as a part of COVID-19 treatment program. Another key factor in the overuse of antibiotics during this pandemic is the use of chloroquine (or hydroxychloroquine) in combination with azithromycin. This was based on a study with serious methodological flaws that garnered much media attention and led to the false belief that it could effectively treat COVID-19 (Gautret et al., 2020).

Although the specific reason and relation between COVID-19 and long-term consequences is unknown, some doctors believe it could be due to virus-induced inflammation or a reveal of an underlying illness. A lot is still a mystery regarding the long-term effects of COVID-19, but efforts are underway. For individuals who have healed from COVID-19 but still have health concerns, it will take longer to figure out what comes next. After recovering from COVID-19, many prominent medical centers are creating specialist clinics to treat people who have persistent symptoms or illnesses. Many support groups on different social media platforms are available for such patients. Internet cognitive behavioral therapy (I-CBT) is the most evidence-based treatment for patients suffering from different disorders due to long COVID-19, including depression, anxiety, bipolar disorder, eating disorders and schizophrenia etc. in this pandemic. It is a cost-effective method and can be easily accessed by anyone anywhere and anytime (Zhang and Ho, 2017; Soh et al., 2020).Preventing infection with the corona virus in the first place is the best strategy to minimize post-COVID-19 problems. The most efficient approaches to avoid catching COVID-19 infection are practicing corona virus safety measures and getting a COVID-19 vaccine as soon as it is accessible to you.

CONCLUSION

Long term COVID-19 is linked to a considerably higher risk of depression and anxiety. According to our results, a long term reduced sense of smell and the accompanying diminished sense of taste is most strongly associated with higher rates of depression and anxiety among COVID-19 patients, especially in youngsters. These higher levels of depression and anxiety among youngsters due to long covid are alarming and need further research to reduce these rates. Installing professional interdisciplinary post-COVID health centers in Pakistan is essential to provide personalized care regarding depression and anxiety.

Finally, further research on therapeutic approaches for patients with post-COVID syndrome in Pakistanis clearly needed.

Declarations

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethics approval and consent to participate

This study was approved from the Ethics Review Committee, University of Management and Technology, Lahore.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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RZ, ZA and SA QS conducted the study, written the manuscript; KF and MA analyzed the results of the study and MZ outlined, supervised the writing, analysis of the manuscript.

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Copyright Statement

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