HEALTH AND WELL-BEING OF LONG COVID PATIENTS IN ERNAKULAM DISTRICT OF KERALA

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By

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CERTIFICATE

I hereby certify that the dissertation entitled **"HEALTH AND WELL-BEING OF LONG COVID PATIENTS IN ERNAKULAM DISTRICT OF KERALA"** prepared and submitted by Ms. Feba George is an original research work carried out under my guidance and supervision.

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DECLARATION

I hereby declare that this research work entitled **"HEALTH AND WELL-BEING OF LONG COVID PATIENTS IN ERNAKULAM DISTRICT OF KERALA"** is an original research work carried out by me under the supervision and guidance of Dr. Rashmi H Poojara, Assistant Professor, Department of Home Science, St. Teresa's College (Autonomous), Ernakulam.

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Date:

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Feba George

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CHAPTER 1

INTRODUCTION

In late December 2019, an outbreak of an unknown disease called pneumonia of unknown cause occurred in Wuhan, Hubei province, China. The outbreak has spread substantial to infect 9720 people in China with 213 deaths and to infect 106 people in 19 other countries up to 31 January 2020. Several independent laboratories identified the primary agent of this unusual pneumonia as a new coronavirus a few days later (Lu *et al.*,2020). The World Health Organization has temporarily designated the causal virus as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and the corresponding infected disease as coronavirus disease 2019 (COVID-19).

The initial clinical sign of the SARS-CoV-2-related disease COVID-19 which allowed case detection was pneumonia. More recent reports also describe gastrointestinal symptoms and asymptomatic infections, especially among young children (Chan et al.,2020). Observations so far suggest a mean incubation period of five days and a median incubation period of 3 days (range: 0–24 days) (Guan, 2020). The proportion of individuals infected by SARS-CoV-2 who remain asymptomatic throughout the course of infection has not yet been definitely assessed. In symptomatic patients, the clinical manifestations of the disease usually start after less than a week, consisting of fever, cough, nasal congestion, fatigue and other signs of upper respiratory tract infections. The infection can progress to severe disease with dyspnoea and severe chest symptoms corresponding to pneumonia in approximately 75% of patients, as seen by computed tomography on admission Pneumonia mostly occurs in the second or third week of a symptomatic infection. Prominent signs of viral pneumonia include decreased oxygen saturation, blood gas deviations, changes visible through chest X-rays and other imaging techniques, with ground glass abnormalities, patchy consolidation, alveolar exudates and interlobular involvement, eventually indicating deterioration. Lymphopenia appears to be common, and inflammatory markers (C-reactive protein and proinflammatory cytokines) are elevated (Christian, 2020). Most people infected with the virus will experience mild to moderate respiratory illness and recover without requiring special treatment. However, some will become seriously ill and require medical attention. Older people and those with underlying medical conditions like cardiovascular disease, diabetes, chronic respiratory disease, or cancer are more likely to develop serious illness. Anyone can get sick with COVID-19 and become seriously ill or die at any age. The virus can spread from an infected person's mouth or nose in small liquid particles when they cough, sneeze, speak, sing or breathe. These particles range from larger respiratory droplets to smaller aerosols. It is important to practice respiratory etiquette, for example by coughing into a flexed elbow, and to stay home and self-isolate until you recover if you feel unwell (WHO,2020).

Comorbidities include chronic lung illness, cardiovascular pathologies, hypertension, renal disorders, diabetes mellitus, and obesity are linked to greater morbidity and death in coronavirus disease 2019 (COVID-19) (Garg *et al*.,2019). COVID-19 deaths, on the other hand, are typically caused by a final homeostasis dysregulation induced by cardiac, circulatory, renal, and/or metabolic consequences in addition to pulmonary injury. Despite the fact that sympathetic activation is one of the specific characteristics of most of the above comorbidities and could have a detrimental effect on COVID-19 patients, attention has been focused on the mechanisms involved in the comorbidity-induced increase in morbidity/mortality, the potential role of the sympathetic nervous system has not yet been considered.

COVID-19 pandemic not only adversely affected the physical health of individuals, but also brought forth significant changes in their lifestyle (Dimple *et al.*,2021). Due to the consistently growing number of confirmed cases and to avoid overwhelming health systems, WHO and public health authorities around the world have been acting to contain the rapid spread of the COVID-19 outbreak, with primary measures focusing on social distancing, self-isolation, and nationwide lockdowns (Achraf *et al*.,2020). Although recognized with hygiene care as one of the most effective measures to curb the spread of disease, the weakening of social contacts can potentially result in a devastating loss of leisure and working hours, disruption of normal lifestyle, and generation of stress throughout the population (Hossain *et al*.,2020). As a result, anxiety, frustration, panic attacks, loss or sudden increase of appetite, insomnia, depression, mood swings, delusions, fear, sleep disorders, and suicidal/domestic violence cases have become quite common during lockdowns with helpline numbers being overloaded during the early months of the COVID-19 spread (Qiu *et al.,*2020).

During the COVID-19 epidemic, the European Sleep Research Society (ESRS) produced a document with information on sleep loss due to unprecedented changes in people's daily routines and house confinement, as well as recommendations for successful insomnia therapy (Altena *et al.*,2019). There are persons who, in addition to sleep loss, have various sleep disturbances, with SDB (Sleep Disordered Breathing) being one of the most common. SDB is a huge burden not only for the affected patients, but also for their close friends and family. SDB covers a wide range of conditions, but Obstructive Sleep Apnea (OSA) is by far the most common, affecting one billion adults aged 30 to 69 years around the world (Benjafield,2019). Sleep disorders occur due to a malfunction of its various regulatory mechanisms. Insomnia, the most common sleep-related complaint, is a multidimensional condition, reflecting the physical and mental state of an individual. It is defined as a difficulty in initiating, maintaining, and consolidating sleep or a worsened overall quality of sleep, leading to physical and mental damage. Depression and the widespread increase in anxiety are risk factors associated with the onset of insomnia. Excessive concern with the progress of the pandemic, their own health, or that of people close to them, and with financial aspects, in addition to social restrictions, collaborate to the impairment of sleep and, due to the role of sleep-in emotional stabilization, this can impair mental health even further (Tempesta *et al.*,2018).

Post-COVID conditions are a wide range of new, returning, or ongoing health problems that people experience after first being infected with the virus that causes COVID-19. Most people with COVID-19 get better within a few days to a few weeks after infection, so at least four weeks after infection is the start of when post-COVID conditions could first be identified. Anyone who was infected can experience post-COVID conditions. Most people with post-COVID conditions experienced symptoms days after their SARS CoV-2 infection when they knew they had COVID-19, but some people with post-COVID conditions did not notice when they first had an infection. There is no test to diagnose post-COVID conditions, and people may have a wide variety of symptoms that could come from other health problems. People who are not vaccinated against COVID-19 and become infected may also be at higher risk of developing post-COVID conditions compared to people who were vaccinated and had breakthrough infections. (CDC,2022).

The immune system protects the host from pathogenic organisms (bacteria, viruses, fungi, parasites). To deal with this array of threats, the immune system has evolved to include a myriad of specialized cell types, communicating molecules and functional responses. The immune system is always active, carrying out surveillance, but its activity is enhanced if an individual becomes infected. This heightened activity is accompanied by an increased rate of metabolism, requiring energy sources, substrates for biosynthesis and regulatory molecules, which are all ultimately derived from the diet. A number of vitamins (A, B_6, B_{12}, folate, C, D and E) and trace elements (zinc, copper, selenium, iron) have been demonstrated to have key roles in supporting the human immune system and reducing risk of infections. Other essential nutrients including other vitamins and trace elements, amino acids and fatty acids are also important. Each of the nutrients named above has roles in supporting antibacterial and antiviral defence, but zinc and selenium seem to be particularly important for the latter. It would seem prudent for individuals to consume sufficient amounts of essential nutrients to support their immune system to help them deal with pathogens should they become infected. The gut microbiota plays a role in educating and regulating the immune system. Gut dysbiosis is a feature of disease including many infectious diseases and has been described in COVID-19. Dietary approaches to achieve a healthy microbiota can also benefit the immune system. Severe infection of the respiratory epithelium can lead to acute respiratory distress syndrome (ARDS), characterized by excessive and damaging host inflammation, termed a cytokine storm. This is seen in cases of severe COVID-19. There is evidence from ARDS in other settings that the cytokine storm can be controlled by n-3 fatty acids, possibly through their metabolism to specialized pro-resolving mediators (Philip, 2020). While no foods or dietary supplements can prevent or cure COVID-19 infection, healthy diets are important for supporting immune systems. Good nutrition can also reduce the likelihood of developing other health problems, including obesity, heart disease, diabetes and some types of cancer. There is no evidence that COVID-19 can be spread through contact with food or food packaging. COVID-19 is generally thought to be spread from person to person. However, it’s always important to practice good hygiene when handling food to prevent any food-borne illnesses. (WHO, 2020).

AIM

The aim of the present study is to evaluate the health and well-being of long COVID patients in Ernakulam district of Kerala

BROAD OBJECTIVES

- To assess the general health profile of COVID patients
- To obtain an insight into health-related problems during and post-recovery

SPECIFIC OBJECTIVES

- To assess the nutritional status of Long COVID patients using Anthropometric assessment and Dietary Diversity Score.
- To evaluate the health and well-being of study subjects by assessing comorbidities, symptoms during COVID and the Long COVID period, as well as fatigue, stress, and insomnia.
- To compare the mean scores of Stress, Fatigue and Insomnia among subjects during COVID and Long COVID
- To find out the relationship between Stress and Insomnia among COVID patients

SIGNIFICANCE OF THE STUDY

Long COVID conditions are a wide range of new, returning, or ongoing health problems that people experience after first being infected with the virus that causes COVID-19. Many researchers have looked into COVID-19 patients, but just a few systematic studies have looked into the long-term effects of the virus. Many patients have not fully recovered, have not returned to their previous levels of work, and continue to suffer from substantial symptom burden. Most Long COVID patients were not hospitalized. It is important that the persistent symptoms of these people are acknowledged, and that society is made aware of this. Family members, employers, co-workers, and a multidisciplinary medical team should all provide them with unconditional support and care. This study looks into the health and well-being of people who have been infected with the COVID-19 virus and have long-term impacts from it.

CHAPTER 2

REVIEW OF LITERATURE

The review of literature of the study entitled "HEALTH AND WELL-BEING OF LONG COVID PATIENTS IN ERNAKULAM DISTRICT OF KERALA” is discussed under the following heads:

2.1 COVID-19 Pandemic – Emergence, Etiology & Symptoms

- 2.1.1 Emergence
- 2.1.2 Etiology
- 2.1.3 Symptoms

2.2 Health and well-being during COVID-19

- 2.2.1 Mental Health
- 2.2.2 Fatigue
- 2.2.3 Sleep pattern and quality

2.3 Diet and Immunity

2.4 Long COVID and its manifestations

2.1 COVID-19 Pandemic – Emergence, Etiology & Symptoms

2.1.1 Emergence

Coronavirus disease (COVID-19) is a highly contagious and infectious viral infection caused by coronavirus 2 (SARS-CoV-2), a serious acute respiratory illness that started in Wuhan, China and has since spread around the world. Experts believe SARS-CoV-2 began in bats. Infectious fluids such as saliva and droplets exhaled when an infected person coughs, sneezes, or speaks can transmit human infection through direct or indirect contact with infected people. The coronavirus was classified as an infectious disease by the World Health Organization on March 11, 2020, and given the code COVID-19. The incubation period varies between two and fourteen days (Nadia *et al*., 2020).

In 2003, the Chinese population was infected with a virus causing Severe Acute Respiratory Syndrome (SARS) in Guangdong province. The virus was confirmed as a member of the Beta coronavirus subgroup and was named SARS-CoV (Peiris *et al*., Pyrc *et al.*, 2007). The infected patients exhibited pneumonia symptoms with a diffused alveolar injury which lead to acute respiratory distress syndrome (ARDS). SARS initially emerged in Guangdong, China, and then spread rapidly around the globe with more than 8000 infected persons and 776 deceases. A decade later in 2012, a couple of Saudi Arabian nationals were diagnosed to be infected with another coronavirus. The detected virus was confirmed as a member of coronaviruses and named as the Middle East Respiratory Syndrome Coronavirus (MERS-CoV). The World health organization reported that MERS- coronavirus infected more than 2428 individuals and 838 deaths (Rahman, 2020). MERS-CoV is a member beta-coronavirus subgroup and phylogenetically diverse from other human-CoV. The infection of MERS- CoV initiates from a mild upper respiratory injury while progression leads to severe respiratory disease. Similar to SARS-coronavirus, patients infected with MERS-coronavirus suffer pneumonia, followed by ARDS and renal failure (Memish *et al.*,2013).

The outbreak was initiated from the Hunan seafood market in Wuhan city of China and rapidly infected more than 50 people. The live animals are frequently sold at the Hunan seafood market such as bats, frogs, snakes, birds, marmots and rabbits. On 12 January 2020, the National Health Commission of China released further details about the epidemic, suggested viral pneumonia (Wang *et al*.,2013). From the sequence-based analysis of isolates from the patients, the virus was identified as a novel coronavirus. Moreover, the genetic sequence was also provided for the diagnosis of viral infection. Initially, it was suggested that the patients infected with Wuhan coronavirus induced pneumonia in China may have visited the seafood market where live animals were sold or may have used infected animals or birds as a source of food. However, further investigations revealed that some individuals contracted the infection even with no record of visiting the seafood market. These observations indicated a human to the human spreading capability of this virus, which was subsequently reported in more than 100 countries in the world. The human to the human spreading of the virus occurs due to close contact with an infected person, exposed to coughing, sneezing, respiratory droplets or aerosols. These aerosols can penetrate the human body (lungs) via inhalation through the nose or mouth (Phan *et al.*,2020).

2.1.2 Etiology

Coronavirus is a single-stranded RNA virus that is enclosed. As the name implies, it is a member of the Orthocoronavirinae subfamily, which has "crown-like" spikes on their surfaces (Perlman *et al*.,2020). The coronavirus has a diameter of 80–120 nm and is single-stranded RNA. Four types of viruses have been reported, which include α-coronavirus, β-coronavirus, δ-coronavirus, and γ-coronavirus (Wang *et al*.,2020). Six coronaviruses cause infection in humans, with the 2019 new coronavirus (SARS-CoV-2) being the seventh (Zhu *et al*.,2020). The virus belongs to the beta coronavirus group like the MERS coronavirus (MERS-CoV) and SARS coronavirus (SARS-CoV) (which also cause disease in human). SARS and SARS-CoV-2 have approximately 79% genome sequence homology, and SARS-CoV-2 has a higher similarity to coronaviruses found in bats, causing SARS (Wang *et al*.; Wu *et al*., 2020). The virus shares 88 percent sequence identity with two bat-derived severe acute respiratory syndrome (SARS)-like corona viruses, but is farther distant from the severe acute respiratory syndrome corona virus, according to a complete viral genome analysis (SARS-CoV) (Lai *et al*., 2020). Coronavirus is a single-stranded, encapsulated ribonucleic acid with 9–12 nm-long surface spikes that give it a corona-like appearance (Cheng *et al*., 2020). The spike (S) protein binds to the angiotensin-converting enzyme 2 (ACE2) receptor and mediates subsequent fusion between the envelope and host cell membranes to aid viral entry into the host cell, and is one of four primary structural proteins encoded by the coronaviral genome on the envelope (Kanne *et al*.,2020). On 11 February 2020, the Coronavirus Study Group (CSG) of the International Committee on Taxonomy of Viruses finally designated it as severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) based on phylogeny, taxonomy and established practice (Roujian,2020).

2.1.3 Symptoms

The current Coronavirus Disease 2019 (COVID-19) pandemic, caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has seen an exponential rise in cases, overrunning hospitals around the world (Dong *et al*.,2020). Many people have mild forms of the disease and are advised not to go to the hospital or to seek a diagnostic test because they can recover at home. A large number of others are asymptomatic. Infected individuals are highly contagious and can transmit the disease even if they are asymptomatic, and this fact furthers the need to isolate and test often (Cascella *et al*.,2020). In addition, COVID-19 is two to three times more contagious than influenza (Anderson *et al*., 2020). Due to these characteristics, outbreaks of COVID-19 occur in clusters (Sun *et al*.,2020). Early detection of COVID-19 could lessen the number and size of clusters, however early signs are unclear. The Centers for Disease Control and Prevention (CDC) in the United States and the World Health Organization (WHO) both encourage people to contact their doctor if they think they've been exposed to COVID-19 or are experiencing fever and cough (Sohrabi *et al*.,2020). However, fever and cough are associated with other respiratory diseases such as influenza (WHO,2020). Similar to COVID-19, the Middle East Respiratory Syndrome (MERS) and the Severe Acute Respiratory Syndrome (SARS) are respiratory illnesses contracted from coronaviruses called the MERS-Related Coronavirus (MERS-CoV) and SARS-Related Coronavirus (SARS-CoV), respectively (Yin *et al*.,2020).

COVID Symptom Study group identified six clusters of symptoms (Sudre *et al*.,2021). They are:

- "Flu-like" with no fever—headache, loss of smell, muscle pains, cough, sore throat, chest pain, no fever
- "Flu-like" with fever—headache, loss of smell, cough, sore throat, hoarseness, fever, loss of appetite
- Gastrointestinal—headache, loss of smell, loss of appetite, diarrhoea, sore throat, chest pain, no cough
- Severe level one, fatigue—headache, loss of smell, cough, fever, hoarseness, chest pain, fatigue
- Severe level two, confusion—headache, loss of smell, loss of appetite, cough, fever, hoarseness, sore throat, chest pain, fatigue, confusion, muscle pain
- Severe level three, abdominal and respiratory—headache, loss of smell, loss of appetite, cough, fever, hoarseness, sore throat, chest pain, fatigue, confusion, muscle pain, shortness of breath, diarrhea, abdominal pain (Sudre *et al*.,2021).

A total of 99 cases were documented during the first outbreak of the disease in Wuhan, with symptoms including headache, dyspnea, lymphocytopenia, abdominal pain, diarrhoea, mucus production, and hemoptysis; around 74 of the infected people had bilateral pneumonia (Nanshen *et al*. ,2020). Dry cough, chest pain, fever, myalgia, dyspnea, and exhaustion are some of the symptoms. Clinical manifestations such as dizziness, stomach pain, nausea, headache, vomiting, and diarrhea are less common (Zhenwei *et al*.,2020). Coronavirus infected people had a lot of upper respiratory symptoms including sneezing and sore throat, which suggests that the virus prefers to stay in the lower respiratory tract, which is different from the Middle East Respiratory Syndrome and Severe Acute Respiratory Syndrome coronavirus infections. Acute Respiratory Stress Syndrome (ARDS), shock, critical cardiac injury, hypoxemia, arrhythmia, and critical kidney damage have all been documented as chronic consequences in coronavirus infected individuals, and patients at this stage of the infection are admitted to the intensive care unit (Chaolin *et al*.,2020). In a study of 99 coronavirus-infected people in Wuhan, roughly 17% of them had Acute Respiratory Distress Syndrome (ARDS), and 11 percent of their deaths were due to multiple organ failure, with a median duration from initial presentation to ARDS of eight days (Peter *et al*.,2020).

2.2 Health and Well-being during COVID-19

Well-being is not just the absence of disease or illness. It's a complicated mix of physical, mental, emotional, and social aspects that affect a person's health. Mental health refers to a condition of well-being in which a person recognizes his or her own abilities, is able to cope with everyday stressors, works productively, and contributes to his or her community. Because it indicates that people believe their lives are going well, well-being is a positive result that is relevant for individuals and many sectors of society. Health is more than the absence of disease; it is a resource that enables people to achieve their goals, meet their requirements, and cope with their surroundings in order to live a happy and healthy life (Martin, 2016).

2.2.1 Mental Health

Any viral pandemic is a global health and mental health issue (Cuero *et al*., 2020). Perceived stress is the feeling of individuals about general stressfulness of their life in a given time period and their ability to deal with such problems or difficulties (Liu *et al*., 2020). Certain personality traits such as neuroticism, conscientiousness, and extroversion have particularly strong associations with perceived stress (Afshar *et al*., 2015). Extraversion is generally associated with a lower level of perceived stress (Jackson and Schneider, 2014). However, given the social isolation and quarantine measures during COVID-19, the generalizability that extraversion is associated with less stress may be limited (Brooks and Moser, 2020).

The COVID-19 pandemic is likely to be perceived as a significant stressor for many people. A systematic review of the impact of the pandemic on mental health in general population shows that there is an unprecedented threat to the mental health of the people (Jiaqi *et al*., 2020). A recent study found that during the COVID-19 pandemic, individuals with high neuroticism showed higher levels of perceived threat of COVID-19 virus leading to an increased level of negative affect (Kroencke *et al*., 2020). Due to the pathogenicity of the virus, the rate of spread, the resulting high mortality rate, COVID-19 may affect the mental health of individuals at several layers of society, ranging from the infected patients, and health care workers, to families, children, students, patients with mental illness, and even workers in other sectors (Bao *et al*., 2020; Ryu *et al*., 2020; Chen *et al*.,2020).

The World Health Organization as well as the international mental health associations have warned that the current COVID-19 pandemic will lead to a drastic increase of stress-related conditions and mental health issues globally (Kaufman *et al*.,2020). In fact, emerging reports have been documenting an increase of stress-related symptoms, anxiety and depression especially among vulnerable populations such as socially and economically disadvantaged people, chronically, and mentally ill populations (Bao *et al*.,2020; Jones *et al*.,2017). Also, this condition may add severity to negative prognoses of physical as well as mental diseases with adjunctive difficulty in accessing health services (Kaufman *et al*.,2020; Kim *et al*.,2015). For these reasons, psychological support and crisis interventions should be promoted to contrast the effects of the pandemic. Psychological support should be offered to vulnerable subjects, healthcare workers as well as to general population. Moreover, advices to the general population on how to cope with subjective stress during the pandemic may be helpful (Bao *et al*., 2020). Measures of stress in the epidemiological research may include three components: (a) environmental, including stressful life events; (b) psychological, which involves subjective experience and emotional response to stressors; and, (c) biomedical, which comprises the physiological systems involved in coping the stressful stimuli (Kopp *et al*.,2010).

Nervousness and anxiety in a society affect everyone to a large extent. Recent evidence suggests that people who are kept in isolation and quarantine experience significant levels of anxiety, anger, confusion, and stress (Xiang *et al*., 2019). At large, all of the studies that have examined the psychological disorders during the COVID-19 pandemic have reported that the affected individuals show several symptoms of mental trauma, such as emotional distress, depression, stress, mood swings, irritability, insomnia, attention deficit hyperactivity disorder, post-traumatic stress, and anger (Rubin and Wessely,2020). Studies conducted in China, the first country that was affected by this Virus spread, show that people's fear of the unknown nature of the Virus can lead to mental disorders (Shigemura *et al*.,2019). Depression is a mental illness characterized by symptoms of poor morale, such as hopelessness, melancholy, self-depreciation, and worthlessness, which result in low self-esteem and a lack of interest in life. The disorder is connected to a reduced likelihood of accomplishing key life goals, as well as declining health and suicide attempts in persons who suffer from it (Siegrist,Wege, 2020). Along with the fear of contracting this highly contagious virus, the fear of losing loved ones, the spread of COVID-19-related misinformation, the lack of medical treatment, and the shortage of properly equipped units to treat the patients, lockdown-related issues (i.e., prolonged home isolation, social distancing, food insecurity, fear of unemployment, loss of income, etc.) are being linked to mental distresses such as depression, anxiety, phobia, insouciance, and insecurity (Brooks *et al*., 2020). Editorials, scientific letters, perspectives, and commentaries in scientific literature and reports in print and visual media have pointed out an increase in mental health problems. Experts across the world expressed concerns for an increasing toll of mental health problems and urged for mental health support (Xiang *et al*., 2019). The increase in mental health problems in every society and age group in every nation has turned out to be another important global public health concern during this pandemic (Torales *et al*., 2020). Lockdown-related loneliness and isolation may play a part in this distress (Chen *et al*.,2020). Personal factors may affect the subsequent development of psychological problems, with people being classified according to their constitution and coping abilities into high-, medium-, and low-risk for the development of psychological symptoms, mainly anxiety, and depression. Depressive, anxiety, and sleep symptoms develop in patients with COVID-19 while in the hospital (Hu *et al*.,2020), but anxiety may persist after recovery (Wu *et al*.,2020).

The response to the COVID-19 pandemic could prove to be analogous to the response to natural disasters or other similar catastrophic events impinging upon a population (Momoi *et al*.,2020), and may cause permanent distress in the affected population (North *et al*.,2020). Psychological/psychiatric consequences of disasters may persist as long as 12 years in one out of six members of the affected population (Raker *et al*.,2020). The psychological response to the COVID-19 pandemic has been promptly reported; in hardly-hit populations, it is similar to post-traumatic stress disorder (PTSD) symptomatology in the population (Liu *et al*.,2020). Similarly, patients who actually developed COVID-19 and survived, are likely to develop PTSD symptomatology (Xiao *et al*.,2020). Patients with COVID-19 reported many PTSD and depressive symptoms (Vindegaard *et al*.,2020). A meta-analysis reported depressed mood, insomnia, anxiety, irritability, memory impairment, fatigue, and traumatic memories as the most frequent complaints in the post-illness stage (Rogers *et al*.,2020).

2.2.2 Fatigue

Fatigue is one of the most reported symptoms both during and after COVID-19 infection. Fatigue cannot be completely explained by a single disease or unique pathogenetic mechanism. The most promising mechanisms underlying the condition include inflammation, mitochondrial dysfunction, sleep alterations, autonomic nervous system abnormalities, and poor nutritional status (Zengarini *et al*.,2020). COVID-19 infection might also be characterized by loss of taste and smell, leading to anorexia, which is an important contributor to malnutrition (i.e., undernutrition). Additionally, the high catabolic response to COVID-19 infection, leading to weight loss and muscle decline, might further contribute to the manifestation of fatigue. Loss of muscle mass and strength is a whole-body process that also affects respiratory muscles (Azzolino *et al*., 2021). Hence, respiratory function might be further compromised by the acute muscle wasting seen during COVID-19 infection or in individuals with a sarcopenic or dysphagic background. Furthermore, reduced force of contraction of respiratory muscles can lead to so-called respiratory fatigue9 and might result in a reduced ability for expulsive airway clearance tasks, such as coughing and sneezing, contributing to an increased risk of pneumonia and other respiratory infections, and thus creating a vicious circle (Aubier *et al*.,2021). Obesity, which has been evoked as one of the key risk factors associated with poor COVID-19 outcomes (Menassa *et al*.,2021), has been repeatedly associated with fatigue; the release of proinflammatory cytokines and adipokines by adipose tissue has been described as the mechanism that mediates this finding (Resnick *et al*.,2006). Inflammatory mediators can pass the blood–brain barrier and can be transmitted as stress signals, leading to autonomic nervous system abnormalities, including fatigue. Recently, SARS-CoV-2 variants characterized by and increased transmission capacity have emerged, with a consequent net decrease in the mean age of infected people who can also experience fatigue despite their young age (Domenico,2021).

2.2.3 Sleep Pattern and Quality

Sleep becomes crucial in the face of the COVID-19 epidemic due to its numerous mental and physical health advantages (Haitham *et al*.,2021). Sleep deprivation can affect psychologic functioning and decision making, imperil immune response, increase accidents, create mood swings, raise medical costs, and make people more vulnerable to virus infection due to poor focus (Medic G,2017). The colloquial terms “coronasomnia” or “COVID-somnia” have been proposed to encompass the constellation of symptoms of sleep dysfunction such as insomnia, disrupted sleep continuity, changes in sleep-wake cycle, feelings of non-restorative sleep and decreased sleep quality arising either due to stresses related to fear of the virus itself or the psychosocial impact on daily living (such as loss of employment, financial concerns, social isolation resulting from lockdowns and quarantine, or the actual medical and psychological sequalae of contracting COVID-19 infection) (Gupta,2020). Several factors are likely responsible for sleep dysfunction related to COVID-19. A recent meta-analysis showed relatively high rates of symptoms of anxiety, depression, post-traumatic stress disorder (PTSD), psychological distress, and stress in the general population across the globe during the COVID-19 pandemic (Xiong *et al*.,2020). Anxiety and depression are well known to have reciprocal relationships with insomnia (Kim *et al*.,2019; Cutler,2016), and it has been shown that the prevalence of all forms of psychological distress in the general population has been higher during the pandemic (Lakhan *et al*.,2020).

During the COVID-19 epidemic, the European Sleep Research Society (ESRS) produced a document with information on sleep loss due to unprecedented changes in people's daily routines and house confinement, as well as recommendations for successful insomnia therapy (Altena *et al*.,2019). There are persons who, in addition to sleep loss, have various sleep disturbances, with SDB (Sleep Disordered Breathing) being one of the most common. SDB is a huge burden not only for the affected patients, but also for their close friends and family. SDB covers a wide range of conditions, but Obstructive Sleep Apnea (OSA) is by far the most common, affecting one billion adults aged 30 to 69 years around the world (Benjafield,2019).

Initiation and maintenance of sleep-wake cycle are explained by two-process models, whereby circadian factors and homeostatic factors interact constantly to induce and maintain sleep. This model posits that owing to circadian factors, human have higher chances to fall asleep at night as we are designed to behave as a diurnal species by nature. Sleep pressure represents the homeostatic factor, which is proportional to the time awake. In other words, longer the time awake, higher the sleep pressure, and higher the chances of falling asleep. Being a diurnal species, human stay awake during the day and accumulate sleep pressure, which reaches maximum at night, where it interacts with circadian factors to induce sleep. Confinement to home can disrupt circadian rhythms as well as homeostatic process (reduced sleep pressure) due to opportunities for extending sleep in the morning and taking naps during the day (Borbély *et al*., 2016).

When compared to their sleep before being ill with COVID, many people recovering from COVID note that their sleep has changed. Some people have trouble falling or staying asleep, while others wake up earlier than normal and can't sleep again (NHS,2021). The negative health impacts of COVID-19 patients may be linked to sleep disruption. COVID-19 patients who had sleep disruption had a higher rate of hospital-acquired infection, longer hospitalization days, and a higher requirement for ICU admission than those who did not (Zhang,2020).

2.3 Diet and Immunity

Nutritional health is critical for maintaining a strong immune system against the virus (Faseeha *et al*.,2020).During the COVID-19 pandemic, people's nutritional health was employed as a predictor of their ability to withstand instability (Bogoch,2020). Micronutrients may have the potential to augment immune function and defend against COVID-19 (Lange,2020). For immunological function to be maintained, zinc, iron, and vitamins A, B12, B6, C, and E must be consumed in sufficient quantities. COVID-19 has offered a new set of problems for people who want to eat a healthy diet in the current situation (Yousafzai *et al*.,2020). A variety of nutrients have been linked to better results for COVID-19 patients.

Vitamin D has received particular attention in the recent months of the COVID-19 pandemic. The vitamin has often been suggested to be involved in decreasing the risk of microbial infection (McDonnell *et al*.,2020). Vitamin D has been linked to lower infection rates as well as better patient outcomes. Vitamin C may help to reduce the intensity of symptoms and shorten the course of the condition. Vitamin E, zinc, and selenium are known to help with viral infection recovery and may be effective in COVID-19 (Hira,2021). The use of probiotics to enhance the immune system is suggested in the COVID-19 guidelines (Jin *et al*.,2019).

Limited access to fresh foods may compromise opportunities to continue eating a healthy and varied diet. It can also potentially lead to an increased consumption of highly processed foods, which tend to be high in fats, sugars and salt. Nonetheless, even with few and limited ingredients, one can continue eating a diet that supports good health (WHO,2020). Various food plants, such as garlic, ginger, blueberries and others, have been suggested to have antiviral and immunomodulatory effects (Yang *et al*.,2020). Food bioactives, such as polyphenols and carotenoids, are thought to have antiviral efficacy. Hypotheses regarding antiviral benefits of polyphenols and carotenoids are based mainly on research in cell cultures and animal models (Burkard *et al*.,2017). A balanced diet containing diverse food bioactives and micronutrients may have supportive effects in COVID-19 (Klaus,2020).

2.4 Long COVID-19 and its manifestations

"Long COVID" is a term used to describe presence of various symptoms, even weeks or months after acquiring SARS-CoV-2 infection irrespective of the viral status (Geddes,2020). It is also called "Post-COVID Syndrome". It can be continuous or relapsing and remitting in nature (Nikki,2020). There can be the persistence of one or more symptoms of acute COVID, or appearance of new symptoms. Majority of people with post-COVID syndrome are PCR negative, indicating microbiological recovery. In other words, post COVID syndrome is the time lag between the microbiological recovery and clinical recovery (Garg *et al*.,2020). Majority of those with long COVID show biochemical and radiological recovery. Depending upon the duration of symptoms, post COVID or Long COVID can be divided into two stages-post acute COVID where symptoms extend beyond 3 weeks, but less than 12 weeks, and chronic COVID where symptoms extend beyond 12 weeks (Matthew *et* *al*., 2020). Individuals with a history of probable or proven SARS-CoV-2 infection develop post COVID-19 condition three months after the commencement of COVID-19, with symptoms lasting at least two months and not explained by any other diagnosis. Fatigue, shortness of breath, and cognitive dysfunction are among the most common symptoms, but there are others that have an influence on daily life. Symptoms may appear suddenly after an acute COVID-19 episode has passed, or they may remain from the first sickness. Over time, symptoms may change or recur (WHO 2021).

The previous epidemics of SARS-CoV and MERS-CoV left individuals who recovered from these viral illnesses with persistent symptoms of severe fatigue, decreased quality of life (QOL), persistent shortness of breath, and behavioral health problems that resulted in a significant burden on local healthcare systems where the epidemics occurred. Similarly, a constellation of various clinical symptoms termed post-acute COVID-19 syndrome has been described in a minor proportion of patients who recovered from SARS-CoV-2 induced COVID-19 despite biochemical evidence that the replication of SARS CoV 2 ceases to exist after four weeks after the initial infection. Post-acute COVID-19 is a syndrome characterized by the persistence of clinical symptoms beyond four weeks from the onset of acute symptoms. The Center for Disease Control (CDC) has formulated "post-Covid conditions" to describe health issues that persist more than four weeks after being infected with COVID-19. These include: Long Covid (which consists of a wide range of symptoms that can last weeks to months) or persistent post-Covid syndrome (PPCS), Multiorgan effects of COVID-19 and Effects of COVID-19 treatment/hospitalization. The typical clinical symptoms in "long covid" are tiredness, dyspnea, fatigue, brain fogginess, autonomic dysfunction, headache, persistent loss of smell or taste, cough, depression, low-grade fevers, palpitations, dizziness, muscle pain, and joint pains. Multiorgan effects of COVID-19 include clinical manifestations pertaining to the cardiovascular, pulmonary, renal, and neuropsychiatric organ systems, although the duration of these multiorgan system effects is unclear. Long-term "effects of COVID-19 treatment or hospitalization" are similar to other severe infections. They include post-intensive care syndrome (PICS), resulting in extreme weakness and posttraumatic stress disorder. Many of the patients with these complications from COVID-19 are getting better with time. Post COVID-19 care clinics are being opened at multiple medical centers across the USA to address these specific needs (Venu *et al.*,2022). Based on the chronicity of symptoms post COVID-19 infection, Nalbandian *et al.* classified post-acute COVID-19 as follows-

- Subacute or persistent symptomatic COVID-19 symptoms (up to 12 weeks from the initial acute episode).
- Chronic or post-COVID syndrome, symptoms present beyond 12 weeks. However, it should not be attributable to an alternative diagnosis (Nalbandian *et al.*,2021).

Post-acute COVID-19 syndrome is a multisystem disorder that commonly affects the respiratory, cardiovascular, and hematopoietic systems. In addition, neuropsychiatric, renal, and endocrine systems are also involved to a lesser extent. COVID-19 lung autopsy has shown all phases of diffuse alveolar damage with focal and organized fibroproliferative diffuse alveolar damage similar to ARDS. Rarely microcystic honeycombing, myofibroblastic proliferation, and mural fibrosis were also noted (Burnham *et al.*,2020). Lung tissue analysis (autopsy and explanted lungs of lung transplant recipients) with severe COVID-19 pneumonia showed histopathology like end-stage pulmonary fibrosis without active SARS-CoV-2 infection, suggesting that some people may develop lung fibrosis following resolution of active infection. The severity of endothelial damage, microthrombi seen on lung autopsy is significantly more in SARS-CoV-2 infection compared to ARDS from influenza (Ackermann *et al.*,2020).

There is much variability in COVID-19 myocardial insult in the histopathologic examination. 62% of Autopsy findings of acute COVID-19 showed the presence of virus genome in the heart tissue (Lindner *et al.*,2020). Endomyocardial biopsy is the definitive test in the diagnosis of myocarditis. The presence of lymphocyte infiltration with myocyte injury without ischemia is consistent with viral myocarditis according to 1987 Dallas criteria. However, in post-acute COVID-19 syndrome, only 10% to 20% of myocarditis is diagnosed with endomyocardial biopsy. This low sensitivity is secondary to sampling error. Immunohistochemical analysis of endomyocardial biopsy showed severe intramyocardial inflammation with increased perforin-positive cells. There are increased numbers of macrophages, T lymphocytes, CD45R0 T memory cells. There is an increased number of cell adhesion molecules (CAM). (Escher *et al.*,2020). A single-center histopathological study of brain specimens obtained from eighteen patients who succumbed to COVID-19 demonstrated acute hypoxic injury in the cerebrum and cerebellum of all patients. Notably, no features of encephalitis or other specific brain changes were seen. Additionally, immunohistochemical analysis of brain tissue did not show cytoplasmic viral staining (Solomon *et al*.,2020). SARS-CoV-2 has been isolated from multiple kidney biopsies, with the most predominant finding being acute tubular necrosis. The presence of collapsing variant focal segmental glomerulosclerosis, acute tubular injury, and global tuft involution is specific for COVID-19 associated nephropathy (COVAN) (Peleg *et al*.,2020).

People with post-COVID conditions may develop or continue to have symptoms that are hard to explain and manage. Clinical evaluations and results of routine blood tests, chest x-rays, and electrocardiograms may be normal. The symptoms are similar to those reported by people with ME/CFS (myalgic encephalomyelitis/chronic fatigue syndrome) and other poorly understood chronic illnesses that may occur after other infections. People with these unexplained symptoms may be misunderstood by their healthcare providers, which can result in a long time for them to get a diagnosis and receive appropriate care or treatment. There is no test to diagnose post-COVID conditions, and people may have a wide variety of symptoms that could come from other health problems. This can make it difficult for healthcare providers to recognize post-COVID conditions (CDC,2021).

CHAPTER 3

METHODOLOGY

The methodology of the study entitled "HEALTH AND WELL-BEING OF LONG COVID PATIENTS IN ERNAKULAM DISTRICT OF KERALA" is discussed under the following headings:

3.1 Study locale

3.2 Selection of subjects

3.3 Selection of tools

3.3.1 Socio- demographic characteristics

3.3.2 Assessment of Nutritional status

3.3.2.1 Anthropometric assessment

3.3.2.1.1 Height

3.3.2.1.2 Weight

3.3.2.1.3 BMI

3.3.2.2 Dietary Diversity Score of the selected subjects

3.3.3 Assessment of Health and Well-being

3.3.3.1 Assessment of comorbidity and medical history

3.3.3.1.1 Hypertension / High blood pressure

3.3.3.1.2 Diabetes mellitus

3.3.3.1.3 Cardiovascular disease

3.3.3.1.4 Obesity/overweight

3.3.3.1.5 Chronic lung disease

3.3.3.1.6 Kidney disease

3.1 Study Locale

The coronavirus disease pandemic which originated in the city of Wuhan, China in early December 2019 has rapidly widespread with confirmed cases in almost every country across the world and has become a new global public health crisis. India recorded 2,710 new coronavirus infections, taking the country's totally of COVID-19 cases to 43,147,530, according to WHO data. As of 23 May 2022, a total of 1,941,328,608 vaccine doses have been administered.

The locale selected for study was Ernakulam District.

3.2 Selection of the Subjects

The survey was open to individuals 18 years of age and older who experienced symptoms consistent with COVID-19, including those with and without positive SARS-CoV-2 diagnostic or antibody test results. In order to be able to characterize the Long COVID symptom properties over an extended duration, analysis was limited to respondents with illnesses lasting longer than 28 days and whose onset of symptoms occurred between July 2021 and January of 2022.

The only other exclusion criteria for all groups were age less than 18 and current pregnancy and lactation (or pregnancy during COVID-19). In order to select a sample, random sampling technique was used. A total of 250 samples were collected for the study. Telephonic survey method was used for the data collection. Specific information, such as contact numbers and address were gathered from different family members and neighbours. By using these collected data, the 250 subjects were interviewed with the purpose to extract the desired information from the respondent. The subjects are interviewed by telephone interview in accordance with prepared questionnaire.

3.3 Selection of tools

The tool selected for this study is an interview schedule (Appendix).

An interview is an important qualitative research method in which the researcher collects data directly from the participants with a specific set of questions. Most of the qualitative research interviews are either semi-structured, lightly structured or in-depth. Structured interviews are fully controlled by the interviewer (who possesses much power) and as such, gives the interviewee less room to be flexible and casual. However, semi-structured interviews also an outline of topics and questions prepared by the researcher but have no rigid adherence. Their implementation is dependent on how the interviewee responds to the question or topics laid across by the researcher. This form of interviews needs to be conceptualized as the narrative interview. Unstructured interviews need to be conceptualized as the narrative interview (Stuckey, 2013).

Traditionally, qualitative interviews have involved a face-to-face interviewee dyad (or pairing). However, in recent years, data has been collected in increasingly various ways, including focus groups, telephone interviews, e-mail, and the internet (Bolderston, 2012).

3.3.1 Socio- demographic characteristics

The respondents' socio-demographic variables were included in the first section of the interview schedule in order to obtain general background and personal information. The sociological and demographic characteristics obtained by an individual(s) in a population influence his or her socio-demographic positions, socio-demographic roles, and the corresponding socio-demographic benefits he or she achieves and succeeds in. It provides information about a person's socio-demographic profile (Abdullahi, 2019).

Personal information such as name, designation, age, gender, and education were collected.

3.3.2 Assessment of Nutritional status

Nutritional assessment is the systematic process of collecting and interpreting information in order to make decisions about the nature and cause of nutrition related health issues that affect an individual (British Dietetic Association (BDA), 2012).

3.3.2.1 Anthropometric assessment

Anthropometry is the science that defines the physical measurements of a person's size, shape, and functional abilities. Adults' health and dietary status, disease risk, and body composition are all estimated using body measurements (CDC, 2021). The main components of anthropometry are height, weight, body mass index (BMI).

3.3.2.1.1 Height

The participant's height was measured by standing upright against a wall marked with a height mark. The individual was measured while standing barefoot against the wall with his back against the wall and his head in the Frankfort posture with his heels together. The subject was instructed to stretch as far as possible. After the subject was properly positioned, he or she was asked to exhale and a height mark was created with white chalk. Using the tape-measure, the height was measured in centimeters from the mark to the floor. The measurements were taken to within 0.1 cm of each other (Msyamboza *et al*., 2013).

3.3.2.1.2 Weight

Weighing is usually the initial step in anthropometric assessment and is required to calculate the weight-for-height z-score (WHZ) for children and the body mass index (BMI) for adults. Weight has a strong link to one's overall health. Unintentional weight reduction means poor health and a weakened immune system. Weighing requisites, the use of a working weighing scale that measures weight in kilograms. Correct measurement is critical since inaccuracies can lead to erroneous nutritional status classification and improper care and treatment (NACS, 2016).

3.3.2.1.3 BMI

BMI is a weight-to-height ratio-based anthropometric indicator. It is used to classify malnutrition in people who are not pregnant or postpartum (NACS, 2016). WHO defined underweight, normal weight, overweight, and obesity based on BMI. Individuals with BMI less than 18.5 were considered malnourished, BMI from 18.5 to 24.9 was normal and overweight if ≥ 25 (Lancet, 2004).

$$BMI = kg/m^2$$

Table 3.1

WHO (2004) classification of weight status

WHO CLASSIFICATION OF WEIGHT STATUS	
WEIGHT STATUS	BODY MASS INDEX (BMI)
Underweight	< 18.5
Normal	18.5 – 24.9
Overweight	25.0 – 29.9
Obese	≥ 30.0

3.3.2.2 Dietary Diversity Score of selected subjects

The Diet diversity of the households was assessed using DDS. The Dietary Diversity Score (DDS) is a proxy tool that is based on the idea that "dietary diversity is a fundamental part of diet quality, and a diverse diet helps provide appropriate intakes of vital nutrients that promote health" (FAO, 2018). The quantity of various meals or food groups consumed in the previous day is referred to as dietary diversity (DD). DDS is a reflection of the diet quality and the diversity of the diet. DDS makes a list of everything they ate or drank in the past two days (meals and snacks), both during the day and at night. It starts with the first meal or drink of the day, which comprised all of the stated meals and beverages.

Dietary diversity scores are obtained by adding the totals of 16 food groups consumed by each respondent over a 24-hour period. The IDDS (Individual Dietary Diversity Score) is made up of the following steps: new food group variables for those food groups that need to be aggregated were created to form a total of nine food groups. In the IDDS, for example, the food group "Starchy basics" is made up of "Cereals" and "White roots and tubers." By merging the answers to "Cereals" and "White roots and tubers," a new variable called "Starchy staples" was formed.

Starchy staples = 1 if (Cereals) =1 or (White roots and tubers) = 1

Starchy staples = 0 if (Cereals) = 0 and (White roots and tubers) =0

DDS correlates with the severity of symptoms. A person with a high dietary variety score has fewer DDS < 4 was considered as poor dietary diversity. A score between 6 and 9 represents good diversity. Each food group was only counted once when calculating DDS. The nine groups used were: 1) cereals/roots/tubers; 2) meat/poultry/fish; 3) dairy; 4) eggs; 5) vitamin A rich fruit and vegetables; 6) legumes; 7) other fruit; 8) other vegetables; 9) fats and oils (FAO, 2010).

The food intake data of the subjects were collected by the 24-hour food recall by a trained person on a random day to minimize day-to-day differences. A standard protocol used to take 24-hour recall. The interviews included a detailed description such as the foods eaten, the cooking methods followed, and brand names. The respondent assessed how much the subject ate, using cups, tablespoons, coconut spoons, the size of a box of matches, and other typical home measurements (Rathnayake *et al*., 2012).

However, interviewers should be provided with standardized neutral probing questions so as to avoid leading the respondent to specific answers when the respondent really does not know or remember. The current state-of-the-art 24-hour dietary recall instrument is the U.S. Department of Agriculture’s (USDA) Automated Multiple-Pass Method (AMPM). This is used in the U.S. National Health and Nutrition Examination Survey (NHANES) (Steinfeldt., 2013).

Table 3.2

Scale to assess dietary diversity of the study subject

SCORE	INTERPRETATION
1-3	Low
4-6	Medium
6-9	High

3.3.3 Assessment of Health and Well-being

Well-being is the experience of health, happiness, and prosperity. It includes having good mental health, high life satisfaction, a sense of meaning or purpose, and ability to manage stress. More generally, well-being is just feeling well (Tchiki,2019).

The different components assessed among the study subjects include comorbidity, symptoms during COVID and Long COVID, stress, fatigue, and sleep.

3.3.3.1 Assessment of Comorbidity and medical history

Comorbidity refers to the existence of a long-term health condition in the presence of a primary disease of interest (Porta, 2014). Patients with chronic comorbid diseases face significant obstacles in terms of diagnosis, ill health, and disease management, all of which have a negative impact on treatment options and outcomes (Mahumud *et al*., 2020). Early clinical experience revealed that individuals with COVID-19 who were older and had a number of comorbidities, such as hypertension, cardiovascular disease, diabetes mellitus, and chronic pulmonary disease, had a higher chance of death (Kario *et al*., 2020).

The following lifestyle diseases were assessed:

3.3.3.1.1 Hypertension / High blood pressure

In COVID-19 patients, hypertension has been routinely identified as the most common pre-existing comorbidity. During SARS-CoV-2 infection, hypertension patients appear to have a higher mortality risk than normotensive patients (Fernández-de-las-Peas *et al*., 2022). Hypertension results in several pathophysiological changes in the cardiovascular system such as left ventricular hypertrophy and fibrosis (Kulkarni *et al*., 2020).

3.3.3.1.2 Diabetes Mellitus

Diabetes mellitus (DM) also known as simply diabetes, is a group of metabolic diseases in which there are high blood sugar levels over a prolonged period. In diabetic patients, SARS-CoV-2 triggers higher stress conditions, inducing hyperglycemic hormones (glucocorticoids and catecholamine) and elevating blood sugar levels (Koneru *et al*., 2021).

3.3.3.1.3 Cardiovascular Disease

In people infected with SARS, cardiovascular disease is a prevalent comorbidity (Nishiga *et al*., 2020). A wide range of issues can occur in the cardiovascular system, putting patients at a higher risk of morbidity and mortality (Hamadi *et al*., 2020). SARS-CoV-2 may infect and destroy cardiac cells directly in the short term, resulting in severe cellular and organ-wide disease and dysfunction (Chung *et al*., 2021).

3.3.3.1.4 Obesity / overweight

Obesity generally worsens the severity of respiratory disorders, however it's unclear whether obese persons are also more prone to develop COVID-19 symptoms that are more severe (Mohammad *et al*., 2021). Obese patients have poorer chest-wall elastance and overall respiratory system compliance, as well as a smaller expiratory reserve volume. Patients with obesity frequently experience difficult airway management, as well as this altered lung and chest-wall physiology, in combination with positional gas trapping (Jose & Manuel, 2020).

3.3.3.1.5 Chronic Lung Disease

Chronic lung disease is a largely preventable and treatable disease characterized by persistent airflow limitation and respiratory symptoms due to chronic inflammation, which causes structural changes, such as fibrosis of the small airways and alveolar wall destruction (Barnes *et al*., 2021). The patients have an increased risk of severe pneumonia and poor outcomes when they develop COVID-19 (Leung *et al.*, 2020).

3.3.3.1.6 Kidney Disease

Kidney disease means your kidneys are damaged and can't filter blood the way they should (NIDDK, 2017). Kidney problems include acute kidney injury, kidney cysts, kidney stones, and kidney infections. The kidneys are like filters that screen out toxins, extra water and waste products from the body. COVID-19 can cause tiny clots to form in the bloodstream, which can clog the smallest blood vessels in the kidney and impair its function.

3.3.3.1.7 Liver Disease

Individuals with liver illness have an immune inflammatory state that is especially important in other infectious disorders (Martinez & Franco, 2021). COVID19 is largely a respiratory condition, although it also affects the liver. Because viral entry receptors, such as angiotensin-converting enzyme 2, are widely distributed, the liver may be involved (ACE2). COVID-19 related liver injury is defined as any liver damage that occurs during the progression of COVID-19 disease and treatment in patients with or without preexisting liver disease (Garrido *et al*., 2020; Nawghare *et al*., 2022)

3.3.3.1.8 Cancer

Cancers are a group of diseases characterized by uncontrolled growth and the spread of abnormal cells (Mathur *et al*., 2015). Cancer patients increased susceptibility to severe complications of COVID-19 can be attributed to the immunosuppressed status caused by the malignancy and anticancer treatments, such as chemotherapy or surgery (Al-Quteimat & Amer, 2020).

The medical history of patients was evaluated. The questions included whether the patient is taking regular medicines and also the medications followed during covid period such as Allopathy, Homeopathy, and Ayurveda etc. If it was allopathy treatment, the patient was asked which all drugs were consumed like paracetamol, antibiotics, cough syrup, nutritional supplements etc.

Physical activity refers to any physical movement that produces skeletal muscle that requires energy expenditure. It includes all movements, including leisure. Moderate and vigorous physical activity improves health. Regular physical activity is good for body and mind. It can lower high blood pressure, control body weight, and reduce the risk of heart disease, stroke, type 2 diabetes, and various cancers - all conditions that increase sensitivity to COVID-19 (WHO, 2020). Most people nowadays participate in yoga, dancing, and gym classes to keep themselves fit and healthy.

3.3.3.2 Assessment of COVID and Long COVID Symptoms

The SARS-CoV-2 virus causes Coronavirus Disease (COVID-19), an infectious disease. The majority of those infected with the virus will have mild to moderate respiratory symptoms and will recover without the need for medical attention. Some, on the other hand, will become critically unwell and require medical assistance. Serious sickness is more likely to strike the elderly and those with underlying medical disorders such as cardiovascular disease, diabetes, chronic respiratory disease, or cancer. COVID-19 can make anyone sick and cause them to get very ill or die at any age. The majority of infected patients will experience mild to moderate sickness and will be able to recover without the need for hospitalization. Fever, cough, fatigue, and loss of taste or smell are the most prevalent symptoms (WHO, 2020).

Although most people with COVID-19 get better within weeks of illness, some people experience post-COVID conditions. Post-COVID conditions are a wide range of new, returning, or ongoing health problems people can experience four or more weeks after first being infected with the virus that causes COVID-19. Even people who did not have COVID- 19 symptoms in the days or weeks after they were infected can have post-COVID conditions. These conditions can present as different types and combinations of health problems for different lengths of time. (CDC, 2021).

A 4-point Likert scale was used for each symptom reported as absent, mild, moderate, or severe so participants could respond to it to the best of their knowledge, and post-covid symptoms were analyzed in the time duration of 1-5 months. The study asked respondents to specify the number of months their symptoms lasted in order to investigate disease duration.

Table 3.3

4-Point Likert scale to assess severity of symptoms of the study subject

SCORE	INTERPRETATION
1	Absent
2	Mild
3	Moderate
4	Severe

3.3.3.3 Assessment of Stress

Stress is a universal occurrence that affects everyone at some point in their lives. Stress is a situation or feeling that occurs when a person believes that demands are greater than the individual's personal and social resources (Salari *et al*., 2020). COVID-19 survivors will have a high prevalence of emergent psychiatric illnesses such as mood disorders, anxiety disorders, PTSD, and insomnia, based on the limited preliminary investigations on COVID-19 and earlier findings from the SARS pandemic. Confusion and delirium are prominent symptoms in the acute stage, according to available data, but little evidence on psychopathology in the post-illness phase exists (Gennaro *et al*., 2020). Individuals who have been through a stressful event may develop posttraumatic stress disorder (PTSD). In post-illness stages, coronavirus epidemics were linked to PTSD diagnoses, with meta-analytic studies revealing a prevalence of 32.2 percent (Janiri *et al*., 2021).

Personal stress was assessed using the Perceived Stress Scale (PSS-10-C). It is a measure of how stressful a situation one's life is. The scale also includes several direct questions about the current levels of stress experienced. The questions and the alternatives of response are easy to understand. The questions in the PSS ask about feelings and thoughts during the quarantine days. In each case, the respondents were asked how many times they felt a particular condition. The PSS-10-C comprises 10 items, each of which offers five response options: never, rarely, occasionally, almost always, and always. Items 1, 2, 3, 6, 9, and 10 are scored directly from 0 to 4, and items 4, 5, 7, and 8, conversely, from 4 to 0 (Campo-Arias *et al*., 2020). PSS score correlates with the severity of stress. A person with a score of 0 – 13 was considered low stress. A score of 14-26 indicates moderate stress, while a score of 27-40 indicates high–perceived stress.

Table 3.4

PSS-10-C Scale to assess stress of the study subject

SCORE	INTERPRETATION
0 - 13	Low stress
14-26	Moderate
27-40	High–perceived stress

3.3.3.4 Assessment of Fatigue

Fatigue is a multidimensional concept that can manifest as general tiredness (i.e., trait, chronic subjective fatigue) or as the expectation and experience of becoming tired in response to activities, leading to difficulty in maintaining these activities at a desired level of performance (Lin et al., 2014). People who were infected with COVID generally felt weary, lacked energy, or were weak throughout the pandemic time, necessitating the assessment of fatigue in the selected participants. COVID-19-related fatigue can affect multiple patients at the same time.

Fatigue was assessed by using the Chalder fatigue scale (CFQ-11). The CFQ 11 allows the user to distinguish between 'cases' and 'non-cases' of fatigue. The physical and mental fatigue subscales are not employed in this study; instead, the responder is given a global binary fatigue score ranging from 0 to 11. Those who are not exhausted have a global binary fatigue score of 3 or less, while those who have a score of 4 or more have severe fatigue (Jackson, 2015).

Table 3.5

CFQ-11 Scale to assess fatigue of the study subject

SCALE	INTERPRETATION
0-3	Not severe /Not a case
4-11	Severe fatigue/caseness

3.3.3.5 Assessment of Sleep

Sleep is a crucial biological function for regulating internal balance and enhancing quality of life. Increased sleep quality has positive effects on physical and mental health; yet, sleep difficulties have a negative impact on immunological responses because of their effects on the body's circadian rhythm (El Sayed *et al*., 2021). A sleep disorder is an irregular sleep pattern that interferes with a person's normal physical, mental, and/or emotional functioning.

The true prevalence of sleep problems is unknown due to the fact that they are still underdiagnosed in the majority of cases. According to certain surveys, the prevalence in the general population is between 10% and 15% (Shukla *et al*., 2013). Because a significant shift in lifestyle is a large stressor, the general population is likely to acquire mental health and sleep difficulties as a result of COVID-19's effects (Alimoradi *et al*., 2021).

The *Insomnia Severity Index* (ISI) is a brief instrument that was designed to assess the severity of insomnia. The ISI is a 7-item self-report questionnaire assessing the nature, severity, and impact of insomnia. The usual recall period is the "last month" and the dimensions evaluated are: severity of sleep onset, sleep maintenance, and early morning awakening problems, sleep dissatisfaction, interference of sleep difficulties with daytime functioning, noticeability of sleep problems by others, and distress caused by the sleep difficulties (Morin *et al*.,2011).

The total score is interpreted as follows: absence of insomnia (0–7); sub-threshold insomnia (8–14); moderate insomnia (15–21); and severe insomnia (22–28) (El Sayed *et al*., 2021).

Table 3.6

ISI to assess insomnia of the study subject

SCALE	INTERPRETATION
0-7	Absence of insomnia
8-14	Subthreshold insomnia
15-21	Moderate insomnia
22–28	Severe insomnia

3.4 Data analysis and interpretation

The data that was collected from the study subjects using the developed tool was consolidated and appropriately interpreted. Statistical analysis that could determine the correlates of the different variables was used wherever relevant.

Data were recorded, validated and stored using the Statistical Package for the Social Sciences (SPSS) Windows software, version 20.0. Statistical analysis of the data was done using Test of significance of difference between means of large independent samples (t-test) and Pearson's product moment coefficient of correlation.

a) Test of significance of difference between means of large independent samples (t-test)

A t-test is a type of inferential statistic used to determine if there is a significant difference between the means of two groups, which may be related in certain features. 't' value is calculated from the mean and standard deviation of two groups.

The difference between mean scores is said to be significant at 0.05 or 0.01 levels depending upon whether the obtained ratio or t- value equals to or exceeds 1.96 or 2.58 respectively.

b) Pearson's product moment coefficient of correlation

Correlation refers to relationship between two variables. An index of the degree of relationship between two sets of measures is known as coefficient of correlation. It is the ratio for expressing the extent to which change in one variable is accompanied by or dependent upon changes in the second variable. 'r' is the significant if obtained value is equal to or greater than 1.96 or 2.58 at 0.05 level or 0.01 level of significance respectively. The obtained results are discussed in the near section of the study.

CHAPTER 4

RESULTS AND DISCUSSION

The results and discussion of the study entitled "HEALTH AND WELL-BEING OF LONG COVID PATIENTS IN ERNAKULAM DISTRICT OF KERALA" is discussed under the following heads:

4.1 Socio- demographic status of study subjects

4.2 Nutritional status assessment of study subjects

4.2.1 Anthropometric assessment of study subjects using BMI classification

4.2.2 Dietary Diversity Score among study subjects

4.3 System of medicine adopted to treat COVID-19 infection

4.4 Assessment of Health and Well-being

4.4.1 Assessment of Comorbidity among study subjects

4.4.2 Assessment of symptoms during COVID among study subjects

4.4.3 Assessment of symptoms during Long COVID among study subjects

4.4.4 Assessment of Stress among study subjects

4.4.5 Assessment of Fatigue among study subjects

4.4.6 Assessment of Sleep among study subjects

4.5 Pearson's coefficient of correlation between Stress and Insomnia among subjects during COVID

4.6 Comparison of mean scores among subjects during COVID and Long COVID

4.6.1 Comparison of mean scores of Stress among subjects during COVID and Long COVID

4.6.2 Comparison of mean scores of Fatigue among subjects during COVID and Long COVID

4.6.3 Comparison of mean scores of Insomnia among subjects during COVID and Long COVID

4.1 Socio- demographic status of study subjects

Socio-demographics refer to a combination of social and demographic factors that define people in a specific group or population.

The socio demographic information of the subjects with respect to gender, age and educational attainment are tabulated in Table 4.1

Table 4.1

Socio-demographic status of study subjects

N=250

SOCIO-DEMOGRAPHIC CHARACTERISTICS	FREQUENCY (N)	PERCENTAGE (%)
Gender		
Male	104	41.6
Female	146	58.4
Age		
18 – 29	95	38
30 – 39	31	12.4
40 – 49	48	19.2
50 – 59	49	19.6
Above 60	27	10.8
Education		
PG and above	65	26
Graduation	85	34
Higher Secondary	66	26.4
Secondary	34	13.6

In this study, 250 subjects were involved, with 104 (41.6%) men and 146 (58.4%) women. On studying the age wise distribution of the subjects, 95 (38%) were in the 18-29 age group, 31 (12.4%) in the 30-39 age group, 48 (19.2%) in the 40-49 age group, 49 (19.6%) in the 50-59 age group, and 27 (10.8%) in the above 60 age group.

According to the educational attainment of the study subjects, 65 (26%) had attained post-graduation, 85 (34%) were graduates, 66 (26.4%) had attained higher secondary education, and 34 (13.6%) had secondary education.

4.2 Nutritional status assessment of study subjects

Nutritional assessment is the systematic process of collecting and interpreting information in order to make decisions about the nature and cause of nutrition related health issues that affect an individual (British Dietetic Association (BDA), 2012).

4.2.1 Anthropometric assessment of study subjects using BMI classification

BMI is defined as a person's weight in kilograms divided by the square of the person's height in metres (kg/m^2).

The anthropometric assessment of the study subjects using BMI is shown in Figure 4.1

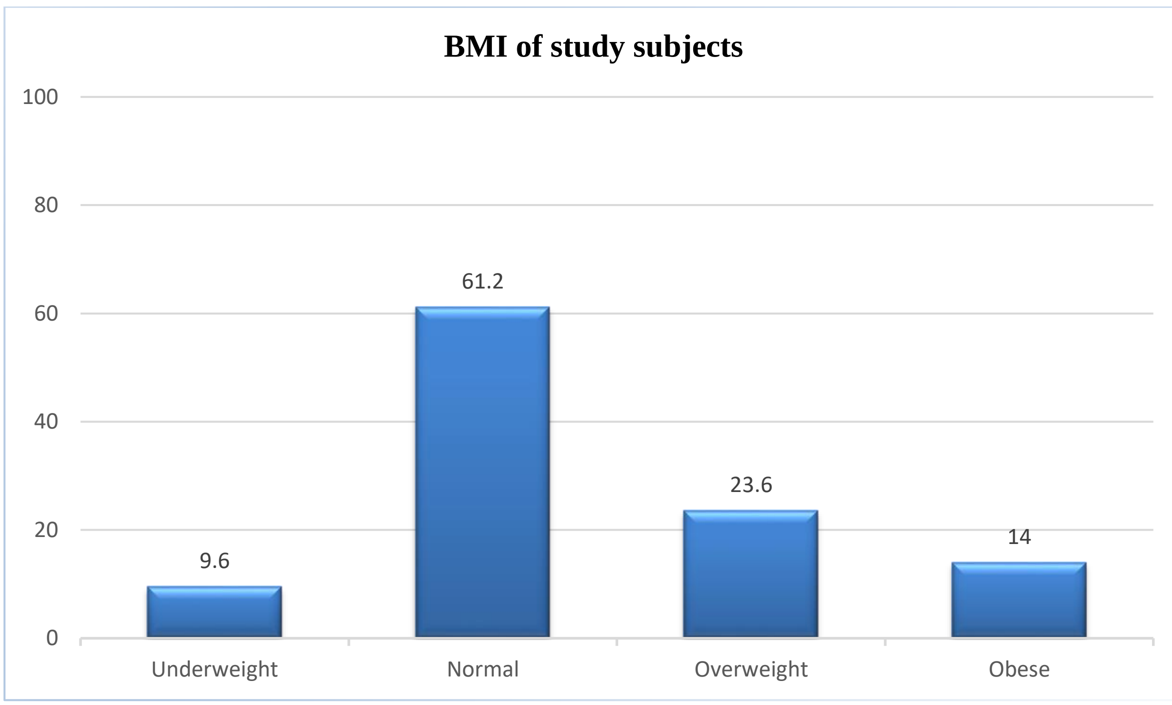


Fig 4.1

Anthropometric assessment of study subjects using BMI classification

Fig 4.1 shows the BMI categories of the study subjects, with 24 (9.6%) of subjects being underweight, 153 (61.2%) being normal, 59 (23.6%) being overweight, and 14 (5.6%) being obese.

According to Lyudmyla *et al*., (2021), a non-linear association was discovered between Body Mass Index (BMI) and COVID-19 severity among 148,494 U.S. people with COVID-19, with lowest risks at BMIs near the threshold between healthy weight and overweight in most cases, then increasing with higher BMI. Obesity and being overweight were found to be risk factors for invasive mechanical ventilation. Obesity was found to be a risk factor for hospitalization and death in persons over the age of 65.

The details regarding the physical activity pattern among study subjects are presented in Fig. 4.2

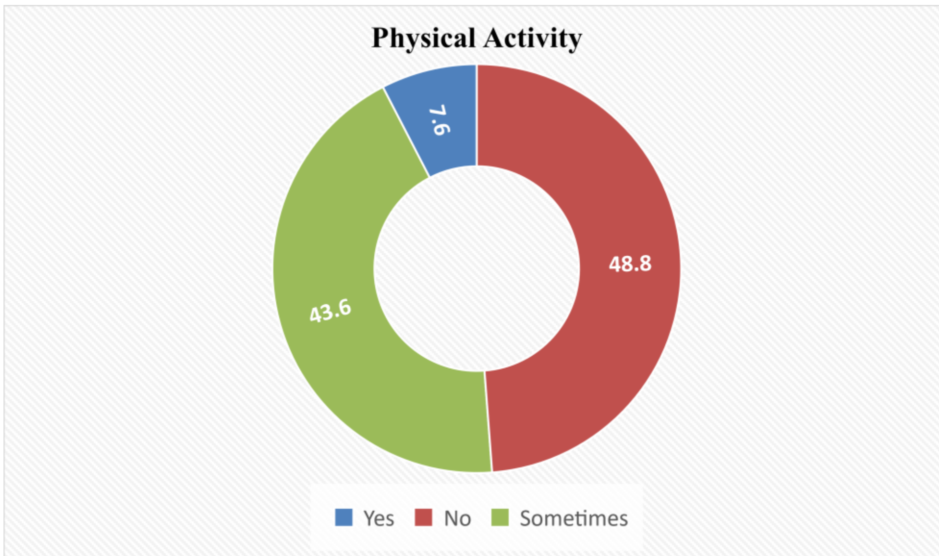


Fig. 4.2
Physical activity pattern among study subjects

Among the subjects, only 19 (7.6%) exercise on a regular basis whereas 109 (43.6%) exercise occasionally. Physical inactivity was seen in 122 (48.8%) of the participants.
Ammar *et al*. (2020) have reported that COVID-19 home confinement has resulted in a decrease in all levels of physical activities and about 28% increase in daily sitting time as well as increase in unhealthy pattern of food consumption.

4.2.2 Dietary Diversity Score among study subjects

Dietary Diversity is defined as the number of different foods or food groups consumed over a given reference period. The Dietary Diversity Score (DDS) is a proxy tool that is based on the idea that "dietary diversity is a fundamental part of diet quality, and a diverse diet helps provide appropriate intakes of vital nutrients that promote health" (FAO, 2018). DDS were categorized into three groups: high dietary diversity (6–9), medium dietary diversity (4–6), and low dietary diversity (1–3), with the results reported in Table 4.2

Table 4.2

Dietary assessment of the study subjects using DDS

N=250

SCORE	INTERPRETATION	FREQUENCY (N)	PERCENTAGE (%)
6-9	High	65	26
4-6	Medium	148	59.2
1-3	Low	37	14.8

Among the subjects, 26% had a high dietary diversity score of 6-9, 59.2% had a medium dietary diversity score of 4-6 and 14.8% had a low dietary diversity score of 1-3.

A study conducted by Yi et al.,2021, among 2,201 primary school students and 1,341 junior high-school students indicated that, COVID-19 had a significant negative effect on the dietary diversity of students from low- and middle-income groups, with the DDS of the low-income group decreasing by 0.31 points ($p < 0.01$) and that of the middle-income group by 0.12 points ($p < 0.1$). Dietary diversity score (DDS) of rural students decreased by 0.295 points ($p < 0.01$) compared with that of urban students during COVID-19. Specifically, COVID-19 significantly reduced the frequency of rural students' consumption of vegetables by 1.8 percent, protein-rich foods such as soybean products and nuts by 6.0 percent, meats by 4.0 percent, aquatic products by 6.7 percent, and eggs by 5.3 percent, compared with urban students.

4.3 System of medicine adopted to treat COVID-19 infection

COVID-19 is treated with specific medications. Fig. 4.3 depicts the system of medicines used to treat COVID-19 infection.

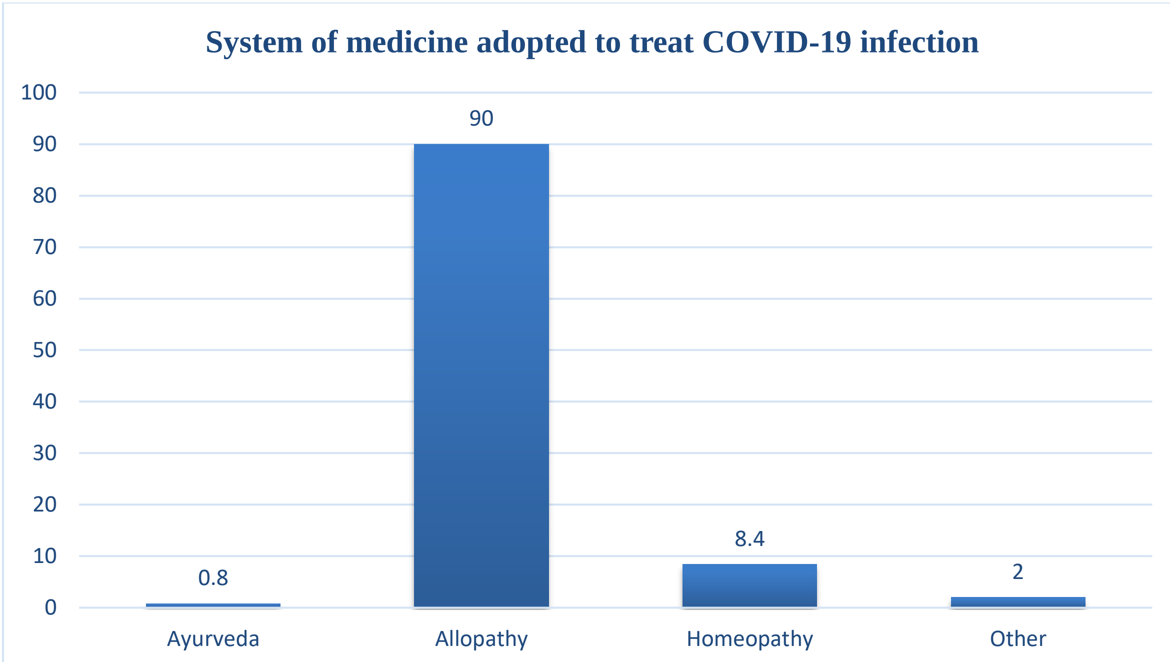


Fig 4.3

System of medicines adopted to treat COVID-19 infection

Fig 4.3 shows the different system of medicines adopted to treat COVID-19 infection, with 2 (0.8%) of subjects adopted Ayurveda, 225 (90%) adopted Allopathy, 21 (8.4%) adopted Homeopathy and about 2 (0.8%) adopted other modes of treatment.

A study by Chen et al., (2019), reported that allopathic therapy was used for COVID-19 treatment in the Wuhan Jinyintan Hospital (based on 99 patients) during the SARS-CoV-2 outbreak in Wuhan, including antiviral treatment (76%), antibiotic treatment (71%), oxygen therapy (75%), and intravenous immunoglobulin therapy (75%).

4.4 Assessment of Health and Well-being

Well-being is the experience of health, happiness, and prosperity. It includes having good mental health, high life satisfaction, a sense of meaning or purpose, and ability to manage stress. More generally, well-being is just feeling well (Tchiki,2019).

The different components assessed among the study subjects include comorbidity, symptoms during COVID and Long COVID, stress, fatigue, and sleep.

4.4.1 Assessment of Comorbidity among study subjects

Comorbidity means more than one disease or condition is present in the same person at the same time. The comorbidity assessment of the study subjects is shown in Table 4.3

Table 4.3

Comorbidity assessment of study subjects

N=250

COMORBIDITY	FREQUENCY (N)	PERCENTAGE (%)
Hypertension		
Yes	60	24
No	190	76
Diabetes Mellitus		
Yes	48	19.2
No	202	80.8
Cardiovascular Disease		
Yes	42	16.8
No	208	83.2
Obesity		
Yes	52	20.8
No	198	79.2
Chronic Lung Disease		
Yes	11	4.4
No	239	95.6
Kidney Disease		
Yes	13	5.2
No	237	94.8
Liver Disease		
Yes	7	2.8
No	243	97.2
Cancer		
Yes	8	3.2
No	242	96.8

Table 4.3 shows the comorbidity assessment of the subjects. The most common comorbidity among the study subjects was hypertension 60 (24%), followed by obesity 52 (20.8), diabetes mellitus 48 (19.2%) and cardiovascular disease 42 (16.8%). The least observed comorbidities were kidney disease 13 (5.2%), lung disease 11 (4.4%) and cancer 8 (3.2%).

In the present study, it is observed that hypertension 60 (24%) is the most prevalent comorbidity. In another study, approximately 25% of COVID-19 positive people had at least one comorbidity associated (Guan *et al.,* 2020). Heart diseases, including hypertension along with cardiovascular diseases, are the most frequent association with SARS-CoV2 infection in most countries (Shweta *et al*., 2020). Similar reports of a high prevalence of cardiovascular disease and hypertension among hospitalized and diseased patients were demonstrated by Richardson *et al.* (2020), Wu and McGoogan (2020), and Zhou *et al.*, (2020) in case reports from China and the United Formulated, respectively.

4.4.2 Assessment of symptoms during COVID among study subjects

COVID-19 manifested with different symptoms in different individuals. The majority of infected people will experience mild to moderate symptoms and recover without the need for hospitalisation. Fever, cough, weariness, and loss of taste or smell are the most common symptoms, with sore throat, headache aches and pains, diarrhoea, rash on skin, or discoloration of fingers or toes, and red or irritated eyes being less prevalent.

The symptoms experienced during the COVID period are shown in Table 4.4

Table 4.4

Assessment of symptoms during COVID among study subjects

N=250

SYMPTOMS	FREQUENCY	PERCENTAGE (%)
Fever		
Absent	42	16.8
Mild	73	29.2
Moderate	85	34
Severe	50	20
Dry Cough		
Absent	81	32.4
Mild	83	33.2
Moderate	55	22
Severe	31	12.4

Tiredness		
Absent	27	10.8
Mild	36	14.4
Moderate	97	38.8
Severe	90	36
Headache		
Absent	53	21.2
Mild	111	44.4
Moderate	55	22
Severe	31	12.4
Diarrhea		
Absent	227	90.8
Mild	13	5.2
Moderate	7	2.8
Severe	3	1.2
Loss of taste/smell		
Absent	109	43.6
Mild	72	28.8
Moderate	41	16.4
Severe	28	11.2
Skin rash		
Absent	242	96.8
Mild	4	1.6
Moderate	3	1.2
Severe	1	0.4
Breathlessness		
Absent	175	70
Mild	38	15.2
Moderate	25	10
Severe	12	4.8
Chest pain		
Absent	185	74
Mild	45	18
Moderate	17	6.8
Severe	3	1.2

Table 4.4 shows the assessment of symptoms of studied subjects during COVID. Tiredness 223 (89.2%) was the most prevalent symptom among the COVID patients, followed by fever 208 (83.2%), headache 197 (78.8%), dry cough 169 (67.6%), and loss of taste/smell141 (56.4%). Breathlessness 75 (30%), chest pain 65 (26%) and diarrhoea 23 (9.2%) were the other significant symptoms. The least prevalent symptom was skin rash 8 (3.2%).

According to Michael *et al.*, (2020), who investigated 148 patients from different countries, fever (78%) and cough (57 %) are the most prevalent symptoms of adults infected with SARS-CoV-2. Fever and cough were the most prevalent symptoms, according to Russell et al.,2020, with proportions ranging from 46% to 64.2 % for fever and 32% to 55.9% for cough.

4.4.3 Assessment of symptoms during Long COVID among study subjects

Long COVID refers to the persistence of symptoms in people who have recovered from COVID-19 infection. Post-COVID conditions can include a wide range of ongoing health problems; these conditions can last weeks, months, or years. Most people with COVID-19 get better within a few days to a few weeks after infection, so at least four weeks after infection is the start of when post-COVID conditions could first be identified. Anyone who was infected can experience post-COVID conditions. Most people with post-COVID conditions experienced symptoms days after their SARS CoV-2 infection when they knew they had COVID-19, but some people with post-COVID conditions did not notice when they first had an infection (CDC,2022).

Overall symptom prevalence in 8 organ systems was estimated for a total of 49 symptoms. The study asked respondents to specify the number of months their symptoms lasted in order to investigate disease duration. or a period of 1-6 months, long-term COVID symptoms were observed.

4.4.3.1 Cardiovascular symptoms of Long COVID among study subjects

The details regarding the assessment of cardiovascular symptoms of Long COVID among the study subjects are presented in Table 4.5

Table 4.5

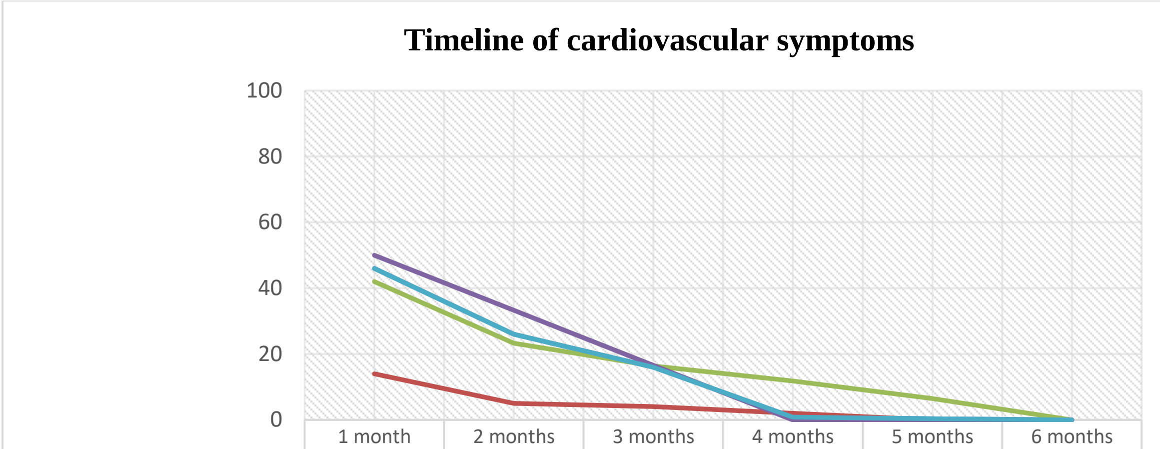
Cardiovascular symptoms of Long COVID among study subjects

N=250

Cardiovascular Symptoms	Frequency (N)	Percentage (%)
Palpitations		
Absent	220	88
Mild	18	7.2
Moderate	8	3.2
Severe	4	1.6
Tachycardia		
Absent	225	90
Mild	14	5.6
Moderate	8	3.2
Severe	3	1.2
Pain / burning in chest		
Absent	213	85.2
Mild	24	9.6
Moderate	10	4
Severe	3	1.2
Bulging		
Absent	226	90.4
Mild	13	5.2
Moderate	8	3.2
Severe	3	1.2
Fainting		
Absent	220	88
Mild	17	6.8
Moderate	10	4
Severe	3	1.2

The most common cardiovascular symptom among the subjects was pain/burning in the chest 37 (14.8%). Palpitation 30 (12%) and fainting 30 (12%) were the other significant symptoms. The least common symptoms are tachycardia 25 (10%) and bulging 24 (9.6%).

The timeline of cardiovascular symptoms of Long COVID among the study subjects are depicted in Fig.4.4



	1 month	2 months	3 months	4 months	5 months	6 months
Palpitations	46	26	16	0.8	0.4	0
Tachycardia	14	5	4	2	0	0
Pain/burning in chest	42	23.3	16.4	11.8	6.5	0
Bulging	50	33.3	16.6	0	0	0
Fainting	46	26	16	0.8	0.4	0

Fig. 4.4
Timeline of cardiovascular symptoms

The most common cardiovascular symptom among the subjects was pain/burning in the chest 37 (14.8%). Among the subjects, 41% of the individuals had the pain in chest for one month, 24.3% for two months, 16.2% for three months, 10.8% for four months, and 8.1% for five months.

[Puntmann et al.,2020], while a large case series showed that chest pain, possibly owing to myocarditis, was a common manifestation in patients 60 days following onset of COVID-19 symptoms, with 21.7% of the 143-patient assessed reporting chest pain (Carfì et al.,2020). In addition to cardiac complaints, studies have highlighted an emerging trend in the development of new onset Postural Orthostatic Tachycardia Syndrome (POTS) in individuals Long COVID-19 infection, because of autonomic dysfunction (Johansson et al.; Dani *et al*.,2021).

4.4.3.2 Systemic symptoms of Long COVID among study subjects

The details regarding the assessment of systemic symptoms of Long COVID among the study subjects are presented in Table 4.6

Table 4.6

Systemic symptoms of Long COVID among study subjects

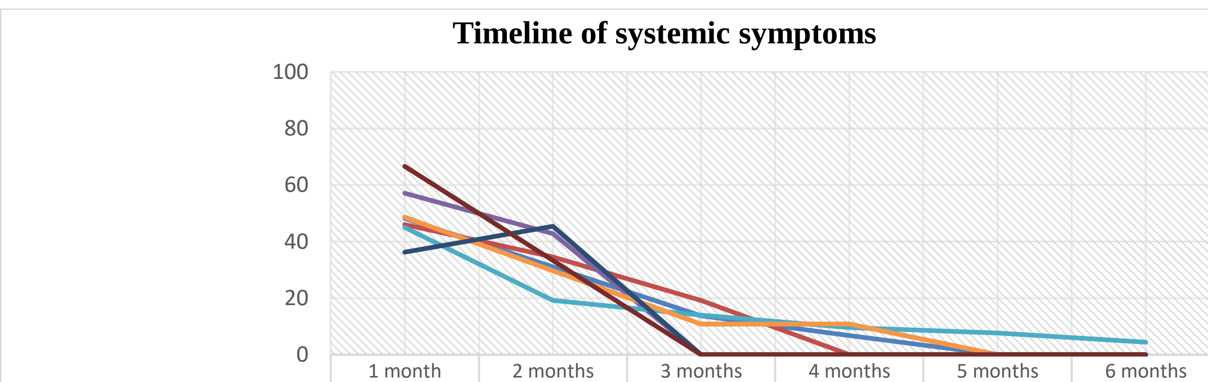
N=250

Systemic symptoms	Frequency (N)	Percentage (%)
Malaise		
Absent	192	76.8
Mild	47	18.8
Moderate	6	2.4
Severe	5	2
Elevated Temperature		
Absent	198	79.2
Mild	42	16.8
Moderate	9	3.6
Severe	1	0.4
Chills/flushing/ sweats		
Absent	213	85.2
Mild	29	11.6
Moderate	7	2.8
Severe	1	0.4
Skin sensation		
Absent	243	97.2
Mild	7	2.8
Moderate	-	-
Severe	-	-
Weakness		
Absent	94	37.6
Mild	89	35.6
Moderate	45	18
Severe	22	8.8
Extreme thirst		
Absent	213	85.2
Mild	25	10
Moderate	9	3.6
Severe	3	1.2

Menstrual issues		
Absent	239	95.6
Mild	7	2.8
Moderate	4	1.6
Severe	-	-
Sexual dysfunction		
Absent	244	97.6
Mild	6	2.4
Moderate	-	-
Severe	-	-

The most common systemic symptom among the subjects was weakness 156 (62.4%). The other prominent symptom was malaise 58 (23.2%), which was followed by elevated temperature 52 (20.8%), chills/flushing/sweat 37 (14.8%) and excessive thirst 37 (14.8%). The least common symptoms include skin sensitivity 7 (2.8%), menstruation problems 11 (4.4%) and sexual dysfunction 6 (2.4%).

The timeline of systemic symptoms of Long COVID among the study subjects are depicted in Fig. 4.5



	1 month	2 months	3 months	4 months	5 months	6 months
Malaise	48.2	31	13.7	6.8	0	0
Elevated Temperature	46	34.6	19.2	0	0	0
Chills/flushing/sweats	48.6	29.7	10.8	10.8	0	0
Skin sensation	57.1	42.8	0	0	0	0
Weakness	45	19.2	14	9.6	7.6	4.4
Extreme thirst	48.6	29.7	10.8	10.8	0	0
Menstrual issues	36.3	45.4	0	0	0	0
Sexual dysfunction	66.6	33.3	0	0	0	0

Fig 4.5
Timeline of systemic symptoms

The most common systemic symptom among the subjects was weakness 156 (62.4%). Among the subjects, 45% of the individuals had the weakness for one month, 19.2% for two months, 14% for three months, 9.6%for four months, 7.6% for five months and 4.4% for 6 months. Results from an international online survey of 3762 individuals (Hannah *et al.,* 2021) demonstrate that, almost all participants experienced systemic symptoms (99.7%, 95% confidence interval 99.49% to 99.84%).

4.4.3.3 Musculoskeletal symptoms of Long COVID among study subjects

The details regarding the assessment of musculoskeletal symptoms of Long COVID among the study subjects are presented in Table 4.7

Table 4.7

Musculoskeletal symptoms of Long COVID among study subjects

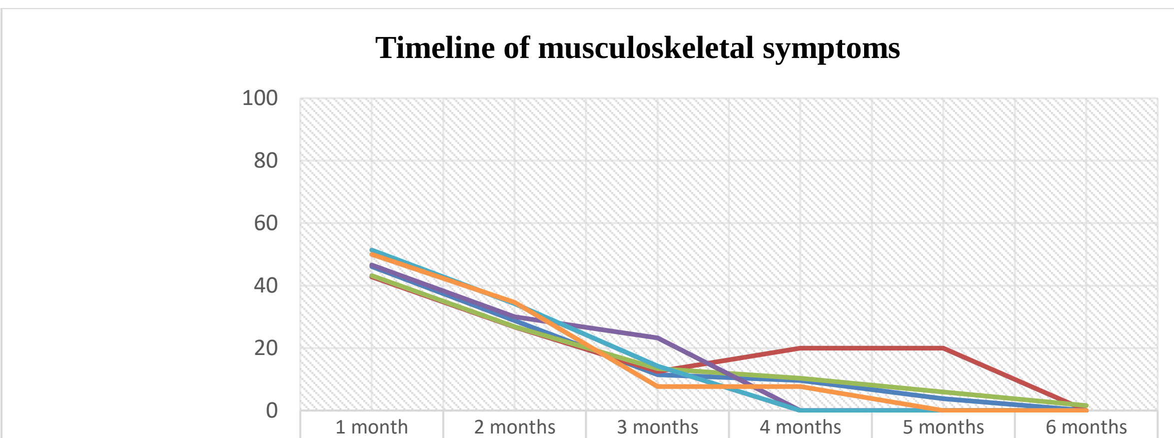
N=250

Musculoskeletal symptoms	Frequency (N)	Percentage (%)
Tightness of chest		
Absent	198	79.2
Mild	33	13.2
Moderate	16	6.4
Severe	3	1.2
Muscle aches		
Absent	194	77.6
Mild	34	13.6
Moderate	12	4.8
Severe	10	4
Joint pain		
Absent	183	73.2
Mild	40	16
Moderate	15	6
Severe	12	4.8
Stiff neck		
Absent	220	88
Mild	22	8.8
Moderate	6	2.4
Severe	2	0.8

Muscle spasms		
Absent	215	86
Mild	18	7.2
Moderate	11	4.4
Severe	6	2.4
Bone aching/burning		
Absent	224	89.6
Mild	16	6.4
Moderate	6	2.4
Severe	4	1.6

Joint pain 67 (26.8%) was the most prevalent musculoskeletal symptom among the participants, followed by muscle aches 56 (22.4%) and tightness of chest 52 (20.8%). The least common symptoms include stiff neck 30 (12%), muscle spasms 35 (14%) and bone aching or burning 26 (10.4%).

The timeline of musculoskeletal symptoms of Long COVID among the study subjects are depicted in Fig. 4.6



	1 month	2 months	3 months	4 months	5 months	6 months
Tightness of chest	46.1	28.8	11.5	9.6	3.8	0
Muscle aches	42.8	26.7	12.5	20	20	0
Joint pain	43.2	26.8	13.4	10.4	5.9	1.6
Stiff neck	46.6	30	23.3	0	0	0
Muscle spasms	51.4	34.2	14.2	0	0	0
Bone aching/burning	50	34.6	7.7	7.7	0	0

Fig. 4.6

Timeline of musculoskeletal symptoms

Joint pain 67 (26.8%) was the most significant musculoskeletal symptom. Among the subjects, 43.2% of the individuals had the joint pain for one month, 26.8% for two months, 13.4% for three months, 10.4%for four months, 5.9% for five months and 1.6% for 6 months.

According to Fulya *et al., (*2021), 240 (85.7%) of the 280 patients had at least one or more musculoskeletal symptoms that started with or were aggravated by their COVID-19 infection, while 40 (14.3%) of the 280 patients' musculoskeletal problems did not change after being infected with COVID-19. Furthermore, back pain in acute COVID-19 was found to be related to post-acute COVID-19 musculoskeletal symptoms.

A rehabilitation centre in Bangladesh reported that the frequency of head and neck pain was 27%, pain in the lower limb 34%, back pain 24% and pain in the upper limb 13% in 90 post-COVID-19 patients (Numan,2021).

4.4.3.4 Immunologic symptoms of Long COVID among study subjects

The details regarding the assessment of immunologic symptoms of Long COVID among the study subjects are presented in Table 4.8

Table 4.8

Immunologic symptoms of Long COVID among study subjects

N=250

Immunologic symptoms	Frequency (N)	Percentage (%)
Reactions to old allergies		
Absent	244	97.6
Mild	5	2
Moderate	1	0.4
Severe	-	-
New allergies		
Absent	243	97.2
Mild	3	1.2
Moderate	3	1.2
Severe	1	0.4

Immunologic symptoms were observed in 6 (2.4%) subjects who reacted to the old allergen and 7 (2.8%) new allergens were found.

The timeline of immunologic symptoms of Long COVID among the study subjects are depicted in Fig.4.7

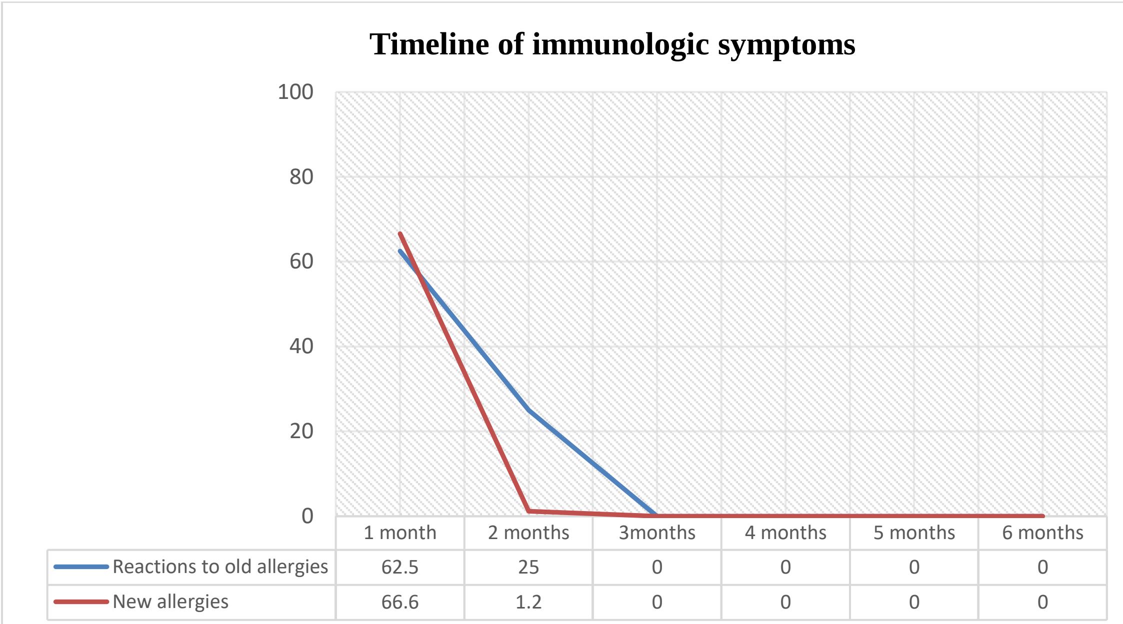


Fig. 4.7

Timeline of immunologic symptoms

Immunologic symptoms were observed in 6 (2.4%) subjects who reacted to the old allergen and 7 (2.8%) new allergens were found. Among the subjects, 62.5% of the individuals had reactions to old allergies for one month and 25% for two months. 67% had new allergies for one month and 1.2% for 2 months.

According to Elena *et al*., (2021), Long COVID was detected in both adults and children and is characterized by immunological dysregulation. Autoimmune reactions in adult patients and allergic reactions in children appear to be critical factors.

4.4.3.5 Dermatologic symptoms of Long COVID among study subjects

The details regarding the assessment of dermatologic symptoms of Long COVID among the study subjects are presented in Table 4.9

Table 4.9

Dermatologic symptoms of Long COVID among the study subjects

N=250

Dermatologic symptoms	Frequency (N)	Percentage (%)
Itchy skin		
Absent	244	97.6
Mild	4	1.6
Moderate	1	0.4
Severe	1	0.4
Skin rashes		
Absent	244	97.6
Mild	2	0.8
Moderate	2	0.8
Severe	2	0.8
Peeling skin		
Absent	247	98.8
Mild	3	1.2
Moderate	-	-
Severe	-	-
Other skin and allergies		
Absent	246	98.4
Mild	4	1.6
Moderate	-	-
Severe	-	-

Itchy skin 6 (2.4%), skin rashes 6 (2.4%), peeling skin 3 (1.2%) and other skin allergies 4 (1.6%) were the dermatological symptoms among the participants.

The timeline of dermatologic symptoms of Long COVID among the study subjects are depicted in Fig.4.8

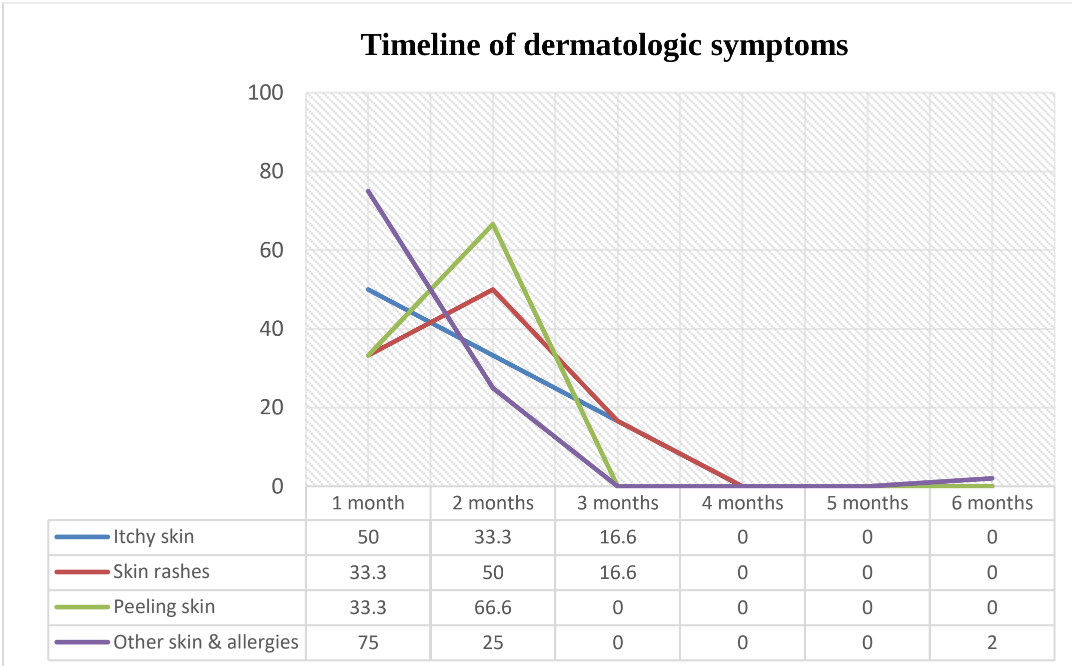


Fig. 4.8

Timeline of dermatologic symptoms

For one month, 50 % of the participants had itchy skin, 33.3% for two months, and 16.6 % for three months. Skin rashes affected 33.3 % of the patients for one month, 50 % for two months, and 16.6% for three months. For one month, 33.3% of the participants had peeling skin, whereas 66.6% had peeling skin for two months. For one month, 75% of the individuals experienced additional skin allergies, and 25% had them for two months.

Tursen *et al.*, have described the skin problems such as erythematous rash, urticarial, petechial and vesicles in 20% of patients. The patients infected with coronavirus have been dubbed COVID toes by the dermatological community, according to Misha Rosenbach (2021). The toes and fingers exhibit a reddish-purple staining, which could be an indication of coronavirus. Other skin problems such as measles, hives, and rashes have also been recorded.

4.4.3.6 HEENT symptoms of Long COVID among study subjects

HEENT stands for “Head, Eyes, Ears, Nose, and Throat.” If someone is experiencing symptoms that affect those areas, they will likely receive a HEENT examination. The details regarding the assessment of HEENT symptoms of Long COVID among the study subjects are presented in Table 4.10

Table 4.10

HEENT symptoms of Long COVID among study subjects

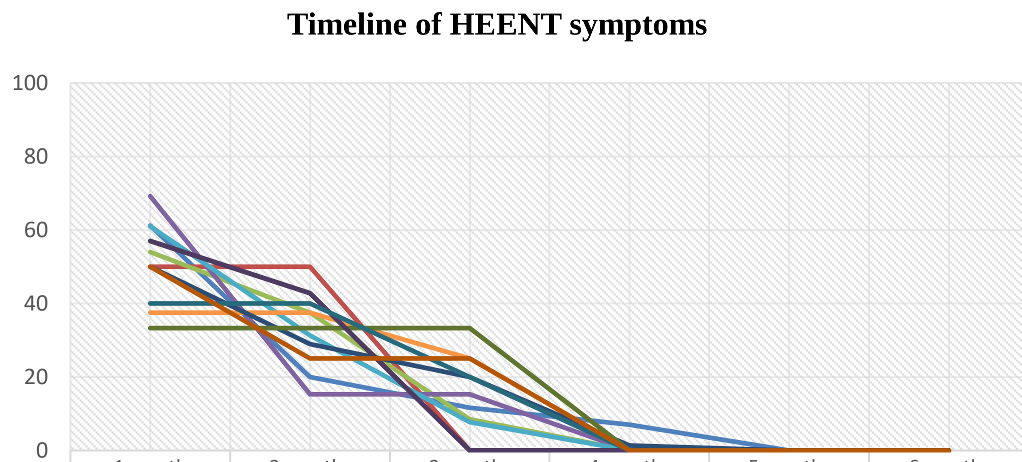
N=250

HEENT symptoms	Frequency (N)	Percentage (%)
Sore throat		
Absent	121	48.4
Mild	84	33.6
Moderate	31	12.4
Severe	14	5.6
Blurred vision		
Absent	248	99.2
Mild	2	0.8
Moderate	-	-
Severe	-	-
Difficulty in swallowing		
Absent	202	80.8
Mild	35	14
Moderate	10	4
Severe	3	1.2
Sensitivity to light		
Absent	237	94.8
Mild	10	4
Moderate	3	1.2
Severe	-	-
Running nose		
Absent	199	79.6
Mild	33	13.2
Moderate	10	4
Severe	8	3.2
Dry eyes		
Absent	234	93.6
Mild	16	6.4
Moderate	-	-
Severe	-	-

Changes in voice		
Absent	180	72
Mild	50	20
Moderate	16	6.4
Severe	4	1.6
Eye pain		
Absent	243	97.2
Mild	7	2.8
Moderate	-	-
Severe	-	-
Ear pain		
Absent	238	95.2
Mild	8	3.2
Moderate	4	1.6
Severe	-	-
Other eye issues		
Absent	243	97.2
Mild	7	2.8
Moderate	-	-
Severe	-	-
Other ear issues		
Absent	245	98
Mild	5	2
Moderate	-	-
Severe	-	-
Numbness in ear		
Absent	246	98.4
Mild	4	1.6
Moderate	-	-
Severe	-	-

Sore throat 129 (51.6%) was the most prevalent HEENT symptom among the participants, followed by changes in voice 70 (28%), running nose 51 (20.4%), difficulty in swallowing 48 (19.2%), dry eyes 16 (6.4%), sensitivity to light 13 (5.2%) and ear pain 12 (4.8%). The least common symptoms include eye pain 7 (2.8%), other eye issues 7 (2.8%), other ear issues 5 (2%), numbness of ear 4 (1.6%) and blurred vision 2 (0.8%).

The timeline of HEENT symptoms of Long COVID among the study subjects are depicted in Fig.4.9



	1 month	2 months	3 months	4 months	5 months	6 months
Sore throat	61.2	20	11.6	7	0	0
Blurred vision	50	50	0	0	0	0
Difficulty in swallowing	54	37.5	8.5	0	0	0
Sensitivity to light	69.2	15.3	15.3	0	0	0
Running nose	61	31.3	7.7	0	0	0
Dry eyes	37.5	37.5	25	0	0	0
Changes in voice	50	29	20	1.4	0	0
Eye pain	57	42.8	0	0	0	0
Ear pain	33.3	33.3	33.3	0	0	0
Other eye issues	57	42.8	0	0	0	0
Other ear issues	40	40	20	0	0	0
Numbness in ear	50	25	25	0	0	0

Fig. 4.9
Timeline of HEENT symptoms

Sore throat 129 (51.6%) was the most prevalent HEENT symptom among the participants. For one month, 61.2 % of the participants had sore throat, 20% for two months, 11.6% for three months and 7% for four months.

A study done by Aravind *et al.*, (2021), included 477 studies for qualitative synthesis and 59 studies for meta-analyses. They found 91 papers on HEENT manifestations, including 14 prospective cohorts, 7 retrospective cohorts, 5 case–control, and 23 cross-sectional studies, as well as 9 case series with ≥10 patients, the remainder being small case series and case report. In total, these publications have described 17,452 patients with COVID-19 and disorders of smell or taste, 188 with dysphagia or dysphonia, 63 with conjunctivitis, 4 with retinal artery occlusion, and 202 with other ocular symptoms like eye pain, photophobia, flashes/floaters, blurry vision, and red eyes.

4.4.3.7 Pulmonary symptoms of Long COVID among study subjects

The details regarding the assessment of Pulmonary symptoms of Long COVID among the study subjects are presented in Table 4.11

Table 4.11

Pulmonary symptoms of Long COVID among the study subjects

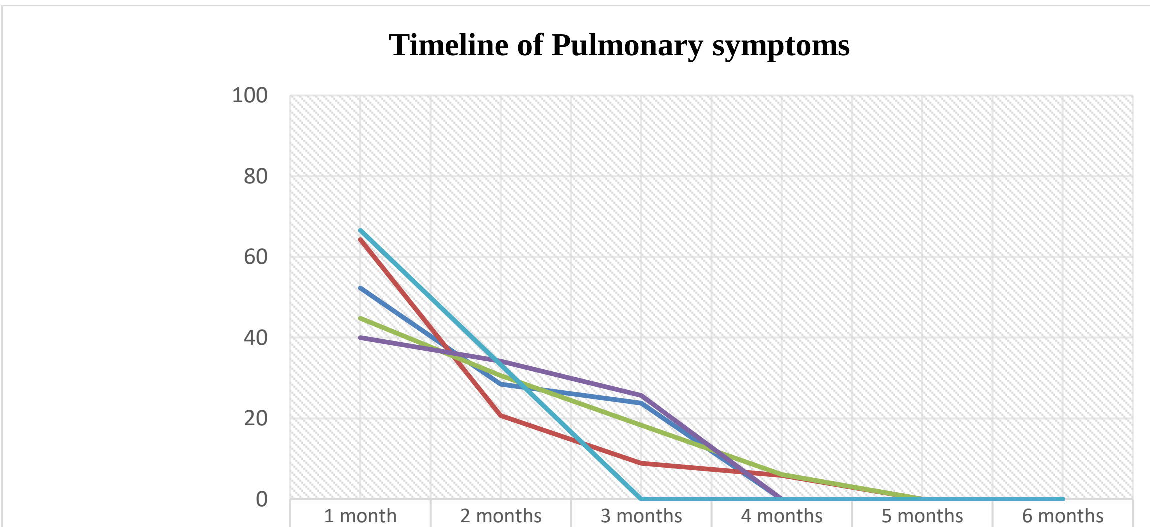
N=250

Pulmonary symptoms	Frequency (N)	Percentage (%)
Shortness of breath		
Absent	208	83.2
Mild	19	7.6
Moderate	15	6
Severe	8	3.2
Dry cough		
Absent	149	59.6
Mild	72	28.8
Moderate	15	6
Severe	14	5.6
Breathing difficulty		
Absent	201	80.4
Mild	21	8.4
Moderate	17	6.8
Severe	11	4.4
Sneezing		
Absent	221	88.4
Mild	17	6.8
Moderate	9	3.6
Severe	3	1.2

Coughing of blood		
Absent Mild Moderate Severe	244 2 4 -	97.6 0.8 1.6 -

The most common pulmonary symptom among the participants was dry cough 101 (40.4%), which was followed by breathing difficulty 49 (19.6%), shortness of breath 42 (16.8%), and sneezing 35 (14%). Coughing up blood 6 (2.4%) was the least prevalent symptom.

The timeline of Pulmonary symptoms of Long COVID among the study subjects are depicted in Fig.4.10



	1 month	2 months	3 months	4 months	5 months	6 months
Shortness of breath	52.3	28.5	23.8	0	0	0
Dry cough	64.3	20.7	8.9	5.9	0	0
Breathing difficulty	44.8	30.6	18.3	6.1	0	0
Sneezing	40	34.2	25.7	0	0	0
Coughing of blood	66.6	33.3	0	0	0	0

Fig. 4.10

Timeline of Pulmonary symptoms

The most common pulmonary symptom among the participants was dry cough 101 (40.4%). 64.3 percent of participants experienced a dry cough for one month, 20.7 percent for two months, 8.9 percent for three months, and 5.9% for four months.

According to a study conducted by Davis et al., 93.0% of respondents had pulmonary and respiratory symptoms. Shortness of breath was more common (77.4%), followed by dry cough (66.2%) and breathing trouble with normal oxygen levels (60.4%).

4.4.3.8 Gastrointestinal symptoms of Long COVID among study subjects

The details regarding the assessment of Gastrointestinal symptoms of Long COVID among the study subjects are presented in Table 4.12

Table 4.12

Gastrointestinal symptoms of Long COVID among study subjects

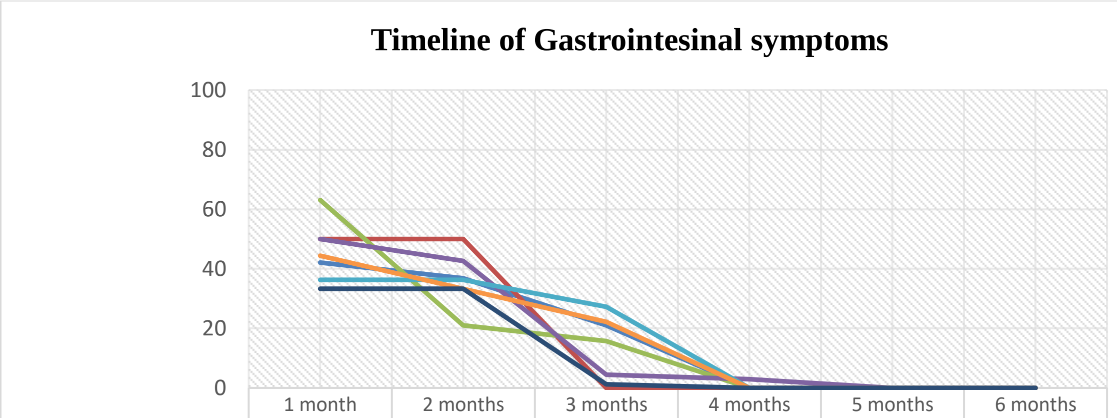
N=250

Gastrointestinal symptoms	Frequency (N)	Percentage (%)
Diarrhea		
Absent	241	96.4
Mild	5	2
Moderate	4	1.6
Severe	-	-
Vomiting		
Absent	242	96.8
Mild	5	2
Moderate	2	0.8
Severe	1	0.4
Constipation		
Absent	231	92.4
Mild	12	4.8
Moderate	5	2
Severe	2	0.8
Loss of appetite		
Absent	161	64.4
Mild	71	28.4
Moderate	12	4.8
Severe	6	2.4

Nausea		
Absent	239	95.6
Mild	9	3.6
Moderate	2	0.8
Severe	-	-
Abdominal pain		
Absent	241	96.4
Mild	6	2.4
Moderate	3	1.2
Severe	-	-
Bowel sensation		
Absent	244	97.6
Mild	6	2.4
Moderate	-	-
Severe	-	-

The most common gastrointestinal symptom among the participants was loss of appetite 89 (35.6%). Constipation 19 (7.6%) and nausea 11 (4.4) were the other significant symptoms. Diarrhoea 19 (7.6%), abdominal pain 9 (3.6%), vomiting 8 (3.2%) and bowel sensation 6 (2.4%) are the least common symptoms.

The timeline graph of the Gastrointestinal symptoms of Long COVID among the study subjects are depicted in Fig.4.11



	1 month	2 months	3 months	4 months	5 months	6 months
Diarrhoea	42.1	36.8	21	0	0	0
Vomiting	50	50	0	0	0	0
Constipation	63.1	21	15.7	0	0	0
Loss of appetite	50	42.6	4.5	2.9	0	0
Nausea	36.3	36.3	27.2	0	0	0
Abdominal pain	44.4	33.3	22.2	0	0	0
Bowel sensation	33.3	33.3	1.2	0	0	0

Fig. 4.11
Timeline of Gastrointestinal symptoms

The most common gastrointestinal symptom among the participants was loss of appetite 89 (35.6%). For one month, 50 percent of the participants lost their appetite, 42.6 percent for two months, 4.5 percent for three months, and 2.9 percent for four months.

In a prospective cohort of 1,783 COVID-19 survivors (with 749 responders to survey questionnaires), 220 patients (29%) self-reported gastrointestinal symptoms at 6 months that included diarrhoea (10%), constipation (11%), abdominal pain (9%), nausea and/or vomiting (7%) and heartburn (16%) (Blackett et al.,2022). In a different study of 73,435 users of the Veterans Health Administration, motility disorders (including constipation and diarrhoea), esophageal disorders, dysphagia and abdominal pain were reported (Xie et al.,2021).

4.4.4 Assessment of Stress among study subjects

The PSS-10-C Scale was used to assess the stress levels of the study subjects during COVID and Long COVID (Table 4.13). The PSS-10-C comprises 10 items, each of which offers five response options: never, rarely, occasionally, almost always, and always. Items 1, 2, 3, 6, 9, and 10 are scored directly from 0 to 4, and items 4, 5, 7, and 8, conversely, from 4 to 0. PSS score correlates with the severity of stress. A person with a score of 0 – 13 was considered low stress. A score of 14-26 indicates moderate stress, while a score of 27- 40 indicates high–perceived stress.

Table 4.13

Stress assessment of the study subjects using PSS-10-C scale

N=250

		DURING COVID		**LONG COVID**	
SCORE	**INTERPRETATION**	**FREQUENCY (N)**	**PERCENTAGE (%)**	**FREQUENCY (N)**	**PERCENTAGE (%)**
0-13	Low Stress	82	32.8	145	58
14-26	Moderate Stress	153	61.2	100	40
27-40	High Stress	15	6	5	2

Table 4.13 shows the assessment of stress during COVID and Long COVID

During COVID, 153 (61.2%) of the subjects had a moderate level of perceived stress, 82 (32.8%) had a low level of stress, and 15 (6%) had a high level of stress.
On analyzing the results of Long COVID, low stress was found in 145 (58%) of the subjects, moderate stress in 100 (40%), and high stress in 5 (2%) of the subjects.

A study by Bijoy et al.,2021, was conducted on 1536 Indian students during the COVID-19. The survey indicated that about 25% of students are negatively affected by the outbreak and have experienced an above average level of stress. Of these students, 6% have experienced severe stress, and around 45% mild stress. There are little data on psychiatric ill-health in adults recovering from COVID-19, especially in those with symptoms weeks to months after their initial infection or "Long COVID" (Callard et al.,2021). One study suggested these adults are more likely to be diagnosed with psychiatric conditions, with an estimated incidence of mood disorders of 9.9% (Taquet et al.,2012).

4.4.5 Assessment of Fatigue among study subjects

The Chalder Fatigue Scale (CFQ-11) was used to measure fatigue or tiredness of the study subjects during COVID and Long COVID (Table 4.14).

The CFQ 11 allows the user to distinguish between 'cases' and 'non-cases' of fatigue. The sub-scales of physical and psychological fatigue are not used here, but rather the respondent receives a global binary fatigue score ranging from 0 to 11. A global binary fatigue score of 3 or less represents scores of those who are not fatigued, with scores of 4 or more equating to 'severe fatigue'

Table 4.14

Fatigue assessment of the study subjects using CFQ-11 scale

N=250

		DURING COVID		LONG COVID	
SCORE	INTERPRETATION	FREQUENCY (N)	PERCENTAGE (%)	FREQUENCY (N)	PERCENTAGE (%)
0-3	Not Severe	144	57.6	49	19.6
4-11	Severe	106	42.4	201	80.4

During COVID, only (42.4%) of the subjects were severely fatigued, while 201 (80.4%) were severely fatigued on Long COVID

In several research, women were more likely than men to be fatigued in the general population (Loge et al. 2014). Fatigue and ageing have also been linked in different ways. Those who had fatigue symptoms for more than 6 months following SARS were more likely to suffer psychological illnesses (Lam et al.,2020).

4.4.6 Assessment of Sleep among study subjects

The Insomnia Severity Index (ISI) was used to assess the severity of insomnia, during COVID and Long COVID, as shown in Table 4.15

The ISI is a 7-item self-report questionnaire assessing the nature, severity, and impact of insomnia. The total score is interpreted as follows: absence of insomnia (0–7); sub-threshold insomnia (8–14); moderate insomnia (15–21); and severe insomnia (22–28)

Table 4.15

Sleep assessment of the study subjects using ISI

N=250

		DURING COVID		LONG COVID	
SCORE	INTERPRETATION	FREQUENCY (N)	PERCENTAGE (%)	FREQUENCY (N)	PERCENTAGE (%)
0-7	Absence of Insomnia	54	21.6	175	70
8-14	Subthreshold Insomnia	111	44.4	57	22.8
15-21	Moderate Insomnia	75	30	14	5.6
22-28	Severe Insomnia	10	4	4	1.6

During the infection period, 54 (21.66%) of the subjects had no clinically significant insomnia,111 (44.4%) had subthreshold insomnia,75 (30%) had moderate insomnia and 10 (4%) had severe insomnia.

When the data of long COVID were analyzed, 175 (70%) of the subjects had no clinically significant insomnia, 57 (22.8%) had subthreshold insomnia, 14 (5.6%) had moderate insomnia and 4 (1.6%) had severe insomnia.

A study conducted by Sanjenbam among 585 individuals (both tribes and non-tribes), shows that the overall prevalence of clinical insomnia is 12.13% (moderate one 11.11% and severe insomnia with 1.02%), and that of subthreshold insomnia is 31.97%.

4.5 Pearson's coefficient of correlation between Stress and Insomnia among COVID patients

Pearson's correlation coefficient is the test statistics that measures the statistical relationship, or association, between two continuous variables.

Hypothesis formulated that there is significant relationship between Stress and Insomnia among covid patients

The coefficient of correlation between Stress and Insomnia for the total sample was calculated and details of the correlation and other features of relationship are tabulated in Table 4.16

Table 4.16

Correlation between Stress and Insomnia among COVID patients

Category	N	r	Fisher's 't'
Stress	250	0.37**	6.28
Insomnia	250		

Note** indicates 'r' is significant at 0.01 level.

Pearson's coefficient of correlation 'r' between Stress and Insomnia among COVID patients for the sample is 0.37. This shows that there is a positive relationship between Stress and Insomnia. From this result it can be concluded that greater the Stress, greater the Insomnia.
Fisher's t-value obtained by the test of significance of 'r' is 6.28. This t-value exceeds 2.58, the table value required for significance at 0.01 level, indicating that the relationship between Stress and Insomnia among COVID patients is significant at 0.01 level of significance.
('r' is significant, if obtained value is equal to or greater than 1.96 or 2.58 at 0.05 level or 0.01 level of significance respectively).

4.6 Comparison of mean scores among subjects during COVID and Long COVID

A t-test is a type of inferential statistic used to determine if there is a significant difference between the means of two groups, which may be related in certain features.

Hypotheses formulated for the present study are:

1. There is significant difference in the mean scores of Stress among subjects during COVID and Long COVID
2. There is significant difference in the mean scores of Insomnia among subjects during COVID and Long COVID.
3. There is significant difference in the mean scores of Fatigue among subjects during COVID and Long COVID.

Analysis based on hypotheses

Each of the hypotheses are tested for their significance individually

4.6.1 Comparison of mean scores of Stress among subjects during COVID and Long COVID

Hypothesis formulated is that there is significant difference in the mean scores of Stress among subjects during COVID and Long COVID

The significance of difference was calculated using the test of significance of difference between Means (t-test). The mean and standard deviation of the two set of scores and the critical ratio was computed. The data and results are given in the Table 4.17

Table 4.17

Significance of difference in the mean scores of Stress among subjects during COVID and Long COVID

Category	N	Mean	S.D	t value	Level of significance
During Covid	250	24	± 7.07	7.14*	P<0.01
Long Covid	250	20	± 5.25		

*Significant at 0.01 level

Table 4.17 shows that the mean scores of Stress among subjects during COVID and Long COVID are 24 and 20 respectively. Obtained t-value (7.14) is greater than 2.58 which is the value required for significance at 0.01 level of significance. Hence the difference between the two sets of scores is significant. The mean score of stress during COVID is greater than that of mean score of Long COVID, indicating the stress during COVID period is high compared to the stress of Long COVID

4.6.2 Comparison of mean scores of Fatigue among subjects during COVID and Long COVID

Hypothesis formulated is that there is significant difference in the mean scores of Fatigue among subjects during COVID and Long COVID

The significance of difference in the mean scores of Fatigue among subjects during COVID and Long COVID was calculated using the mean and standard deviation of the two set of scores. The critical ratio was computed and the data and results are given in the Table 4.17

Table 4.18

Significance of difference in the mean scores of Fatigue among subjects during COVID and Long COVID

Category	N	Mean	S.D	t value	Level of significance
During Covid	250	28.23	±7.82	8.31*	P<0.01
Long Covid	250	33.47	±6.36		

*Significant at 0.01 level

Table 4.18 shows that shows that the mean scores of Fatigue among subjects during COVID and Long COVID are 28.23 and 33.47 respectively. Obtained t-value (8.31) is greater than 2.58 which is the value required for significance at 0.01 level of significance. Hence the difference between the two sets of scores is significant. The mean score of Fatigue of Long COVID is greater than that of mean score during COVID, indicating the Fatigue of Long COVID is high compared to the Fatigue during COVID.

4.6.3 Comparison of mean scores of Insomnia among subjects during COVID and Long COVID

Hypothesis formulated that there is significant difference in the mean scores of Insomnia among subjects during COVID and Long COVID

The significance of difference in the mean scores of Insomnia among subjects during COVID and Long COVID was calculated using the mean and standard deviation of the two set of scores. The critical ratio was computed and the data and results are given in the Table 4.19

Table 4.19

Significance of difference in the mean scores of Insomnia among subjects during COVID and Long COVID

Category	N	Mean	S.D	t value	Level of significance
During Covid	250	37.25	±9.41	10.97*	P<0.01
Long Covid	250	29.02	±7.29		

*Significant at 0.01 level

Table 4.19 shows that the mean scores of Insomnia among subjects during COVID and Long COVID are 37.25 and 29.02 respectively. Obtained t-value (10.97) is greater than 2.58 which is the value required for significance at 0.01 level of significance. Hence the difference between the two sets of scores is significant. The mean score of Insomnia during COVID is greater than that of mean score Long COVID, indicating the Insomnia during COVID period is high compared to the Insomnia of Long COVID.

The study subjects comprised 41.6% men and 58.4% women, with the majority being between the ages of 18 and 29. Most of the subjects (61.2%) had a BMI in the normal range, and only a few were obese (5.6). Among the subjects, 26% had a high dietary diversity score of 6-9, 59.2% had a medium dietary diversity score of 4-6 and 14.8% had a low dietary diversity score of 1-3. The most common comorbidity among the study subjects was hypertension (24%). On studying the most prevalent symptoms during COVID among the study subjects, tiredness was reported by 89.2%, followed by fever (83.2%), headache (78.8%), dry cough (67.6%), and loss of taste/smell (56.4%). Individuals with long COVID experienced a wide range of symptoms. Overall symptom prevalence in 8 organs was estimated for a total of 49 symptoms. On studying the most significant Long COVID symptoms among study subjects, loss of appetite was reported by 89%, followed by weakness (62.4%), sore throat (51.6%), dry cough (40.4%), joint pain (26.8%) and pain/burning in chest (14.8%). There is a positive relationship between stress and fatigue during COVID, with the more stress, the more insomnia. When stress, fatigue, and sleep are compared between COVID and long COVID, it can be assumed that stress and insomnia are more prevalent during COVID, whereas fatigue is more prevalent in long COVID than during COVID.

CHAPTER 5

SUMMARY AND CONCLUSION

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. COVID-19 affects different people in different ways. Most infected people will develop mild to moderate illness and recover without hospitalization. Long COVID conditions are a wide range of new, returning, or ongoing health problems that people experience after first being infected with the virus that causes COVID-19. These conditions can last weeks, months, or years. Many researchers have looked into COVID-19 patients, but just a few systematic studies have looked into the long-term effects of the virus.

The aim of the present study is to evaluate the Health and Well-being of Long COVID patients in Ernakulam district of Kerala. A total of 250 subjects from the Ernakulam district were chosen for this study. Telephonic interview method was used for the data collection. The survey, which was open to people aged 18 and older, included questions about sociodemographic information, anthropometric measurements, dietary assessment, system of medicine used to treat, symptoms experienced during COVID and Long COVID, stress, fatigue, and sleep during COVID and Long COVID.

The findings of the study are summarized as follows:

- The study subjects comprised 41.6% men and 58.4% women, with the majority being between the ages of 18 and 29.
- Most subjects (61.2%) had a BMI in the normal range, 23.6% were overweight, 9.6% were underweight, and 9.6% were obese.
- Only 7.6% of the subjects exercise regularly, 43.6% exercise occasionally, and 48.8% are physically inactive.
- Among the subjects, 26% had a high dietary diversity score of 6-9, 59.2% had a medium dietary diversity score of 4-6 and 14.8% had a low dietary diversity score of 1-3.
- The majority of the study subjects (90%) prefer allopathy to treat COVID 19 infection, with 8.4% adopted Homeopathy and remaining 2% adopted Ayurveda and other systems.

- The most common comorbidity among the study subjects was hypertension (24%), followed by obesity (20.8), diabetes mellitus (19.2%) and cardiovascular disease (16.8%). The least observed comorbidities were kidney disease (5.2%), lung disease (4.4%) and cancer 8 (3.2%).
- Tiredness was the most common symptom of COVID-19 among the study subjects (89.2%), followed by fever (83.2%), headache (78.8%), dry cough (67.6%), and loss of taste/smell (56.4%). Breathlessness 75 (30%), chest pain 65 (26%) and diarrhoea 23 (9.2%) were the other significant symptoms. The least prevalent symptom was skin rash 8 (3.2%).
- Patients with Long COVID experienced a wide range of symptoms. The most common cardiovascular symptom among the subjects was pain/burning in the chest (14.8%) which lasted for 5 months. Palpitation (12%) and fainting (12%) were the other significant symptoms. The least common symptoms are tachycardia (10%) and bulging (9.6%).
- The most common systemic symptom was weakness (62.4%) which lasted for 6 months. The other prominent symptom was malaise (23.2%), which was followed by elevated temperature (20.8%), chills/flushing/sweat (14.8%) and excessive thirst (14.8%). The least common symptoms include skin sensitivity (2.8%), menstruation problems (4.4%) and sexual dysfunction (2.4%).
- Joint pain (26.8%) was the most prevalent musculoskeletal symptom which lasted for 6 months, followed by muscle aches (22.4%) and tightness of chest (20.8%). The least common symptoms include stiff neck (12%), muscle spasms (14%) and bone aching or burning (10.4%).
- Immunologic symptoms were observed in (2.4%) subjects who reacted to the old allergen and (2.8%) new allergens were found.
- Itchy skin (2.4%), skin rashes (2.4%), peeling skin (1.2%) and other skin allergies (1.6%) were the dermatological symptoms among the participants.
- Sore throat (51.6%) was the most prevalent HEENT symptom which lasted for 4 months, followed by changes in voice (28%), running nose (20.4%), difficulty in swallowing (19.2%), dry eyes (6.4%), sensitivity to light (5.2%) and ear pain (4.8%). The least common symptoms include eye pain (2.8%), other eye issues (2.8%), other ear issues (2%), numbness of ear (1.6%) and blurred vision (0.8%).

- The most common pulmonary symptom was dry cough (40.4%), which lasted for 4 months, followed by breathing difficulty (19.6%), shortness of breath (16.8%), and sneezing 35 (14%). Coughing up blood (2.4%) was the least prevalent symptom.
- The most common gastrointestinal symptom was loss of appetite (35.6%) which lasted for 4 months. Constipation (7.6%) and nausea (4.4) were the other significant symptoms. Diarrhoea (7.6%), abdominal pain (3.6%), vomiting (3.2%) and bowel sensation (2.4%) are the least common symptoms.
- During COVID, (61.2%) of the subjects had exhibited moderate level of perceived stress, (32.8%) had a low level of stress, and (6%) had a high level of stress. On analyzing the results of Long COVID, low stress was found in (58%) of the subjects, moderate stress in (40%), and high stress in (2%) of the subjects.
- Only (42.4%) of the subjects were severely fatigued during COVID, while 201 (80.4%) were severely fatigued on Long COVID
- During the infection period, 54 (21.66%) of the subjects had no clinically significant insomnia,111 (44.4%) had subthreshold insomnia,75 (30%) had moderate insomnia and 10 (4%) had severe insomnia. When the data of long COVID were analyzed, 175 (70%) of the subjects had no clinically significant insomnia, 57 (22.8%) had subthreshold insomnia, 14 (5.6%) had moderate insomnia and 4 (1.6%) had severe insomnia.
- Pearson's coefficient of correlation 'r' between Stress and Insomnia among COVID patients for the sample is 0.37. This shows that there is a positive relationship between Stress and Insomnia. From this result it can be concluded that greater the Stress, greater the Insomnia. Fisher's t-value obtained by the test of significance of 'r' is 6.28. This t-value exceeds 2.58, the table value required for significance at 0.01 level, indicating that the relationship between Stress and Insomnia among COVID patients is significant at 0.01 level of significance.
- The mean scores of Stress among subjects during COVID and Long COVID are 24 and 20 respectively. Obtained t-value (7.14) is greater than 2.58 which is the value required for significance at 0.01 level of significance. Hence the difference between the two sets of scores is significant. The mean score of stress during COVID is greater than that of mean score of Long COVID, indicating the stress during COVID period is high compared to the stress of Long COVID.

- The mean scores of Fatigue among subjects during COVID and Long COVID are 28.23 and 33.47 respectively. Obtained t-value (8.31) is greater than 2.58 which is the value required for significance at 0.01 level of significance. Hence the difference between the two sets of scores is significant. The mean score of Fatigue of Long COVID is greater than that of mean score during COVID, indicating the Fatigue of Long COVID is high compared to the Fatigue during COVID.
- The mean scores of Insomnia among subjects during COVID and Long COVID are 37.25 and 29.02 respectively. Obtained t-value (10.97) is greater than 2.58 which is the value required for significance at 0.01 level of significance. Hence the difference between the two sets of scores is significant. The mean score of Insomnia during COVID is greater than that of mean score Long COVID, indicating the Insomnia during COVID period is high compared to the Insomnia of Long COVID.

CONCLUSION

Since the world is in the midst of a pandemic, COVID-19 causes long-term symptoms in a substantial proportion of people. The study was intended to assess the health and well-being of people who have been infected with the COVID-19 virus and have long-term impacts from it. On studying the most prevalent symptoms during COVID, tiredness was reported by 89.2%, followed by fever (83.2%), headache (78.8%), dry cough (67.6%), and loss of taste/smell (56.4%). Individuals with long COVID experienced a wide range of symptoms. Loss of appetite was noted by 89% of study subjects, followed by weakness (62.4%), sore throat (51.6%), dry cough (40.4%), joint discomfort (26.8%), and pain/burning in chest (14.8%). There is a positive relationship between stress and fatigue during COVID, with the more stress, the more insomnia. When stress, fatigue, and sleep are compared between COVID and long COVID, it can be assumed that stress and insomnia are more prevalent during COVID, whereas fatigue is more prevalent in long COVID than during COVID.

It is hoped that the findings of the study will be valid and generalize to a considerable extent.

Limitations of the study

- The COVID -19 pandemic limited the interaction that could have been possible by personal interviews among the study subjects
- Patient outcome measures were assessed by self-reporting, which may differ from findings of formal and actual physical testing.
- Study was not extended to COVID patients exhibiting very severe symptoms during the infection period.
- The study duration was for six months, thus a yearlong follow-up that is necessary for Long COVID was not possible.

Recommendations for future research

- Patient outcome measures were assessed by self-reporting, which may differ from findings at formal, physical testing to actually assess fatigue, stress, and insomnia associated with the infection.
- Study could be extended to include COVID patients exhibiting very severe symptoms during the infection period.
- For more intensive findings, the research can be continued for at least a year of follow-up
- A study on individuals who have been reinfected after recovering from COVID infection is possible.

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APPENDIX

HEALTH AND WELL-BEING OF LONG COVID PATIENTS IN ERNAKULAM DISTRICT OF KERALA

I am Feba George, currently pursuing M.Sc. in Food Science and Nutrition at St. Teresa's College (Autonomous), Ernakulam. As a part of research entitled **"HEALTH AND WELL-BEING OF LONG COVID PATIENTS IN ERNAKULAM DISTRICT OF KERALA''**, I am conducting this survey. This study is being conducted under the guidance of Dr. Rashmi H. Poojara, Assistant Professor, Department of Home Science, St. Teresa's College (Autonomous), Ernakulam.

I request you to provide the information mentioned in this questionnaire. The information provided will be used for academic purposes and kept confidential. Honestly requesting your co-operation for the conduct of the study. Thank you.

I voluntarily consent to participate in the study

◯ Yes

◯ No

GENERAL INFORMATION

1. Name

Mr./Ms./Mrs./Dr ____________________

2. Designation

____

3. Age

◯ 18 – 29
◯ 30 – 39
◯ 40 – 49
◯ 50 – 59
◯ Above 60

4. Gender

- ◯ Male
- ◯ Female

5. Education

- ◯ PG and above
- ◯ Graduation
- ◯ Higher secondary
- ◯ Secondary

ANTHROPOMETRIC ASSESSMENT

1. Enter your height in cm.

   ____

2. Enter your weight in kg.

   ____

PHYSICAL ACTIVITY

Do you exercise regularly?

- ◯ Yes
- ◯ No
- ◯ Sometimes

Have you enrolled yourself in any online activities like Yoga/Dance/Gym class?

- ◯ Yes
- ◯ No

DIETARY ASSESSMENT (DDS)

Please describe the foods (meals and snacks) that you ate or drank during the last 2 days. Startwith the first food or drink of the morning.

Write down all foods and drinks mentioned. When composite dishes are mentioned, ask for thelist of ingredients.

24 HOUR DIETARY RECALL FOR TWO CONSECUTIVE DAYS

MEAL	MENU	QUANTITY (gm/ml)
DAY I		
EARLY MORNING		
BREAKFAST		
MID-MORNING		
LUNCH		
EVENING		
DINNER		
BED TIME		
DAY 2		
EARLY MORNING		
BREAKFAST		
MID-MORNING		
LUNCH		
EVENING		
DINNER		
BED TIME		

DIETARY DIVERSITY SCOR

Question number	Food group	Examples	Yes=1 No=0
1,2	Starchy staples1		
4	Dark greenleafy vegetables		
3,6 and red palm oil if applicable	Vitamin A rich fruits and vegetables		
5,7	Other fruits andvegetables		
8	Organ meat		
9,11	Meat and fish		
10	Eggs		
12	Legumes, nutsand seeds		

COMORBIDITY ASSESSMENT

1. Do you have any of the following lifestyle diseases?

Lifestyle diseases	Yes	No	Borderline	Family history
Hypertension / High blood pressure				
Diabetes mellitus				
Cardiovascular disease				
Obesity / overweight				
Chronic lung disease				
Kidney disease				
Liver disease				
Cancer				

MEDICAL HISTORY

1. Do you take any regular medication?

◯ Yes
◯ No

2. If yes, did you take your regular medication during the period of COVID infection?

◯ Yes
◯ No

3. What was the system of medicine adopted to treat COVID – 19?

◯ Ayurveda
◯ Allopathy
◯ Homeopathy
◯ Other

ASSESSMENT OF SYMPTOMS

- **DURING COVID**

On a scale of 1 – 4, with 0 being no symptoms and 4 being severe. Please respond to the question to your best knowledge.

i. Fever

1 2 3 4

No symptoms ◯ ◯ ◯ ◯ Severe

ii. Dry cough

1 2 3 4

No symptoms ◯ ◯ ◯ ◯ Severe

iii. Tiredness

1 2 3 4

No symptoms ◯ ◯ ◯ ◯ Severe

iv. Headache

1 2 3 4

No symptoms ◯ ◯ ◯ ◯ Severe

v. Diarrhoea

1 2 3 4

No symptoms ◯ ◯ ◯ ◯ Severe

vi. Loss taste/smell

1 2 3 4

No symptoms ◯ ◯ ◯ ◯ Severe

vii. Skin rash

1 2 3 4

No symptoms ◯ ◯ ◯ ◯ Severe

viii. Breathlessness

1 2 3 4

No symptoms ◯ ◯ ◯ ◯ Severe

ix. Chest pain

1 2 3 4

No symptoms ◯ ◯ ◯ ◯ Severe

- **LONG COVID**

On a scale of 1 – 4, with 0 being no symptoms and 4 being severe. Overall symptom severity for each time interval (1-6 months). Please respond to the question to your best knowledge.

Cardiovascular	Scale	Time (Weeks)
Palpitations	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Tachycardia	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Pain or burning in the chest	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Bulging	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Fainting	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯

Systemic	Scale	Time (Weeks)
Malaise	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Elevated temperature	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Chill / flushing/ sweats	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Skin sensation	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯

Weakness	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Sexual dysfunction	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Extreme thirst	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Menstrual issues	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○

Musculoskeletal	**Scale**	**Time (Weeks)**
Tightness of chest	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Muscle aches	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Joint pain	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Stiff neck	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Muscle spasms	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○

Bone ache or burning	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○

Immunologic	Scale	Time (Weeks)
Reactions to mold allergies	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
New allergies	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○

Dermatologic	Scale	Time (Weeks)
Itchy skin	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Skin rashes	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Peeling skin	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Other skin and allergies	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○

HEENT	Scale	Time (Weeks)
Sore throat	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Blurred vision	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Difficulty in swallowing	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Sensitivity to light	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Running nose	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Dry eyes	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Changes in voice	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Eye pain	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○

Ear pain	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Other eye issues	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Other ear issues	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Numbness in ear	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○

Pulmonary	**Scale**	**Time (Weeks)**
Shortness of breath	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Dry cough	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Breathing difficulty	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Sneezing	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○
Coughing of blood	1 2 3 4 ○○○○	0-5 5-10 10-15 15-20 20-25 25-30 ○ ○ ○ ○ ○ ○

Gastrointestinal	Scale	Time (Weeks)
Diarrhea	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Vomiting	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Constipation	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Loss of appetite	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Nausea	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Abdominal pain	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯
Bowel sensations	1 2 3 4 ◯◯◯◯	0-5 5-10 10-15 15-20 20-25 25-30 ◯ ◯ ◯ ◯ ◯ ◯

STRESS ASSESSMENT (Perceived Stress Scale - 10-C)

Did you feel stressed during your quarantine days?

- ◯ Yes
- ◯ No

	Never	Hardly ever	Occasionally	Almost always	Always
I have felt as if something serious was going to happen unexpectedly with the epidemic					
I have felt that I am unable to control the important things in my life because of the epidemic					

I have felt nervous or stressed about the epidemic					
I have been confident about my ability to handle my problems related to the epidemic					
I have felt optimistic that things are going well with the epidemic					
I have felt unable to cope with the things I have to do to monitor for a possible infection					
I have felt that I can control the difficulties that could appear in my life as a result of the infection					
I have felt that I have everything under control about the epidemic					
I have been upset that things related to the epidemic are out of my control					
I have felt that the difficulties are increasing in these days of the epidemic and I feel unable to overcome them					

FATIGUE ASSESSMENT (Chalder Fatigue Scale)

Did you feel tired during your quarantine days?

- ◯ Yes
- ◯ No

	Less than usual	Better than usual	No more than usual	No worse than usual	More than usual	Worse than usual	Much more than usual	Much verse than usual
Do you have problems with tiredness?								
Do you need to rest more?								
Do you feel sleepy or drowsy?								
Do you have problems starting things?								
Do you lack energy?								

Do you have less strength in your muscles?								
Do you feel weak?								
Do you have difficulties concentrating?								
Do you make slips of the tongue when speaking?								
Do you find it more difficult to find the right word?								
How is your memory?								

SLEEP QUALITY ASSESSMENT (Insomnia Severity Index [ISI])

The *Insomnia Severity Index* (ISI) is a brief instrument that was designed to assess the severity of insomnia. The Insomnia Severity Index has seven questions. It was assessed during COVID and long COVID.

Insomnia Problem	**None**	**Mild**	**Moderate**	**Severe**	**Very Severe**
1. Difficulty falling asleep	0	1	2	3	4
2. Difficulty staying asleep	0	1	2	3	4
3. Problems waking up too early	0	1	2	3	4

4. How Satisfied/Dissatisfied are you with your current sleep pattern?

Very Satisfied	**Satisfied**	**Moderately Satisfied**	**Dissatisfied**	**Very Dissatisfied**
0	1	2	3	4

5. How noticeable to others do you think your sleep problem is in terms of impairing the quality of your life?

Not at all noticeable	A Little	Somewhat	Much	Very much noticeable
0	1	2	3	4

6. How Worried/Distressed are you about your current sleep problem?

Not at all worried	A Little	Somewhat	Much	Very much worried
0	1	2	3	4

7. To what extent do you consider your sleep problem to interfere with your daily functioning (e.g., Daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.)

Not at all Interfering	A Little	Somewhat	Much	Very Much Interfering
0	1	2	3	4

ABSTRACT

Coronavirus disease (COVID-19) is an infectious disease caused by the SARS-CoV-2 virus. COVID-19 affects different people in different ways. Most infected people will develop mild to moderate illness and recover without hospitalization. However, some will become seriously ill and require medical attention. COVID-19 causes long-term symptoms in a substantial proportion of people. These conditions can last weeks, months, or years. The aim of this study is to evaluate the health and well-being of long COVID patients in Ernakulam district of Kerala by assessing the comorbidities, symptoms during COVID and Long COVID, fatigue, stress, and insomnia.

The study included a total of 250 subjects. The most common comorbidity among the study subjects was hypertension (24%). On studying the most prevalent symptoms during COVID among the study subjects, tiredness was reported by 89.2%, followed by fever (83.2%), headache (78.8%), dry cough (67.6%), and loss of taste/smell (56.4%). Individuals with long COVID experienced a wide range of symptoms. Loss of appetite was noted by 89% of study subjects, followed by weakness (62.4%), sore throat (51.6%), dry cough (40.4%), joint discomfort (26.8%), and pain/burning in chest (14.8%). There is a positive relationship between stress and fatigue during COVID, with the more stress, the more insomnia. When stress, fatigue, and sleep are compared between COVID and long COVID, it can be assumed that stress and insomnia are more prevalent during COVID, whereas fatigue is more prevalent in long COVID than during COVID.