Arab American University

Faculty of Graduate Studies

Long term effect of covid 19 on physical and functional abilities among covid-19 survivors

By

Lina Sbaihat

Supervisor

Dr. Mohammad Amro

Co- Supervisor

Dr. Dr. Motaz lawna

This thesis was submitted in partial fulfillment of the requirements for the Master`s degree in Physiotherapy

February/ 2024

Thesis Approval

Long term effect of covid 19 on physical and functional abilities among covid-19 survivors

By

Lina Sbaihat

This thesis was defended successfully on 18 /02/2024 and approved by:

Committee members	Signature
1. Dr. Mohammad Amro: Supervisor	……
2. Dr. Motaz Alawna: Co- Supervisor	……
3. Dr. Samer Abu Eid: Internal Examiner	……
4. Dr. Akram Amro: External Examiner	……

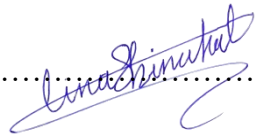
Declaration

I declare that this Master dissertation has been composed by me and is based on my own work, unless stated otherwise. I confirm that this Master's thesis is my own work and I have documented all sources and material used; no other person's work has been used without due acknowledgement.

All references and verbatim extracts have been quoted, and all sources of information, including graphs and data sets, have been specifically acknowledged. To my best knowledge, this Master dissertation has not been accepted in any other previous application for a degree, in whole or in part.

Name: Lina Sbaihat

ID: 202113301

Signature: …… 

Date: 3.11.2024

Dedication

I have the honor to dedicate this research to

Dr. Mohammad Amro and Dr. Mo’taz Alawneh

I dedicate it to my beloved family for their everlasting support, also to each person who helped me accomplishing this study.

Acknowledgement

I would like to express my deepest gratitude and appreciation to my instructor and supervisor: Dr. Mohammad Amro and Dr. Mo’taz Alawneh

For his support, understanding and patience while preparing this research.

I would like, also, to address my appreciation to all AAUP teachers and instructors who helped, instructed and supported me during my study years.

I address my thankfulness to my family: my mother for her unconditioned help and love, my father for his understanding and my brothers and sisters for their tremendous support and care.

Abstract

According to the evidence, COVID-19 may continue to significantly harm the patient results for more than 12 weeks afar the severe infection stage. It is yet unclear how COVID-19 will affect patient outcomes in the long run. The aim of this study was to look at how COVID-19 survivors' physical and functional capacities have changed over time.

The mixed approach is used in this study; quantitative research method will be followed as the researcher uses a questionnaire which will be filled by the researchers, and the cross- sectional approach is also used as the researcher uses two tests which will be applied with the sample individuals. The study included (١٥٠) Corona patients registered in Corona statistics in Palestine aged between 20-٤٥ Yrs. old , who have been infected for at least 6 months or more. Three tests were used including Y Balance Test Lower Quarter, Timed Up and Go (TUG) Test, and 3 Step Test.

The results showed that the long-term effects on patients previously infected with COVID-19 affected their physical and functional abilities. Significant differences were found on functional abilities among COVID-19 survivors due to age for the benefit of the younger individuals. Significant differences were found in the long term effect of COVID 19 on physical abilities among COVID-19 Survivors due to gender for the benefit of the males. And significant differences were found on functional abilities due to weight for the benefit of the light weight individuals.

The results call for additional research to help identify individuals who may benefit from close monitoring and focused rehabilitation and who are at higher risk of long-term

consequences, and to determine the degree of post-COVID-19 effects that last longer than six months, as well as to elucidate their origins and practical solutions for management.

The study recommended that rehabilitation programs could be incorporated in the framework of treatment following Covid19 infection in order to minimize its effect on physical and functional status, the outcome measures used in this study are reliable to be used by researchers and by physiotherapists to measure the long-term impact of COVID 19 on survivors' physical and functional abilities, and early and appropriate diagnosis and care are necessary for recovered older persons following COVID-19.

Keywords: Covid19, physical abilities, functional abilities.

Table of Contents

List of Tables

List of Appendices

List of Abbreviations

TUG	Timed Up and Go
LQYBT	Low Quarter Y Balance Test
MERS	Middle East respiratory syndrome
SARS	Severe acute respiratory syndrome
ADLs	Activities of Daily Living
CT	computed tomography
WHO	World Health Organization

Chapter One: Introduction

1.1 Introduction

COVID -19 started as a novel kind of coronavirus in China in December 2019. COVID -19 became a worldwide epidemic within a few months, posing a severe threat to public health. There were over 10 million cases globally by mid-June 2020, with 2 million cases (WHO, 2020).

The respiratory system is just one among the body organs that Covid-19 affects: Covid-19 may damage the lungs, liver, kidney, heart, blood vessels, and other organs, especially the brain. Additionally, the infection may cause neuroinflammation, which can result in long-term musculoskeletal issues, cognitive decline, and emotional distress. Several long-term clinical complications that have an impact on various aspects of health, such as post-traumatic stress disorder, reduced physical ability, persistent fatigue, increased depression, muscular weakness, anxiety, and sleep issues, were discovered after a review of Middle East respiratory syndrome (MERS) and Severe acute respiratory syndrome (SARS) (Shah et al., 2021).

The continuum of clinical presentation of COVID-19 spans from asymptomatic to symptomatic with varying degrees of severity, depending on parameters like age, concomitant disorders, and baseline metabolic index. (Osikomaiya et al., 2021). COVID-19 patients may have symptoms such as dry cough, fever, anosmia, tiredness, and fatigue as general symptoms, and other indications. A skin rash or discoloration of the fingers or toes might be noted as less frequent symptoms, along with aches and pains, a sore throat, nausea, vomiting, and diarrhea (Abayomi et al., 2020).

According to Ladds et al. (2020) three broad categories of patients with persistent symptoms are identified: group one patients who first underwent hospitalization for acute respiratory distress syndrome and now experience persistent respiratory symptoms mostly related to breathlessness; group two patients who may not have initially required hospitalization but who now suffer from a multisystem illness with signs of damage to their hearts, lungs, or brains; and group three includes those who continue to have symptoms, which are frequently but not always characterized by exhaustion, without any signs of organ impairment.

A study conducted on 24,410 COVID-19 patients found that cough, fatigue, fever; and hyposmia were the most prevailing symptoms (Kronbichler et al., 2020). However, not everyone who is exposed to the disease develops the symptoms, and not everyone who has the condition exhibits symptoms. As a result, there is an inadequate knowledge about how risk factors and individual resiliency influence the disease's progression (Bliddal et al., 2021).

Following the early stage of COVID-19 pandemic, various observational studies revealed that persistent symptoms have been described by patient groups and case studies. Such as diminished respiratory function, tiredness, and hyposmias (Townsend et al., 2020). In a follow-up research, 143 Italian patients with Covid-19 who were in the hospital reported chronic persistent fatigue, and 87.4% of them still exhibited symptoms associated to COVID-19 two months after they started. (Bliddal et al., 2021).

Similar findings were made by Jacobs et al. (2020), who discovered that among 183 Americans, weariness was the most prevalent symptom 35 days after being admitted to the hospital. The majority of participants also reported having problems with their

physical and mental health. In a recent Chinese research, 1,733 hospitalized patients were followed up after six months, and 63% of them still reported fatigue and muscular weakness (Ladds et al., 2020). Therefore, clinical and public health concerns now extend beyond data on patient mortality and clinical outcomes while they are in the hospital to include healing and the long-term effects of COVID-19 post-hospitalization.

Due to these activities the Post-Hospitalization COVID-19 study (PHOSP-COVID) was created in the UK, with the objective of long-term monitoring of 10,000 patients who left the hospital after contracting COVID-19. Moreover, COVID-19 patients are becoming more aware of their lingering symptoms, thus it is vital to define the phrase "long COVID," which has not yet been well defined (Townsend et al., 2020).

A preliminary guideline on the long-term consequences of COVID-19 was recently published by the National Institute of Health and Care Excellence (NICE), which suggests using the terms (ongoing symptomatic COVID-19) for the “symptoms persisting for more than 12 weeks and (post-COVID-19-syndrome) for the symptoms persisting for more than 4 weeks (Bliddal et al., 2021). Participants in the bulk of studies on COVID-19 symptoms were either hospitalized patients, patients who visited outpatient clinics, patients in specialty units, or members of COVID-19 sufferers' support groups.

The most common post-COVID-19 symptoms were fatigue, dyspnea, chest pain, coughing and joint pain. For adult survivors, several Activities of Daily Living (ADLs) are restricted such as walking, dressing, and bathing. As a result, impairments that affect daily living activities raise the need for health services like nursing and increase the risk of death. A few of these symptoms continue over time and have a significant impact on

everyday life, although the majority of them are curable. Chronic ailments may emerge from it, having negative effects on the economy and public health (Aiyegbusi et al., 2021).

Furthermore, after 24 months, only 78% of SARS survivors resumed their jobs, according to Pizarro-Pennarolli et al. (2021), while health-related quality of life and exercise ability were also demonstrated to have declined in SARS patients. Overall, the data demonstrate that individuals with ARDS had worse levels of HRQoL, physical function (gait speed, muscle strength and/or physical activity), and return to work rates.

Additionally, "Long COVID" term has recently been used in the scientific literature to define disease in individuals who have stated long-lasting effect from the infection or who have experienced the normal signs for a lot longer period of time than is typical. Thirty days after hospital release, abnormal chest computed tomography (CT) was documented in COVID-19 patients results and diminished lung function. (Alghamdi et al., 2022).

Fraser (2020) also pointed out that patients with post-COVID-19 have frequently complained of ongoing symptoms between 30 and 56 days after leaving the hospital, including cough, dyspnea, and fatigue. Up to 8 weeks for follow-ups, patients were also shown to have decreased functional ability and challenges with daily living activities including mobility and self-care.

A deterioration in general health was detected by 39% of patients about 6 weeks after the onset of symptoms, according to the Sanchez-Ramirez et al. (2021) study. 61.5% of patients postponed returning to job for at least 5 weeks after the commencement of

their symptoms, with fatigue and weakness being the main justifications. 38% of patients missed time at work due to illness.

According to the evidence, COVID-19 may continue to significantly harm the patient results for more than 12 weeks afar the severe infection stage. It is yet unclear how COVID-19 will affect patient outcomes in the long run. This study's objective is to look at how COVID-19 survivors' physical and functional capacities have changed over time.

1.2 Problem Statement

Due to the public health crisis that the world has been exposed to from COVID-19, there has been huge loss of human life and psychological, physical and economic commotions. As we mentioned, there are physical indications that appear on patients from these symptoms that appeared on those infected with the Corona virus, coughing, fever and shortness of breath. But there are people who show these indications for long periods, and research and medical reports have begun to show that there are symptoms and effects that remain with patients infected with corona for long periods. So far, there are no studies on the details of long-term physical activities. Further research is required to investigate the long-term impact of COVID 19 on physical and functional state. Although this is what the current study will investigate.

1.3 Research Goals

This research aims to:

1- Determine the long-term impact of COVID 19 on survivors' physical and functional abilities.

2- Determine the differences in the long-term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to demographic variables (age, gender, weight, number of infections, and period of long-term symptoms).

1.4 Research Significance

There are physical symptoms that appear in patients infected with the Coronavirus. And there are people who show these symptoms for long periods which affect physical activities and reduce the quality of functional life. Being a new topic, there is a lack of studies that deal with it . So in this research, we add important information on this topic, in addition to information about the effects of the dangerous Coronavirus, and access to having sufficient information about these resulting effects will make it easier for the medical staff to deal with these effects and search for solutions and treatments for them and reduce them.

1.5 Research Questions

1- What are the long-term effects of COVID 19 on physical and functional abilities among COVID-19 survivors?

2- Are there significant differences in the long-term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to demographic variables (age, gender, weight, number of infections, and period of long-term symptoms)?

1.6 Research Hypothesis

H1: There are long-term effects on patients previously infected with COVID-19, so they are likely to reduce their physical ability.

H2: There are long-term effects on patients previously infected with COVID-19, so they are likely to reduce their functional ability.

H3: There are significant differences in the long-term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to age.

H4: There are significant differences in the long-term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to gender.

H5: There are significant differences in the long-term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to weight.

H6: There are significant differences in the long-term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to number of infections.

H7: There are significant differences in the long-term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to period of long-term symptoms.

Chapter Two: Literature Review & Related Studies

2.1 Literature Review

This chapter deals with the theoretical framework, in terms of coronavirus definition, characteristics, symptoms, causes, risk factors, complications, COVID-19 persistent symptoms, and the impact of Long term COVID-19 on physical and functional abilities. In addition to physical ability and functional ability, and the previous studies that dealt with the study subject.

2.2 Coronavirus Definition

In Wuhan- China in December 2019, Covid19 first appeared, and It has subsequently quickly spread around the world. The World Health Organization (WHO) declared the illness caused by this novel coronavirus a worldwide pandemic in March/ 2020 (Phelan et al., 2020). (SARS), (MERS) and the common cold are all conditions that can be brought on by the virus class known as coronaviruses. An illness epidemic that started in China in 2019 was traced to a new coronavirus (WHO, 2020). The virus is now recognized as SARS-CoV-2 (severe acute respiratory syndrome coronavirus). COVID-19, or coronavirus disease 2019, is the name of the virus that causes it. The World Health Organization (WHO) labeled the COVID-19 outbreak a pandemic in March 2020 (Alves et al., 2020).

Under an electron microscope, the RNA virus Coronavirus Disease (COVID-19) resembles a traditional crown due to spikes of glycoprotein on its envelope. Two examples of coronaviruses that have caused epidemics and have constituted a significant threat to world health are the severe acute respiratory syndrome coronavirus (SARS-CoV)

outbreak that started in province of Guangdong in China and the Middle East respiratory syndrome coronavirus (MERS-CoV) outbreak that first surfaced in September 2012 (Gennaro. et al., 2020).

2.2.1 Characteristics of Coronavirus

Coronavirus has the following characteristics: has single-stranded RNA as its nucleic component, very small in size, and size ranging from 26 to 32 kbs in length (Khan et al., 2020). Besides, the coronavirus family is divided into the subgroups alpha (a), beta (b), gamma (c), and delta (d) coronavirus.

2.2.2 Symptoms of Coronavirus

The 2019 coronavirus illness (COVID-19) symptoms may occur 2 to 14 days after exposure. The incubation period is the interval that occurs after exposure but before the start of symptoms. Exhaustion, coughing, and fever are the most prevalent signs and symptoms. One of the premier symptoms of COVID-19 could be a loss of smell or taste. While, breathing difficulties, chest discomfort, headache, chills, sore throat, runny nose, and pink eye are all possible warning signs and symptoms (conjunctivitis) (WHO, 2020).

Sheikhi et al. (2020) stated that (2 to 14) days after exposure the symptoms and indications of COVID-19 may appear. The incubation period is the span of time between exposure and the start of symptoms. Some of the typical warning signs are exhaustion, fever and coughing. A loss of taste or smell might be one of the first signs of COVID-19. Additional symptoms that may manifest include difficulty breathing or longness of breath, chills, muscle pains, sore throats, chest discomfort, runny noses, headaches, and pink eye (conjunctivitis).

2.2.3 Causes of Coronavirus

The severe acute respiratory syndrome coronavirus 2, or SARS- CoV-2, has been identified as the novel coronavirus that causes COVID-19, according to the World Health Organization (WHO, 2020).

The COVID-19 virus develops among individuals quickly, and new details regarding its transmission mechanism are always being found. According to data, HPV primarily travels from one person to another among individuals who are in close proximity (around 6 feet, or 2 meters). Respiratory spray spread into the air when an infected individual sneezes, breathes coughs, speaks, or sings, and other people subsequently breathe them in. This spray can be inhaled or end up in the nose, mouth, or eyes of others nearby (WHO, 2020).

Furthermore, in some cases, airborne transmission happens when an individual is exposed to droplets or aerosols that remain in the air for several minutes or hours. This may transmit the virus of COVID-19. The pace at which the virus spreads in this way is unknown at this time. Another way it might spread is if someone touches a surface or anything it has traces of the virus on it, and then contacts their nose, mouth, or eyes (Nazario, 2022).

2.2.4 Coronavirus Risk Factors

Coughing or sneezing by an infected person, in addition to close contact (between 6 feet or 2 meters), are risk factors for COVID-19 (Yanover et al., 2020).

According to Khan et al. (2020), cardiovascular disorders, chronic respiratory diseases, and individuals with two or more comorbidities were all related to worse outcomes in coronavirus cases. Elderly adults, men, and those suffer from diabetes, cardiovascular disease, cancer or hypertension, are more probable to contract the coronavirus (Rashedi et al., 2020).

Moreover, Gesesew et al. (2021) in their study stated that severe types of COVID-19, which can cause hospitalization and death, are more common in elderly adults and those who have chronic illnesses such HIV, TB, and anemia. Also contributing to COVID-19-related mortality include the high burden of chronic obstructive pulmonary disease, high rates of cigarette use, low levels of healthcare spending, and low levels of global health security score.

2.2.5 Coronavirus Complications

Heart problems, pneumonia and breathing problems, severe renal damage, blood clots, and further viral and bacterial infections are all potential complications of COVID-19. Heart problems, pneumonia, acute respiratory distress syndrome, a severe lung condition that causes low blood oxygen levels reaching the organs and breathing difficulties are also possible complications (Yanover et al., 2020).

Furthermore, there have been several long-term effects associated with COVID-19 infection, including dyspnea, dependency on oxygen or a ventilator, abnormalities in the pulmonary function test (PFT), and fibrotic lung disease. Additionally, Postural tachycardia syndrome (POTS) has been associated with a raised incidence of SARS-CoV-2 infection, and the acute phase of COVID-19 has been associated with an increased prevalence of abnormal echocardiographic findings (Desai et al., 2021).

2.2.6 Persistent Symptoms of COVID-19 Patients

"Long COVID" refers to those who have convalesced from COVID-19 but continue to show signs for a much longer period of time than is normal. Another definition includes "not improving" few weeks or months following the beginning of COVID-19-related symptoms, whether or not the person was tested. Long COVID is described as "Signs and symptoms presenting during or after illness consistent with COVID-19 that lasts more than 4 weeks but are not illustrated by alternative diagnoses" per guidelines from the Scottish Network of Intercollegiate Guidelines, the National Institute for Health and Care Excellence (NICE), and the College Ownership of General practitioners (Peñas et al 2021). According to (Logue et al., 2021) loss of taste, loss of smell, fatigue, headache, breathing difficulties, cough, sore throat, diarrhea, runny nose, ear discomfort, sweating, rash, chills or shivering, feeling feverish, and nausea are some of the chronic symptoms.

For a long time COVID, several types and definitions have been known. The National Institute for Health Excellence (NICE) utilizes the expression "Post COVID-19 Syndrome" that is known as the signs and symptoms that appear during or following a COVID-19 infection that lasts longer than 12 weeks and cannot be illustrated by another diagnosis. Patients still refer to this case as "long COVID" though (Alghamdi et al., 2022).

WHO has clarified this term to include a condition that "…occurs in people who have a history of SARS-CoV-2 infection, generally 3 months after the beginning of COVID-19, with signs persisting at least 2 months and that cannot be accounted for by another diagnosis" (Koc et al., 2022).

Schrimpf et al. (2022) stated that whether COVID-19 was severe or mild, everyone who had it might have long-lasting symptoms such as general symptoms like exhaustion and fever, respiratory symptoms like problems breathing and coughing, and general symptoms like fatigue. Heart symptoms like palpitations and chest discomfort, neurological symptoms like headaches and difficulties focusing ("brain fog"), and digestive symptoms like stomach pain and diarrhea are all examples of symptoms that might occur.

Long-lasting symptoms can occur after a minor to serious disease and include:

Physical symptoms: common persistent physical symptoms include fatigue (13 to 87%), shortness of breath (10 to 71 %), chest pain or tightness (12 to 44 %), in addition to cough (17 to 34%) (Mikkelsen et al., 2022).

Besides, Mikkelsen et al. (2022) stated that Some of the less frequent chronic physical symptoms such as anosmia, headache, joint pain, sicca syndrome, dysgeusia, rhinitis, poor appetite, dizziness (from vertigo, postural tachycardia, or orthostatic), myalgias, sleeplessness, sweating, hoarseness, alopecia, diarrhea and reduced libido.

2.2.7 Impact of Long Term COVID 19 on Physical and Functional Abilities

In addition to the severe clinical indications, over 80% of people with acute COVID-19 develop one or more persistent symptoms. Fatigue, dyspnea, headaches, attention issues, anxiety, mood disorders, and a significant decrease in quality of life are often reported symptoms as post-acute sequelae of SARS-CoV-2 infection. Several investigations have revealed that COVID-19 survivors' physical abilities and functional capacities declined in the acute phase of SARS-CoV-2 infection, which led to a loss of independence (Komici et al., 2022).

In their study, Zhao et al. (2023) demonstrated that most of the survivors of COVID-19 had moderate or severe sequelae 20 months after recovery possessed a physical weakness that would call for physical treatment aimed at improving functioning, and one-tenth of these individuals had mental or cognitive vulnerabilities that might call for psychotherapy and cognitive rehabilitation.

Furthermore, Smith et al. (2022) pointed out that fatigue, headaches, dyspnea and focus problems, were the Post COVID-19 Condition (PCC) signs that were most frequently reported. The effects of post-COVID-19 conditions (PCC) symptoms on everyday functioning can disrupt people's social and professional lives and harm their mental, emotional, and financial health.

Sirayder et al. (2022) study demonstrated that increased fatigue and reduced functional ability may be caused by the infiltration of coronavirus and inflammatory cytokines into the cerebral cortex and muscle. Fatigue was cited by Yanti et al. (2022) as the most prevalent symptom that remained among responders. Additionally, the statistical

findings demonstrated a substantial correlation between post-COVID-19 functional status and the history of COVID-19 severity. The study further shown that a worse quality of life, mental health issues and poor lung function have long-term effects on one's physical, cognitive, mental and social health, which results in a decline in functional status.

2.3 Physical Ability

Strength, flexibility, coordination, balance, and stamina all fall under the category of physical ability. Physical disability is a condition that impairs a person's physical capability, dexterity, mobility, and/or endurance. These illnesses vary from hearing loss to cerebral palsy (Heikkinen, 2017). A person's physical ability includes their capacity to move with ease, their condition, their strength, their mobility, their comprehension of their own bodies, their cerebral abilities, and their motivation (Malm et al., 2019).

Furthermore, Physical ability has three components: a movement dimension, which is related to movement quality; a social dimension, which refers to the capacity to move with others; and a cognitive component, which refers to the capacity to comprehend movement in various contexts and the environment. Physical ability has several facets and is closely related to the concept of physical literacy. It may be cultivated, for instance, through engaging in a variety of activities, receiving training, and relating them to daily life and well-being (Piggin, 2020).

2.3.1 Physical Ability Interpretations

Heikkinen (2017) provide a couple of descriptions of physical ability:

1) The first one, it is described as a skill to move in different ways. This relates to the capacity to organize and evaluate a variety of exercises, such as strength training, conditioning exercises, and mobility exercises. Anatomy, biomechanics, and physiology are also intimately tied to physical ability.
2) The second interpretation of physical ability describes it as the capacity to analyze one's own and other people's movement experiences, observations, and participation in a variety of movement activities. This kind of interpretation may have something to do with how well students are able to hone their abilities to engage in various forms of physical activity. By describing and evaluating one's own experiences with physical activity, this growth might take place.

2.3.2 Physical Activity Mainly Includes Four Dimensions

Zeng et al. (2020) mentioned the following physical activity dimensions:

1) Intensity: Intensity is described by the American Heart Association as the energy expenditure rate, which is a sign of the metabolic requirement of (PA).
2) Frequency: Frequency is the number of daily or weekly sessions, and it is sometimes stated as the number of bouts lasting under 10 minutes.
3) Duration: Duration is defined as the length of a (PA) bout in minutes or hours over a certain time period (such as a day, week, year, or previous month).
4) Completion of a certain activity (as cycling, horticulture, or walking). The type can also be explained in terms of types of physiological and biomechanical needs,

such as aerobic exercises and corresponding anaerobic exercises, stability and balance exercises, and resistance or strength trainings, etc.

Furthermore, Galiuto & Liuzzo (2022) added another dimension to physical activity that is volume, which refers to the entire quantity of activity that has occurred during a specified period of time frame, often one week. In order to describe volume, energy expenditure units like calories per week, minute/s per week, miles per week are frequently used. The majority of study has only covered moderate to strenuous exercises.

2.4 Functional Ability

2.4.1 Definition

Functional health status is often defined as the capacity of an individual to carry out everyday activities necessary to fulfill responsibilities, meet basic requirements and preserve their health and well-being. The significance of a patient's functional health status in assessing overall general health is becoming more widely acknowledged. It has also been used to evaluate the preoperative risk of complications and adverse events (Skube et al., 2018).

Goldman (2020) stated that functional status may be interpreted as a succinct indicator of the total impact of health challenges when taken into account in the setting of an elderly person's environment and social support network. Starting by definite physical movements (like walking and lifting) which are integrated into activities with higher-level (like performing vocational and social duties), the fundamental structure of functional status is an increasing complexity rating. The start of deconditioning, illness,

changes in social support or surroundings, and senior age can all lead to functional status impairment.

The two levels at which functional status is often evaluated are the activities of daily living (ADLs) and instrumental activities of daily living (IADLs). ADLs stand for activities of daily living, which include grooming, eating, transferring, dressing, and using the restroom. According to Edemekong et al. (2022), IADLs are tasks that are necessary for maintaining a self-sufficient domestic, such as phone using, making meals, driving or utilizing public transit, managing laundry, buying groceries, handling money, taking prescription prescriptions and cleaning.

2.4.2 Functional Status Dimensions

Shah (2021) mentioned the following four dimensions of functional status:

1. Functional capacity: Functional capacity is a person's maximum ability to carry out activities.
2. Performance: refers to the everyday activities people engage in throughout their lives, such as activities of daily life, family responsibilities, employment, and leisure. These actions are the result of personal decision, within the capacity restrictions.
3. Reserve: The functional reserve refers to hidden skills that may be used under pressure; it distinguishes between capacity and performance.
4. Capacity utilization: the extent to which available capacity is used for the selected level of performance, and it explains the often-observed fact that two individuals with similar apparent capacities can exhibit various degrees of performance.

2.5 Related Studies

2.5.1 Long Term Effect of COVID -19 on Physical Abilities

The goal of the Gil et al. (2023) study was to ascertain whether survivors of COVID-19 with post- acute symptoms are physically inactive. This study follows COVID-19 survivors who were released from a tertiary care facility in Sao Paulo, Brazil. Between March and August 2020, patients were sequentially invited for a follow-up in-person visit six to eleven months after receiving inpatient care due to laboratory-confirmed COVID-19. Ten (PASC) symptoms were evaluated using established measures. Participants' levels of physical activity were measured using a questionnaire, and they were then grouped according to WHO Guidelines. Patients (614) were examined. According to adjusted models, patients with one or more chronic (PASC) symptoms are more likely to be inactive than patients without any lingering symptoms. Dyspnea, exhaustion, sleeplessness, posttraumatic stress, and severe muscle/joint pain were all linked to inactivity. This study found a link between (PASC) and physical inactivity, which could be thought of as a persistent symptom in COVID-19 survivors.

Zhao et al. (2023) aimed to identify the COVID-19's long-term effects on the physical, cognitive, and 1mental abilities after twenty months of infection. A validated questionnaire addressing (27) sequelae symptoms, including dyspnea, cognitive function, physical condition, and mental health, was used to gather the data. The most frequently reported symptoms were generalized symptoms, then problems with the mind, heart, nervous system, and digestion. In addition, more than half of COVID-19 survivors who presented moderate or severe sequelae (20) months after recovery had a physical vulnerability that may necessitate physical therapy to improve functioning, according to

the study's findings. These findings indicate that one-tenth of cases of mental or cognitive vulnerability necessitate psychotherapy and cognitive rehabilitation.

In order to evaluate the changes in teenage players' mental health, quality of life (QOL), and physical activity (PA) during the COVID -19 epidemic when organized sports resumed, Watson et al. (2023) undertook a study in the USA. Surveys on demographics, sport participation, generalized anxiety disorder (7-item), patient health (9-item), pediatric quality of life, and pediatric functional activity brief scale (Hospital for Special Surgery) were completed by 17421 teen athletes who took part in the study in May 2020 after COVID-19-related sport cancellations (Spring20) and after returning to sports in May 2021 (Spring21). Following COVID-19 infection, participants reported a drop in physical activity and a decline in mental health, which impacted the quality of life of those who were impacted.

By creating a cohort of people who tested positive for COVID-19, Smith et al. (2022) set out to examine how their physical, mental, and social health changed over the course of three months and two years, as well as what factors contributed to a (favorable) evolution. The research population comprised all citizens of Belgium who were 18 years of age or older, had recently acquired COVID-19, and had been contacted by the health authorities for contact tracing. The participants' initial health status and status throughout the acute phase of the disease were assessed using a baseline questionnaire, and three months after joining the cohort, a follow-up questionnaire was given to them. The most prevalent symptoms of PCC were fatigue, headache, concentration disturbance, and dyspnea, according to the findings. The symptoms of post-COVID-19 conditions (PCC)

can create everyday impairments that interrupt people's social and professional lives and have a detrimental influence on their mental, social, and economic health.

A scoping review was created by Borel et al. (2022) to ascertain the long-term consequences of COVID-19 in children's population. The search was done between November 1, 2019, and September 1, 2021 utilizing PubMed, Web of Science, Science Direct, and Cochrane. The study identified long-term physical problems in youngsters, with weariness, difficulty concentrating, disturbed sleep, and sensory issues being the most often reported effects. The social situations in which young people grow up have also been moderately impacted by COVID-19, which may have a detrimental effect on their present and future academic, behavioral, psychological, and physical health..

The Italian study by Acito et al. (2022) examined how BC survivors' lifestyles changed before, during, and after the first two COVID-19 pandemic waves.. (224) BC cancer survivors from Covid-19 made up the sample.. The findings revealed that walking activity and the proportion of patients engaging in vigorous physical exercise significantly decreased during periods of confinement (PA).

The social situations in which young people grow up have also been moderately impacted by COVID-19, which may have a detrimental effect on their present and future academic, behavioral, psychological, and physical health. There were 156 patients in total that took part in the trial. The Mount Sinai Health System hosts the REDCap (Research Electronic Data Capture) electronic data collection tools. The web-based program REDCap is safe and supports data collection for research studies. On March 14, 2021, participants received an email with a link to the survey as part of their clinical care. Fatigue, cognitive fog, and headache were cited as the most prevalent persistent

complaints. The most frequent causes of symptom aggravation were physical effort, stress, and dehydration. Increased levels of exhaustion and dyspnea were observed, along with a decline in the quantity of regular physical activity. The study found that persistent Covid-19 symptoms affect social engagement, health-related quality of life, and cognitive and physical performance.

In order to compare physical activity (PA) levels before and after the COVID-19 pandemic and examine the association between changes in PA and QoL in cancer survivors, Tabaczynski et al. (2022) undertook a research in Canada. (488) BC survivors who responded to an online survey made up the sample. Participants' participation in physical activity (PA) before and during the pandemic was evaluated using the Godin Leisure Time Exercise Questionnaire and the Functional Assessment of Cancer Therapy (FACT) assessments. The data showed that PA decreased over the course of the pandemic, which had detrimental effects on cancer survivors' quality of life and fatigue.

In order to determine how the Covid-19 pandemic influenced quality of life, function, and physical activity, Said et al. undertook a research in Australia in 2022. The study found that the symptoms of COVID-19 had an impact on physical activity both over the long run and the short term. Coughing, shortness of breath, and fever are typical covid-19 symptoms, headaches, exhaustion, chest discomfort, joint pain, depression, and sleeplessness. In addition to diminished quality of life, decreased independence in post-traumatic stress disorder, depression, anxiety, daily activities, and cognitive dysfunction, survivors may continue to experience morbidity and disability.

In order to investigate how COVID-19 affected levels of physical activity among infected people, Park et al. (2022) carried out a short assessment of synthesizes. COVID-

19 has been shown to be associated with substantial declines in mobility, walking, and physical activity as well as rises in sedentary behavior. The study also found that people's regular physical activity and mobility were significantly impacted by COVID-19. Worldwide, survivors noted increased amounts of inactive time and reduced levels of daily physical exercise.(such as watching TV or using electronic devices) and home time compared to pre-COVID periods.

In order to analyze and document the functional position of hospitalized COVID-19 survivors, Battistella et al. (2022) in Brazil conducted a study. (801) Participants in the study were COVID-19 survivors at 3–11 months following hospital discharge. The results showed that the main causes of COVID-19 survivors' declining functioning level were muscular weakness, poor mobility, pain, anxiety, melancholy, dyspnea, insomnia, and daytime sleepiness. Except for those with weaker handgrip strength and those who did not get invasive oxygen support.

An updated assessment of the effects of physical, cognitive, and psychological health issues on COVID-19 survivors is provided by a narrative review by Crispo et al. (2021). The results showed that patients' physical conditions, particularly those recovering in critical care units, can be affected by Covid 19. It was also shown that the virus's effects could linger for several weeks or months. Due to its long-term effects on the neuromuscular, cardiorespiratory, and skeletal systems, COVID-19 can obstruct daily activities and have an impact on physical function. Survivors commonly talk about being unable to work again, having weak muscles and trouble walking, as well as having diminished lung and respiratory function.

Osikomaiya et al. (2021) conducted a retrospective study in Nigeria with the purpose of describing persisting symptoms in COVID-19 survivors and looking into potential risk factors for these persistent symptoms. The study enrolled 274 patients in all, according to the findings. The psychological general well-being index, the short form health survey 36 (SF-36), and the Barthel Index. Insomnia, headaches, chest discomfort, and easy fatigability were the most often reported COVID-like symptoms. The quality of life and return to normal health of survivors were negatively impacted by COVID-like symptoms that persisted after discharge, which was a result of symptomatic COVID-19 illness of intermediate severity as opposed to mild severity.

Additionally, Lopez-Leon et al. (2021) created a systematic review to find papers evaluating the long-term effects of COVID-19 and determining the symptoms, signs, or laboratory parameters among patients at a stage after COVID-19. The five most common symptoms, per the study's findings, were dyspnea, fatigue, headache, attention deficit disorder, and hair loss. The study also found that post-traumatic stress disorder (PTSD) and considerable levels of depression and anxiety were long-lasting effects in those who had previously been infected with several coronaviruses. Treatment for COVID-19 for an extended period of time affects a patient's physical capabilities and quality of life. Based on factors such as gender, age, ethnicity, preexisting medical conditions, COVID-19 viral dosage, or COVID-19 progression. The chance of experiencing long-term COVID-19 effects remained constant..

In Denmark, Bliddal et al. (2021) prepared a study, Its goal was to use polymerase chain reaction PCR to determine the prevalence of and risk factors for acute and chronic symptoms in non-hospitalized patients. COVID-19. (445) people were included in the

sample. A computerized questionnaire on demographics and COVID-19-related symptoms was given to participants. Findings showed that lethargy, headaches, and sneezing were the most common acute symptoms, with weariness and a profound loss of smell and taste. On the other hand, the long-lasting effects are often problems with fatigue, memory, and attention. In addition, the majority of participants reported concerns with their mental and physical health as well as a decline in their quality of life.

Another systematic review research focused on the variations in physical activity and sedentary habits during the COVID-19 pandemic. It was carried out in the UK; the study's findings, as prepared by Stockwell et al. (2021) and showed that in Covid-19 patients, there was a decline in physical activity and an increase in sedentary behaviors. Should such lockdowns occur, the research advised public health initiatives to create and put into place interventions that promote safe physical activity and discourage sedentary behavior.

Additionally, Anaya et al. (2021) review study sought to show a number of PCS patients who attended a Post-COVID Unit and to fully evaluate the topic. The sample consisted of one hundred Covid-19 patients. According to the study, PCS patients most frequently experienced musculoskeletal, digestive (diarrhea), and neurological symptoms, including depression. More than 40% of PCS patients experienced diarrhea and arthralgia. The study found that depression and symptoms of musculoskeletal, respiratory, digestive, and neurological PCS are its main distinguishing features. PCS is unaffected by the intensity of the acute sickness or the humoral response. Significant inter-individual variability and long-lasting antibody responses to SARS-CoV-2 infection were also established.

A thorough analysis of COVID's potential long-term consequences, harmful post-COVID health outcomes, and long-term effects of COVID was prepared by Silva Andrade et al. (2021). The results of the study showed that Covid-19 had an impact on a variety of human systems, including: the immune system; the hematological system; the nervous system; Pulmonary system; cardiac hypertrophy; digestive, hepatic, and renal systems; skeletomuscular system; nervous system; Furthermore, patients' physical and psychological quality of life was impacted by long-term problems .

Aiyegbusi et al. (2021) carried out another systematic review in the UK. This review's objective was to look into the long-term Covid-19 symptoms, problems, and treatment. The Living Systematic Review database was searched by researchers. According to the study's findings, persons with "long COVID" go through both physical and psychological side effects, including breathing difficulties, joint and muscle discomfort, migraines, coughing, chest pain, and changed taste and smell. Cognitive decline, memory loss, and sleep issues are examples of psychological adverse effects. Additionally, many who have long-term COVID have reported worries about their work, mental health, and quality of life.

The scoping review, written by Paterson et al. (2021), looked into the relationships between the coronavirus disease 2019 (COVID-19) pandemic and movement behaviors (physical activity, sedentary behavior, and sleep) of school-aged children (aged 5 to 11 years) and youth (aged 12 to 17 years) in the first year of the COVID-19 outbreak. The findings revealed continuous trends toward later bedtimes, longer sleep lengths, deteriorations in time of physical activity and rises in screen time. Youth indicated that their mobility patterns had been negatively impacted more than did children.

An Italian study prepared by Carfi et al. (2020), its objective was to evaluate lingering symptoms in individuals who had been released from the hospital following COVID-19 recovery. Patients could choose to have a thorough medical evaluation that included a thorough history and physical. A standardized electronic data collection method was used to gather information on all clinical features, such as medical history and lifestyle factors. The study found that fever, dyspnea, cough, gastrointestinal problems, anosmia/dysgeusia and musculoskeletal symptoms are the most prevalent chronic Covid-19 symptoms. 87.4% of COVID-19 survivors reported that at least one symptom persisted, most commonly fatigue, dyspnea, coughing, joint discomfort, and chest pain. The study found that patients' quality of life had gotten worse.

Jacobs et al. (2020) studied the influence of persisting COVID-19 symptoms on patients' quality of life and physical health after 35 days from discharge from the hospital. The study used the PROMIS® Instruments to identify symptoms and quality of life indicators in patients, and the sample consisted of (183) Covid-19 survivors, Participants in the study reported symptoms that persisted after 35 days, such as fatigue, dyspnea, and muscular discomfort. These symptoms were linked to poorer quality of life, general health, physical health, participation in social activities, and mental health.

Lesser & Nienhuis (2020) conducted a study in Canada to explore the effects of Covid-19 on physical activity behavior and wellbeing. The levels of participants' physical activity, exposure to nature, well-being, and anxiety were assessed using an online survey. The findings demonstrated that COVID-19 had a detrimental impact on physical activity participation as a whole and that this would be linked to factors that discourage physical activity, such as social exclusion and the closing of playgrounds, national parks, and local

and provincial recreation centers. Additionally, a detrimental effect on Canadian well-being was observed, particularly among those who lowered their levels of physical exercise.

2.5.2 Long Term Effect of COVID 19 on Functional Abilities

Shanbehzadeh et al. (2023) carried out a cross-sectional study in Iran to investigate the effects of Long COVID, physical activity levels, and functional decline on older people's health-related quality of life following COVID-19. The sample consisted of (121) seniors between the ages of 60 and 90. The study's standardized measurements included the Fatigue Severity Scale, Physical Activity of the Elderly, SF12, Post-COVID-19 functional status scale, and COVID-19 Yorkshire rehabilitation screening scale. The findings showed that there were six indicators predicting physical health six months after COVID-19, with fatigue, degree of physical activity, worsening pain, difficulties performing everyday activities, and cognitive communication issues being the important determinants. Problems with cognitive-communication and hospital days were related to mental health. Additionally, the study found a connection between poor physical condition and the degree of post-COVID-19 weariness as well as new or escalating discomfort. 23.3% of responders noted mild to substantial limits as a result of COVID-19 on functional status. 72% or thereabouts of COVID-19 survivors reported ongoing clinical problems. Asthenia/fatigue, discomfort (joint or muscle pain), shortness of breath, and mental health issues were the most often reported post-discharge problems.

Sirayder et al. (2022) study, which was prepared in Turkey, aimed to evaluate comparing quality of life, functional ability, fatigue, and balance in severe COVID patients across time 6 months after being discharged from the intensive care unit. The

sample includes (26) adult patients who had COVID thereafter. Measurements were made of respiratory, peripheral muscle strength and respiratory muscle. For forced vital capacity and forced expiratory volume in one second, the lower limit of normal cutoff values were calculated. Using the 6-minute walk test, functional capacity was evaluated. To assess balance, a stadiometer was used for the Time Up and Go test. St. George Respiratory Questionnaire and the Nottingham Health Profile were used to measure quality of life. The results of the study demonstrated that six months after leaving the critical care unit, patients with severe COVID-19 infections had decreased respiratory function, functional ability, quality of life, and levels of weariness. The invasion of coronavirus and inflammatory cytokines into the cerebral cortex and muscle may result in an increase in fatigue and a decline in functional abilities.

Yanti et al. (2022) conducted a cross-sectional research on COVID-19 patients in Banda Aceh, Indonesia to ascertain the relationship between sickness severity and functional level. The study comprised (109), post-COVID-19 patients who had been well for more than 4–8 weeks in a hospital in Banda Aceh, Indonesia. The functional status was assessed and divided into five groups using the Post-COVID-19 Functional Status Scale (PCFS) questionnaire: no functional limitation, minimum, minor, moderate, and severe functional restriction. The quantitative analysis of the relationship between COVID-19 severity and functional status was performed using the Spearman rank test. The most frequent and persistent symptom among responders, according to the findings, was weariness. Furthermore, the statistical results showed a strong association between post-COVID-19 functional status and the past severity of COVID-19. The study also showed how long-term consequences on one's physical, mental, social, and cognitive

health lead to a reduction in functional status. These effects include mental health problems, impaired lung function, and a reduced quality of life.

To understand how COVID-19 symptoms affect adult patients' ability to carry out their daily activities (ADL), Pizarro-Pennarolli et al. (2021) in Canada conducted a comprehensive study. After the acute phase of infection, COVID-19 patients lost their independence as a result of the chronic disease's symptoms, which had an effect on six fundamental BADL-related tasks, including bathing, dressing, toileting, transfer, continence, and eating. The findings showed a significant decline in functional ability in ADL performance. Predicting the severity of the illness and mortality depends on functional ability level before COVID-19.

Sanchez-Ramirez et al. planned a comprehensive study in China in 2021 to examine the effects of COVID-19 on patients' chest computed tomography (CT), lung function, respiratory symptoms, fatigue, functional capacity, health-related quality of life (HRQoL), and the ability to return to work in Canada after 3 months following infection. According to the research, after recovering from COVID-19, individuals may continue have respiratory problems such as coughing, fatigue, dyspnea, tightness in the chest, impaired lung function, and abnormalities on CT scans. Additionally, a worse HRQoL and functional abilities were found.

The COVID-19 Yorkshire Rehabilitation Scale was used in the study by Sivan et al. (2021) to examine post-COVID symptoms and their impact on functional impairment. On a Likert scale from 0 to 10, each symptom or functional issue was graded, and its severity was compared to previous infections. The sample consisted of (370) Covid-19 survivors, and the research's findings showed that the condition's 16 primary symptoms

were dyspnea, a persistent cough, exhaustion, pain or discomfort, cognitive difficulties, anxiety, melancholy, and PTSD-like symptoms, as well as palpitations, dizziness, weakness, and sleep problems. A moderately negative correlation between the post-covid-19 symptom and general health and a considerable positive correlation between functional problems and the symptom. Besides having an effect on five aspects of daily life (communication, mobility, personal care, other daily activities, and social functioning), they also have an impact on other areas of daily life.

Shah et al.'s study in 2021 examined how COVID-19 affects survivors' quality of life (QoL) in the UK. Of the 735 COVID-19 survivors included in the sample, those who were hospitalized reported significantly more issues with mobility and daily activities. Hospitalization also had a greater negative impact on survivors' ability to take care of themselves. The study assessed the quality of life of COVID-19 survivors using the EuroQol group five dimensions three level (EQ-5D-3L) and the Family Reported Outcome Measure (FROM-16) to assess the impact on their partners' or family members' quality of life. Survivors of COVID-19 reported a significant, ongoing impact on their physical and emotional health, according to the study's findings. The lives of their partners and other family members were also adversely affected.

Clavario et al. (2020) carried out a study in Finland, the study included cardiopulmonary exercise testing to evaluate the survivors of COVID-19 who did not have severe disease. The first 150 consecutive COVID-19-infected patients to be released from Azienda Sanitaria Locale, Genoa, Italy, alive between March and April 2020 were prospectively recruited. Three months after being released from the hospital, a thorough clinical evaluation, trans-thoracic echocardiography, cardiopulmonary exercise testing,

pulmonary function testing, and an evaluation of dominant leg extension maximum strength were done. The majority of critically sick patients have long-lasting functional impairment after discharge, and over half of non-severe COVID-19 survivors have functional capacity restriction, with muscle damage being the primary reason.

A systematic review by Ceban et al. (2020) in Canada quantified the proportion of patients who experienced tiredness and cognitive impairment 12 weeks or more after getting a COVID-19 diagnosis. One of the most common and debilitating symptoms of post-COVID-19 syndrome is fatigue, followed by cognitive impairment. Additionally, a sizable number of patients still have ongoing weariness and/or cognitive impairment after the acute COVID-19 has faded.

2.5.3 Summary

Following a review of the prior research, it was evident to the researcher that these studies had been conducted in various nations, had spanned the years (2020–2023), and had involved various samples of individuals with Covid-19. The researcher had benefited from these studies in developing the theoretical framework and from earlier research pertaining to the study's topic.

The current study differs from previous studies in terms of the place of preparation, as it will be conducted in Palestine, and on a sample of survivors of COVID-19 in

Palestine. In Addition, this study will investigate the correlation between physical and functional status and different variables.

Chapter Three: Methodology

3.1 Introduction

This part of the study contains the research method including the study setting, design, population, sample size. Sampling methods, etc., are illustrated in this chapter. Additionally, it discusses the study's tools and the data analysis techniques used.

3.2 Study Setting

This study investigated the Long term effect of COVID 19 on physical and functional abilities among COVID-19 Survivors. The study is conducted in rehabilitation centers in Palestine.

3.3 Research Design

The mixed approach was used in this study; quantitative research method was followed as the researcher uses a questionnaire which was filled by the researchers, and thee cross- sectional approach was also used as the researcher uses three tests which will be applied with the sample individuals. Both research approaches rely on the collection and analysis of numerical data to define, clarify, forecast, or govern variables and phenomena of interest.

3.4 Study Population

The study population included all corona patients registered in Corona statistics in Palestine, all of whom were previously infected with the Corona virus, and they have been infected for at least 6 months or more. The ages of the patients ranged between (20-

60). The sample size was determined according to the statistics on the number of corona patients through the private browser in Corona statistics in Palestine .

Inclusion criteria: Corona patients registered in Corona statistics in Palestine aged between 20-60 Yrs. old , who have been infected for at least 6 months or more.

Exclusion criteria: Patients who have other diseases, patients who have been infected for a period less than 6 months or more, patients out of age range (20-60), and patients who refuse to participate due to any special reason.

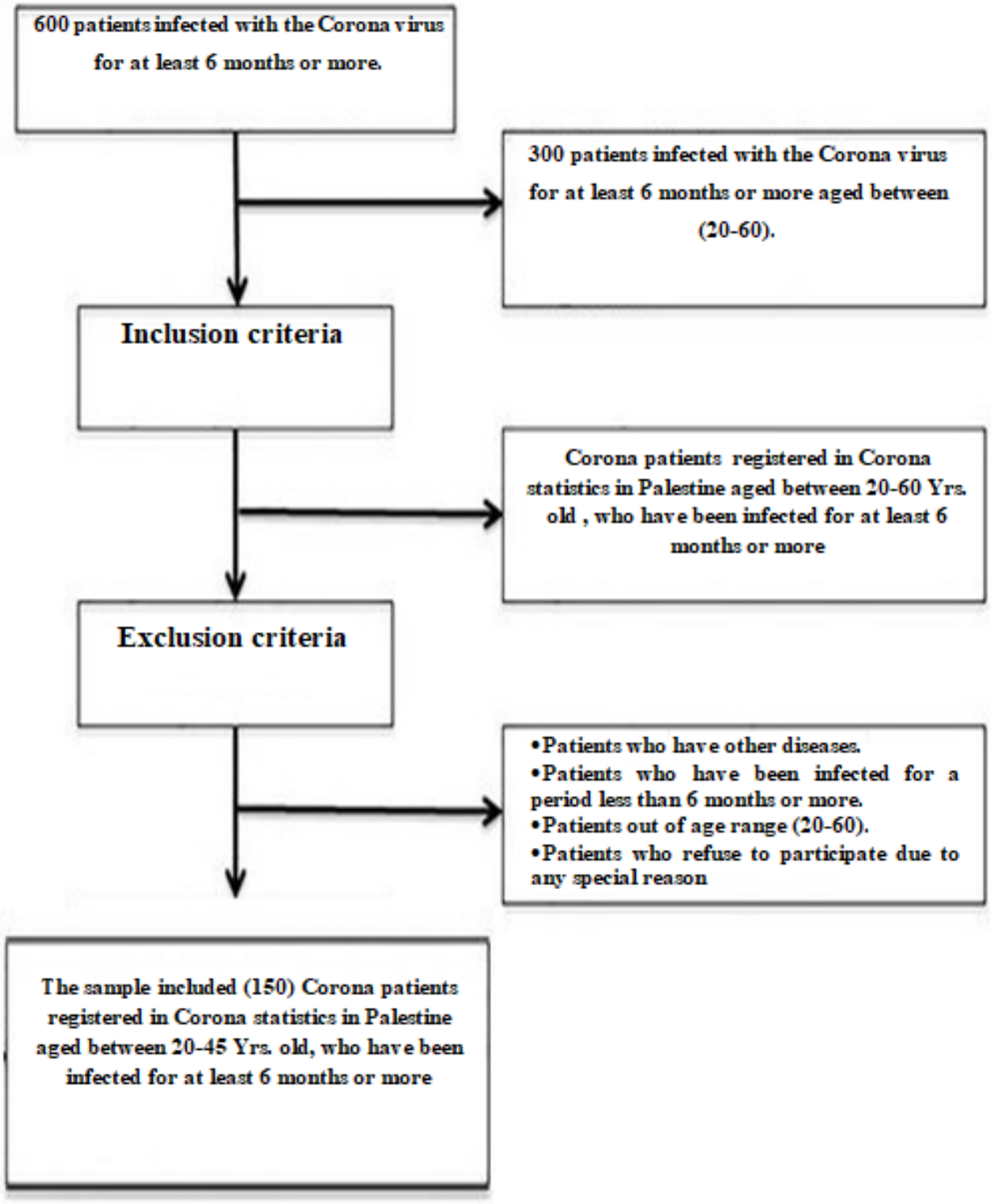
3.5 Sample Selection and Method

A convenient sample of the study population is selected. A convenient sample (accident or opportunity sample) involves the sample being drawn from that part of the population that is close to hand (Etikan et al., 2016).

3.6 Sample Size

The sample included (١٥٠) Corona patients registered in Corona statistics in Palestine aged between 20-٤٥ Yrs. old, who have been infected for at least 6 months or more.

The final sample size is illustrated in the following diagram:



3.7 Data Collection

After the researcher designed the questionnaire questions and adopted the tests that are suitable to measure the study purposes, she began to collect data from the target sample after obtaining all the requires approvals and permissions to meet the patients .

The questionnaire included five questions that describe the physical abilities and six questions that describe the functional abilities of the patient before being infected with Covid19. The questions were adopted from (Klok et al., 2020) .

Three tests are adopted by the researcher:

1. **Y Balance Test Lower Quarter**

According to research, the anterior reach direction's right and left reach distances shouldn't differ by more than four centimeters. The difference in reach distance between the posteromedial and posterolateral directions shouldn't be more than six centimeters. Additionally, the composite score, which is calculated by multiplying three times the limb length by the total of the three reach directions, by 100, should not fall below the cut points established for the person's age and gender.

Reliability

Numerous research have proved the Y Balance Test to give reproducible and consistent test findings. With many raters, researchers discovered that the Y Balance Test Lower Quarter had high reliability (Plisky et al., 2006).The authors discovered intraclass correlation coefficients for the maximal reach's interrater test-retest reliability (Butler et al, 2006). For the three reach directions (anterior, posteromedial, and posterolateral), the

range was 0.80 to 0.85 with a standard error of measurement of 3.1 to 4.2 cm. (Plisky et al., 2006) revealed that the scale's inter-rater reliability ranged from good to outstanding.

In the LQYBT, the patient is instructed to balance on one leg while extending the opposite lower limb in three distinct directions. Posterolateral, Posteromedial, and Anterior are their names. Utilizing the Y-Balance test kit, the three reaches provide a "composite reach distance" or composite score that is used to forecast damage. According to research, the risk of injury rose from 37.7% to 68.1% for NCAA football players with a composite score under 89%. As a result, a cut point of 89% composite reach on the YBT (with a sensitivity of 100% and a +LR of 3.5) was created. (Butler et al, 2006).The cut threshold for high school basketball players was 94%. These studies demonstrate that every sport and group has a unique risk cutoff. (Plisky et al., 2006; and Butler et al., 2006).

2. Timed Up and Go (TUG) Test

Patients can utilize a walking assistance if necessary and wear their usual shoes.

- Start by asking the patient to locate a line on the floor that is 3 meters (10 feet) away from them while relaxing in a regular armchair.
- I want you to: when I say "Go," Get out of the chair, Move slowly toward the line on the floor. Turn, return to the chair while moving normally, again take a seat.
- Start timing as soon as you hear "Go." After the patient sits back down, stop timing. Record period.

The necessary equipment for this test is a stopwatch, a standard chair, and a scale that measures function in relation to balance and fall risk. 10 feet (3 meters) of measurement.

To interpret the results : 10 seconds or less equals normal, 20 seconds or more equals good mobility, the ability to leave the house without assistance, and 30 seconds or more equals difficulties, the need for a gait aid. According to research, a score of less than 14 seconds indicates a high chance of falling. (Herman et al., 2011).

When used to test senior persons, the TUG has shown to have strong inter- and intrarater reliability. Additionally, it has proven to be reliable when evaluating functional mobility. The majority of people who need more than 30 seconds to complete the exam require physical assistance with transfers. Most people who can handle steps and move outside the home and finish the test in less than 20 seconds are likely to be independently mobile (Alghadir et al., 2018).

3. 3 Step Test

A person's degree of aerobic fitness may be determined using the Step Test. Participants stepped up and down, on and off an aerobics-style step for 3 minutes in order to increase heart rate and measure the rate of recovery of the heart in the minute after the step test exercise. A 12-inch high bench (or a solid box of a same size) and a watch for keeping time are required. (CDC, 2017).

The Three Step test showed validity and good reliability in measuring degree of aerobic fitness for different ages (Ferreira et al., 2020; and Bohannon et al., 2015).

3.8 Data Analysis

After patients filled out the questionnaires and performed the tests, the researcher analyzed the results, to see if there are physical effects on patients previously infected with corona virus. Data analysis was made via SPSS program for statistical analysis, the means and the frequencies were found through descriptive analysis and other tests were used to test the differences according to demographic variables.

3.9 Ethical Considerations

All participants got oral and written explanations from the researcher about the study's objectives, methods, potential exhaustion, and minimal dangers. Prior to participating in the study, each participant signed an Arabic-language informed consent form.

All patients also were given anonymity and confidentiality. Additionally, they always had the option to withdraw from the study without it affecting their interests. Under the direction of the principal investigator, the data was examined without using names and locked in a secure location. The participants in this study had access to the study findings.

The information gathered was anonymous, it was used only to further the study's goals, participants were made aware of these goals, no pressure was applied on the patients to complete the tests, and the information was reported accurately and without falsification or alteration. Participants were also instructed to report their cases honestly and completely, and it was stressed on the value of doing so in order to provide accurate findings and conclusions.

Chapter Four: Results

4.1 Results Related to Demographic Characteristics

The sample included (150) Corona patients registered in Corona statistics in Palestine aged between 20-45 Yrs. old , who have been infected for at least 6 months or more.

The sample included 72 (48%) males and 78 (52%) females, 146 (97%) of the sample individuals had a period of long term symptoms for more than (6 months), the majority of the sample individuals (66.7%)were infected twice while (30.7% were infected once, and only (2.7) were infected for 3 times. The mean age of the sample is (36.93± 5.80) and the mean weight is (75.53 ± 8.18).

4.2 Physical and Functional Abilities before Infection with Covid 19

The sample were asked about their physical and functional abilities before infection with Covid 19 and the tables below shows the results:

Table (1): Physical abilities before infection

Level of Disability	No of individuals (%)
no disability	88 (58.7%)
very low disability	56 (37.3)
low disability	6 (4.0)
Total	150 (100%)

Mean= (0.45 ± 0.57)

The table shows that the majority of the sample (58.7%) had no physical disability before infection, and (37.3%) had very low physical disability, while (4%) had low physical disability.

Table (2): Functional abilities before infection

Level of Difficulty	No of individuals (%)
No difficulty	94 (63%)
Little difficulty	46 (31%)
Moderate difficulty	10 (6%)
Total	150 (100%)

Mean= (0.34 ± 0.23)

The table shows that the majority of the sample (63%) had no functional difficulty before infection, and (31%) had little functional difficulty, while (6%) had moderate difficulty.

4.3 Physical and Functional Abilities Post Infection with Covid 19

4.3.1 Physical Abilities Post Infection

The Low Quarter Y Balance Test was used to measure balance among sample individuals, previous studies such as (Cook and Plisky, 2015) and (Alghadir et al., 2018) ensured that Anterior, Posteromedial, and Posterolateral difference between right and left legs above 4 indicates low balance and a composite score below 89% had an increased probability of injury.

The results of the sample individuals are shown in the following table:

Table (3): The results of Low Quarter Y Balance test

	N	Minimum	Maximum	Mean ± Std. Deviation
Anerior R	١٥٠	53.00	74.50	61.45 ± 4.677
Anterir L	١٥٠	52.00	77.00	61.49 ± 4.719
Anterior Difference	١٥٠	.50	13.00	4.37 ± 2.512
Posteromedial R	١٥٠	92.00	115.00	103.74 ± 4.588
Posteromedial L	١٥٠	91.00	115.00	103.44 ± 5.169
Posteromedial Difference	١٥٠	1.00	10.00	4.02 ± 2.296
Posterolateral R	١٥٠	91.00	112.00	102.72 ± 5.294
Posterlateral L	١٥٠	90.00	112.00	101.88 ± 4.942
Posterolateral Difference	١٥٠	1.00	10.50	4.53 ± 2.153
Composite R	١٥٠	77.00	99.00	88.04 ± 4.363
Composite L	١٥٠	57.00	96.00	87.24 ± 5.574

The table shows that the means of Anterior, Posteromedial, and Posterolateral differences between right and left legs are all above ٤ which indicates low mean balance among the sample individuals.

The table also shows that the mean of the means of composite scores on the right and left legs are below 89%, which indicates an increased probability of injury among the sample individuals.

From the previous tables we can notice that the physical ability before infection was good because the level of disability was low as shown in table no (1). While table no. (3) showed that the physical ability after infection was low because the mean differences between right and left were above 4.

4.3.2 Functional Abilities Post Infection

The Results of the Timed Up and Go Test

Adults who take longer than 14 seconds to complete the Timed Up and Go test, have a risk for falls. In this study the score 14 or less was considered to have (no risk for falls), the score 15-16 was considered to have (risk for falls), and the score more than 16 was considered to have (high risk for falls) The results of the Timed Up and Go test are shown in the following table:

Table (٤): The results of the Timed Up and Go test

Risk for falls	No of individuals (%)
≤14 (No risk for falls)	26 (17.3%)
15-16 (low risk for falls)	64 (42.7%)
≥17 High risk for falls	60 (40.0%) 30
Total	150 (100%)

Mean= (16.8± 1.62)

The table shows that 42.7% of the sample individuals have a risk for falls and 40% have a high risk for falls. This means that the functional abilities of the sample individuals were affected by long term symptoms of Covid 19.

The “3-Minute Step Test” is designed to measure the aerobic fitness. It assesses fitness level based on how quickly the heart rate recovers after exercise. The more aerobically fit the person is, the quicker his or her heart rate will return to normal after exercise. The results of the 3 Minute step test are shown in the following table:

Table (°): The results of the 3 Minute step test

Level of aerobic fitness	No of individuals (%)
very poor	16 (10.7%)
Poor	36 (24%)
below average	44 (29.3%)
Average	40 (26.7%)
above average	4 (2.7%)
Good	8 (5.3%)
Excellent	2 (1.3%)
Total	150 (100%)

Mean= (3.08±1.32)

The table shows that 29.3 % of the sample individuals have below average fitness, 24% have poor fitness, and 10.7% have a very poor fitness. This means that the level of aerobic fitness of the sample individuals were affected by long term symptoms of Covid 19 .

The previous tables show that the functional ability before infection was good because the level of difficulty was low. While the level of functional ability after infection was low because the timed up and go test showed a high level of fall risk , and the 3 Minute Step Test showed that the level of aerobic fitness was below average.

4.4 Results Related to Study Hypotheses

In this section, the hypotheses that were previously developed are tested using the appropriate statistical tests as shown in the following pages.

H1: There are long-term effects on patients previously infected with COVID-19, so they are likely to reduce their physical ability.

The results indicated that the long-term effects on patients previously infected with COVID-19 affected their physical ability. So this hypothesis was accepted

H2: There are long-term effects on patients previously infected with COVID-19, so they are likely to reduce their functional ability.

The results indicated that the long-term effects on patients previously infected with COVID-19 affected their functional ability. So this hypothesis was accepted

H3: There are significant differences in the long term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to age.

Oneway Anova test was conducted to find the differences on physical and functional abilities between the study sample individuals due to age and the results are shown in the following table:

Table (٦): Results of Oneway Anova test regarding the differences on physical abilities between the study sample due to age

Age	F	Sig.
Anterior Difference	1.237	.26
Posteromedial Difference	.580	.89
Posterolateral Difference	1.430	.15
Composite R	.739	.75
Composite L	.852	.62

No significant differences were found in the long term effect of COVID 19 on physical abilities among COVID-19 Survivors due to age since the value of significance (sig.) was more than (0.05) on all the dimensions of physical ability.

Table (٧): Results of Oneway Anova test regarding the differences on functional abilities between the study sample due to age

Age	F	Sig.
Risk for falls	1.756	.04
Aerobic fitness	1.141	.04

Significant differences were found in the long-term effect of COVID 19 on functional abilities among COVID-19 Survivors due to age since the value of significance was less than (0.05) on all the dimensions.

H4: There are significant differences in the long-term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to gender.

Oneway Anova test was conducted to find the differences on physical and functional abilities between the study sample individuals due to gender and the results are shown in the following table:

Table (٨): Results of Oneway Anova test regarding the differences on physical abilities between the study sample due to gender

Gender	F	Sig.
Anterior Difference	3.522	.06
Posteromedial Difference	2.576	.11
Posterolateral Difference	4.015	.04
Composite R	2.680	.10
Composite L	.576	.45

No significant differences were found in the long term effect of COVID 19 on physical abilities among COVID-19 Survivors due to gender on all the dimensions except for the

Posterolateral Difference since the value of significance on this dimension was less than (0.05).

Table (٩): Results of Oneway Anova test regarding the differences on functional abilities between the study sample due to gender

Gender	F	Sig.
Risk for falls	3.603	.06
Aerobic fitness	.023	.87

No significant differences were found in the long-term effect of COVID 19 on functional abilities among COVID-19 Survivors due to gender since the value of significance was more than (0.05) on all the dimensions.

H5: There are significant differences in the long term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to weight.

Oneway Anova test was conducted to find the differences on physical and functional abilities between the study sample individuals due to weight and the results are shown in the following table:

Table (10): Results of Oneway Anova test regarding the differences on physical abilities between the study sample due to weight

Weight	F	Sig.
Anterior Difference	.894	.60
Posteromedial Difference	1.354	.18
Posterolateral Difference	.782	.73
Composite R	.552	.93
Composite L	.260	.99

No significant differences were found in the long-term effect of COVID 19 on physical abilities among COVID-19 Survivors due to weight since the value of significance (sig.) was more than (0.05) on all the dimensions of physical ability.

Table (11): Results of Oneway Anova test regarding the differences on functional abilities between the study sample due to weight

Weight	F	Sig.
Risk for falls	1.863	.03
Aerobic fitness	.781	.04

Significant differences were found in the long term effect of COVID 19 on functional abilities among COVID-19 Survivors due to weight since the value of significance was less than (0.05) on all the dimensions.

H6: There are significant differences in the long term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to number of infections.

Oneway Anova test was conducted to find the differences on physical and functional abilities between the study sample individuals due to number of infections and the results are shown in the following table:

Table (12): Results of Oneway Anova test regarding the differences on physical abilities between the study sample due to number of infections

Number of infections	F	Sig.
Anterior Difference	.457	.63
Posteromedial Difference	.824	.44
Posterolateral Difference	1.413	.25
Composite R	.195	.82
Composite L	.405	.66

No significant differences were found in the long term effect of COVID 19 on physical abilities among COVID-19 Survivors due to number of infections since the value of significance (sig.) was more than (0.05) on all the dimensions of physical ability.

Table (13): Results of Oneway Anova test regarding the differences on functional abilities between the study sample due to number of infections

Number of infections	F	Sig.
Risk for falls	.166	.84
aerobic fitness	.067	.93

No significant differences were found in the long term effect of COVID 19 on functional abilities among COVID-19 Survivors due to number of infections since the value of significance was more than (0.05) on all the dimensions.

H7: There are significant differences in the long-term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to period of long-term symptoms.

Oneway Anova test was conducted to find the differences on physical and functional abilities between the study sample individuals due to period of long-term symptoms and the results are shown in the following table:

Table (14): Results of Oneway Anova test regarding the differences on physical abilities between the study sample due to period of long-term symptoms

Period of long-term symptoms	F	Sig.
Anterior Difference	.459	.63
Posteromedial Difference	.491	.61
Posterolateral Difference	1.610	.20
Composite R	.516	.59
Composite L	.247	.78

No significant differences were found in the long-term effect of COVID 19 on physical abilities among COVID-19 Survivors due to period of long-term symptoms since the value of significance (sig.) was more than (0.05) on all the dimensions of physical ability.

Table (15): Results of Oneway Anova test regarding the differences on functional abilities between the study sample due to period of long-term symptoms

period of long-term symptoms	F	Sig.
Risk for falls	.375	.68
Aerobic fitness	.004	.99

No significant differences were found in the long-term effect of COVID 19 on functional abilities among COVID-19 Survivors due to period of long-term symptoms since the value of significance was more than (0.05) on all the dimensions.

Chapter Five: Discussion & Conclusions

5.1 Discussion

The purpose of this study was to determine the long-term impact of COVID 19 on survivors' physical and functional abilities, and to determine the differences in the long term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to demographic variables (age, gender, weight, number of infections, and period of long term symptoms).

The sample includes (١٥٠) Corona patients registered in Corona statistics in Palestine aged between 20-٤٥ Yrs. old, who have been infected for at least 6 months or more.

5.2 The Long-Term Impact of COVID 19 on Survivors' Physical Abilities

In order to explore the long-term impact of COVID 19 on survivors' physical abilities, the researcher first asked the patients' about their physical status before infection through a questionnaire, then she conducted the Low Quarter Y Balance Test to explore their physical abilities after long term symptoms .

The study showed that the means of Anterior, Posteromedial, and Posterolateral differences between right and left legs were all above ٤ which indicates low mean balance among the sample individuals.

The study also showed that the mean of the means of composite scores on the right and left legs were below 89% which indicates an increased probability of injury among the sample individuals.

The study revealed that the physical abilities of the sample individuals were affected by long term symptoms of Covid 19.

This result supports the results of Gil et al. (2023) which investigated whether survivors of COVID-19 with post- acute symptoms are physically inactive, and found a link between (PASC) and physical inactivity.

This result is also supported by Zhao et al. (2023) which identified the COVID-19's long-term effects on the physical abilities after twenty months of infection, and found that more than half of COVID-19 survivors who presented moderate or severe symptoms 20 months after recovery had a physical vulnerability that may necessitate physical therapy.

This result is also supported by Park et al. (2022) who carried out a study to investigate whether COVID-19 has been shown to be associated with substantial declines in mobility, walking, and physical activity, and found that people's regular physical activity and mobility were significantly impacted

Tabaczynski et al. (2022) also compared physical activity (PA) levels before and after the COVID-19 pandemic, and found that physical activity decreased over the course of the pandemic, and this was supported by the current study.

5.3 The Long-Term Impact of COVID 19 on Survivors' Functional Abilities

In order to explore the long-term impact of COVID 19 on survivors' functional abilities, the researcher first asked the patients' about their functional status before infection through a questionnaire, then she conducted two tests including the Timed

Up and Go Test to explore the risk for falls and the 3 step Test to explore the level of aerobic fitness among the patients after long term symptoms .

The results of the Timed Up and Go Test showed that 42.7% of the sample individuals have a risk for falls and 40% have a high risk for falls.

This result means that the risk for falls increased after the sample individuals experienced long term symptoms of Covid 19.

The results of the 3 Step Test showed that 29.3 % of the sample individuals have below average fitness, 24% have poor fitness, and 10.7% have a very poor fitness.

This result means that the level of aerobic fitness of the sample individuals was affected by long term symptoms of Covid 19 .

Our results revealed that the functional abilities of the sample individuals were affected by long term symptoms of Covid 19.

This result is supported by Sirayder et al. (2022) study which aimed to evaluate functional ability in severe COVID patients across time 6 months after being discharged from the intensive care unit, and found that six months after leaving the critical care unit, patients with severe COVID-19 infections had decreased functional ability, and included that the attack of Covid19 and inflammatory cytokines into the cerebral cortex and muscle may result in an increase in fatigue and a decline in functional abilities.

This result is also supported by Yanti et al. (2022) who conducted a study to explore the relationship between post covid19 long term symptoms and functional level, and its result showed that long-term consequences lead to a decline in functional status.

This result is also supported by Sivan et al. (2021) who conducted a study to examine post-COVID symptoms and their impact on functional impairment and found a considerable positive correlation between functional problems and the symptom .

5.4 The Differences in the Long Term Effect of COVID 19 on Physical and Functional Abilities among COVID-19 Survivors Attributed to Demographic Variables (age, gender, weight, number of infections, and period of long term symptoms). The current study revealed that:

No significant differences were found in the long term effect of COVID 19 on physical abilities among COVID-19 Survivors due to age. But significant differences were found on functional abilities among COVID-19 survivors due to age. The differences were for the benefit of the younger individuals who scored better on the functional ability scales.

No significant differences were found in the long term effect of COVID 19 on physical abilities among COVID-19 Survivors due to gender on all the dimensions except for the Posterolateral Difference, where the differences were for the benefit of the males who scored better on the physical ability scale. Also no significant differences were found on functional abilities due to gender .

Similarly, Lopez-Leon et al. (2021) found significant differences in the effect of post Covid symptoms based on factors such as gender and age.

The current study also found no significant differences were found in the long term effect of COVID 19 on physical abilities among COVID-19 Survivors due to weight. But significant differences were found on functional abilities due to weight. The differences

were for the benefit of the light weight individuals who scored better on the functional ability scales.

No significant differences were found in the long term effect of COVID 19 on physical abilities among COVID-19 Survivors due to number of infections . And no significant differences were found on functional abilities among COVID-19 Survivors due to number of infections.

No significant differences were found in the long term effect of COVID 19 on physical abilities among COVID-19 Survivors due to period of long term symptoms. And no significant differences were found on functional abilities due to period of long term symptoms.

The previous studies did not dealt with these demographic variables similar to the current study, therefore, this study is considered to have a valuable addition to previous studies, as it dealt with the relationship with some demographic variables that were not mentioned in previous studies, and its results showed the existence of differences related to age, gender, and weight.

Participants showed a drop in physical activity and a decline in functional ability. According to these findings, The symptoms of post-COVID-19 conditions can create everyday impairments that interrupt people's social and professional lives and surely have a detrimental influence on their social and economic health.

The main causes of COVID-19 survivors' declining physical and functioning levels may be attributed to muscular weakness, poor mobility, pain, anxiety, dyspnea, insomnia, and daytime sleepiness.

5.5 Conclusion

It can be concluded that this research added new support about the long-term impact of COVID 19 on survivors' physical and functional abilities. The study added new information about the effect of some demographic variables that the previous studies did not talk about specially (age, gender, and weight).

These results call for additional research to help identify individuals who may benefit from close monitoring and focused rehabilitation and who are at higher risk of long-term consequences, and to determine the degree of post-COVID-19 effects that last longer than six months, as well as to elucidate their origins and practical solutions for management.

5.6 Recommendations

Upon the study results, the researcher put the following recommendations:

- Rehabilitation programs could be incorporated in the framework of treatment following Covid19 infection in order to minimize its effect on physical and functional status.
- The outcome measures used in this study are reliable to be used by researchers and by physiotherapists to measure the long-term impact of COVID 19 on survivors' physical and functional abilities.
- Due to the unfavorable impact on physical and functional activities, early and appropriate diagnosis and care are necessary for recovered older persons following COVID-19.

- The researchers should conduct other researches that include a bigger sample of patients with long term symptoms of Covid19.
- It is recommended to conduct a monitoring program to assess the post-COVID-19 physical functional status regularly, especially in healthcare centers.

5.7 Implications

The research will add knowledge and raise awareness about the long-term impact of COVID 19 on survivors' physical and functional abilities, and the differences in the long term effect of COVID 19 on physical and functional abilities among COVID-19 survivors attributed to demographic variables (age, gender, weight, number of infections, and period of long term symptoms). That will benefit patients, library of physical therapy, and students of physical therapy, in addition to rehabilitation centers and institutions.

5.8 Limitations

The study was conducted on a small size of sample, and it was conducted in a limited area, a large sample that includes a wide area in Palestine is needed in order to empower its results. Another limitation in the study was the difficulty to conduct the tests because the researcher had to find them and to persuade them to participate.

References

Abayomi, A. Odukoya, O. Osibogun, A. Wright, O. Adebayo, B. & Balogun, M. (2020). Presenting symptoms and predictors of poor outcomes among 2,184 patients with COVID-19 in Lagos state. *International Journal of Infectious Diseases*;102:226–32. Doi.org/10.1016/j.i jid.2020.10.024.

Acito, M., Rondini, T., Gargano, G., Moretti, M., Villarini, M., & Villarini, A. (2022). How the COVID-19 pandemic has affected eating habits and physical activity in breast cancer survivors: the DianaWeb study. Journal of cancer survivorship: research and practice, 1–12. *Advance online publication*. https://doi.org/10.1007/s117 64-022-01294-w

Aiyegbusi, O. L., Hughes, S. E., Turner, G., Rivera, S. C., McMullan, C., Chandan, J. S., Haroon, S., Price, G., Davies, E. H., Nirantharakumar, K., Sapey, E., Calvert, M. J., & TLC Study Group (2021). Symptoms, complications and management of long COVID: a review. Journal of the Royal Society of Medicine, 114(9), 428–442. https://doi.org/10.1177/01410768211032850

Alghadir, A.H., Al-Eisa, E.S., Anwer, S. et al. (2018). Reliability, validity, and responsiveness of three scales for measuring balance in patients with chronic stroke. BMC Neurol 18, 141. https://doi.org/10.1186/s12883-018-1146-9.

Alghamdi, F., Owen, R., Ashton, R. E. M., Obotiba, A. D., Meertens, R. M., Hyde, E., Faghy, M. A., Knapp, K. M., Rogers, P., & Strain, W. D. (2022). Post-acute COVID syndrome (long COVID): What should radiographers know and the potential impact for imaging services. Radiography (London, England: 1995), 28 Suppl 1, S93–S99. https://doi.org/10.1016/j.radi.2022.08.009

Alves, R. Samorinha, C. &Precioso, J. (2020). Knowledge, attitudes and preventive behaviors toward COVID-19: a study among higher education students in Portugal, *Journal of Health Research*, available on Emerald Insight at: https://www.emerald.com/insight/2586-940X.htm

Anaya, J. M., Rojas, M., Salinas, M. L., Rodríguez, Y., Roa, G., Lozano, M., Rodríguez-Jiménez, M., Montoya, N., Zapata, E., Monsalve, D. M., Acosta-Ampudia, Y., & Ramírez-Santana, C. (2021). Post-COVID syndrome. A case series and comprehensive review. *Autoimmunity Reviews*, *20*(11). https://doi.org/10.1016/ j.autrev.2021.102947

Battistella, L. R., Imamura, M., De Pretto, L. R., Van Cauwenbergh, S. K. H. A. A., Delgado Ramos, V., Saemy Tome Uchiyama, S., Matheus, D., Kuhn, F., Amaral de Oliveira, A. A., Souza Naves, G., Rossetti Mirisola, A., de Quadros Ribeiro, F., Tadeu Sugawara, A., Cantarino, M., Andrade Santos Antunes Cavalca, R., Pagano, V., Valentim Marques, M., Mendes da Silva, E., Pereira Gomes, A., & Fregni, F. (2022). Long-term functioning status of COVID-19 survivors: a prospective observational evaluation of a cohort of patients surviving hospitalisation. *BMJ open*, 12(7), e057246. https://doi.org/10.1136/bmjopen-2021-057246

Bliddal, S. Banasik, K. Pedersen, O. Nissen, I. Cantwell, L. Schwinn, M. Tulstrup, M. Westergaard, D. Ullum, H. Brunak, S. Tommerup, N. Feenstra, B. Geller, F. Ostrowski, S. Grønbæk, K. Nielsen, C. Nielsen, S. Feldt-Rasmussen, U. (2021). Acute and persistent symptoms in non-hospitalized PCR-confirmed 2 COVID-19 patients, Master Thesis, University of Copenhagen, Copenhagen, Denmark.

Bohannon, R. W., Bubela, D. J., Wang, Y. C., Magasi, S. S., & Gershon, R. C. (2015). Six-minute walk test versus three-minute step test for measuring functional endurance (alternative measures of functional endurance). Journal of strength and conditioning research/National Strength & Conditioning Association, 29(11), 3240.

Borel, M., Xie, L., Kapera, O., Mihalcea, A., Kahn, J., & Messiah, S. E. (2022). Long-term physical, mental and social health effects of COVID-19 in the pediatric population: a scoping review. *World journal of pediatrics: WJP*, 18(3), 149–159. https://doi.org/10.1007/s12519-022-00515-7

Butler RJ, Lehr ME, Fink ML, Kiesel KB, Plisky PJ. (2013). Dynamic balance performance and noncontact lower extremity injury in college football players. Sports Health. 5:417-422.

Carfi, A. Bernabei, R. & Landi, F. (2020). Persistent Symptoms in Patients After Acute COVID-19, *American Medical Association*, Volume 324, Number 6. 603- 605. doi:10.1001/jama.2020.12603

Ceban, F., Ling, S., Lui, L. M. W., Lee, Y., Gill, H., Teopiz, K. M., Rodrigues, N. B., Subramaniapillai, M., Di Vincenzo, J. D., Cao, B., Lin, K., Mansur, R. B., Ho, R. C., Rosenblat, J. D., Miskowiak, K. W., Vinberg, M., Maletic, V., & McIntyre, R. S. (2022). Fatigue and cognitive impairment in Post-COVID-19 Syndrome: A systematic review and meta-analysis. Brain, behavior, and immunity, 101, 93–135. https://doi.org/10.1016/j.bbi.2021.12.020

Centers for Disease Control and Prevention, (CDC). (2017). 3 Minute Step Test, https://www.cdc.gov/physicalactivity/

Clavario, P., De Marzo, V., Lotti, R., Barbara, C., Porcile, A., Russo, C., & Porto, I. (2020). Assessment of functional capacity with cardiopulmonary exercise testing in non-severe COVID-19 patients at three months follow-up. *MedRxiv*, 2020-11.

Crispo, A., Bimonte, S., Porciello, G., Forte, C. A., Cuomo, G., Montagnese, C., Prete, M., Grimaldi, M., Celentano, E., Amore, A., de Blasio, E., Pentimalli, F., Giordano, A., Botti, G., Baglio, G., Sileri, P., Cascella, M., & Cuomo, A. (2021). Strategies to evaluate outcomes in long-COVID-19 and post-COVID survivors. *Infectious agents and cancer*, 16(1), 62. https://doi.org/10.1186/s13027-021-00401-3

Desai, A. Lavelle, M. Brian, C. and Boursiquot, E. (2021). Long-term complications of COVID-19, American Journal of Physiotherapy, 322: C1–C11.

Edemekong, P., Bomgaars, D. Sukumaran, S. (2022). Activities of Daily Living. [Updated 2022 Nov 19]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing.

Ferreira, S. T. B. P., Bernardino, M. E. C., MG, S. M., Bezerra, P., & Jaguaribe de Lima, A. M. (2020). The three-minute step test showed good construct validity and intra-rater

reliability in healthy children aged 7-11 years. Acta Paediatrica (Oslo, Norway: 1992), 109(11), 2354-2355.

Fraser, E. (2020). Long term respiratory complications of covid-19. BMJ (Clinical research ed.), 370, m3001. https://doi.org/10.1136/bmj.m3001

Galiuto, L., & Liuzzo, G. (2022). Volume of physical activity and cardiovascular health status: is more necessarily better?. *European heart journal*, 43(13), 1286–1287. https://doi.org/10.1093/eurheartj/ehac041

Gennaro. F . Pizzol, D. Marotta , C, Antunes, M. Racalbuto, V. Veronese, N. & Smith, N. (2020). Coronavirus Diseases (COVID-19) Current Status and Future Perspectives: A Narrative Review. *Environ*. doi:10.3390/ijerph17082690.

Gesesew, H., Koye, D. Fetene, D. Woldegiorgis, M. Kinfu, Y. et al. (2021). Risk factors for COVID-19 infection, disease severity and related deaths in Africa: a systematic review, *BMJ Open*;11:e 044618. doi:10.1136/bmjopen-2020-044618

Gil, S., Gualano, B., de Araújo, A.L. (2023). Post-acute sequelae of SARS-CoV-2 associates with physical inactivity in a cohort of COVID-19 survivors. *Scientific Reports*, 13, 215. https://doi.org/10.1038/s41598-022-26888-3

Goldman, L. (2020). Geriatric Assessment, Goldman-Cecil Medicine, 26th Edition, https://www.sciencedirect.com/topics/pharmacology-toxicology-and-pharmac eutical-science/functional-status

Heikkinen, K. (2017). Physical ability and strength training in physical education and health: A qualitative study of Swedish PEH teachers' views and practices of strength training as a way of developing their students' physical ability. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.diva-portal.org/smash/ get/ diva2:1115261/FULLTEXT01.pdf

Herman, T., Giladi, N., & Hausdorff, J. M. (2011). Properties of the 'timed up and go' test: more than meets the eye. Gerontology, 57(3), 203–210. https://doi.org/10.1159/000314963

Ilker, E., Sulaiman A. Musa, R. Sunusi, A. (2016): Comparison of Convenience Sampling and Purposive Sampling. American Journal of Theoretical and Applied Statistics. Vol. 5, No. 1, 2016, pp. 1-4. doi: 10.11648/j.ajtas.20160501.11

Jacobs, L. Paleoudis, E. Di Bari, D. Nyirenda, T. Friedman, T. Gupta, A. Rasouli, L. Zetkulic, M. Balani, B. Ogedegbe, C. Bawa, H. Berrol, L. Qureshi, N. Aschner, J. (2020). Persistence of symptoms and quality of life at 35 days after hospitalization for COVID-19 infection, *PLOS ONE*, 1-14. oi.org/10. 1371/journal.pone.0243882

Khan, A., Althunayyan, S., Alsofayan, Y., Alotaibi, R., Mubarak, A., Arafat, M., Assiri, A., & Jokhdar, H. (2020). Risk factors associated with worse outcomes in COVID-19: a retrospective study in Saudi Arabia. *Eastern Mediterranean health journal*, 26(11), 1371–1380. https://doi.org/10.26719/emhj.20.130

Khan, S. Shereen, M. Kazmi, A. Bashir, N. Siddique, R. (2020). COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses. *Journal of Advanced Research*. doi.org/10.1016/j.jare.202 0.03.005.

Klok, F. A., Boon, G. J. A. M., Barco, S., Endres, M., Geelhoed, J. J. M., Knauss, S., Rezek, S. A., Spruit, M. A., Vehreschild, J., & Siegerink, B. (2020). The Post-COVID-19 Functional Status scale: a tool to measure functional status over time after COVID-19. *The European respiratory journal*, 56(1), 2001494. https://doi.org/10.1183/13993003.01494-2020

Koc, H. C., Xiao, J., Liu, W., Li, Y., & Chen, G. (2022). Long COVID and its Management. *International journal of biological sciences*, 18(12), 4768–4780. https://doi.org/10.7150/ijbs.75056

Komici, K., Bencivenga, L., & Rengo, G. (2022). Editorial: Post COVID-19 physical performance and functional capacity. Frontiers in medicine, 9, 920645. https://doi.org/10.3389/fmed.2022.920645

Kronbichler, A. Kresse, D. Yoon, S. Lee, K. Effenberger, M. & Shin, J. (2021). Asymptomatic patients as a source of COVID-19 infections: A systematic review 348 and meta-analysis. *International Journal of Infectious Diseases*; 98, 180-186.

Ladds, E. Rushforth, A. Wieringa, S. Taylor, S. Rayner, S. Husain, L. & Greenhalgh, T. (2020). Persistent symptoms after Covid-19: qualitative study of 114 "long Covid" patients and draft quality principles for services, *BMC Health Services Research*; 20:1144. doi.org/10.1186/s12913-020-06001-y.

Lesser, I. A., & Nienhuis, C. P. (2020). The Impact of COVID-19 on Physical Activity Behavior and Well-Being of Canadians. *International Journal of Environmental Research and Public Health*, 17(11), 3899. MDPI AG. http://dx.doi.org/10.3390/ijerph17113899

Logue, J. Franko, N. McCulloch, D. McDonald, D. Magedson, A. Wolf, C. & Chu, H. (2021). Sequelae in Adults at 6 Months After COVID-19 Infection, *JAMA Network Open*;4 (2): e210830. doi:10.1001/jamanetworkopen.2021. 0830.

Lopez-Leon, S., Wegman-Ostrosky, T., Perelman, C., Sepulveda, R., Rebolledo, P. A., Cuapio, A., & Villapol, S. (2021). More than 50 Long-term effects of COVID-19: a systematic review and meta-analysis. *medRxiv : the preprint server for health sciences*, 2021.01.27.21250617. https://doi.org/10.1101/2021.01.27.21250617

Malm, C., Jakobsson, J., & Isaksson, A. (2019). Physical Activity and Sports-Real Health Benefits: A Review with Insight into the Public Health of Sweden. *Sports (Basel, Switzerland)*, 7(5), 127. https://doi.org/10.3390/sports7050127

Mikkelsen, M. E., Abramoff, M. B., & Elmore, J. G. (2022). COVID-19: Evaluation and management of adults with persistent symptoms following acute illness (" Long COVID"). UpToDate. Waltham, MA.

Nazario, B. (2022). Coronavirus and COVID-19: What You Should Know, https://www.webmd.com/covid/coronavirus#091e9c5e80d2648b-1-2

Osikomaiya, B. Erinoso, B. Ololade, K. Odusola, A. Thomas, B. Adeyemi, O. Bowale, A. Adejumo, O. Falana, A. salam, S. Ogboye, O. Osibogun, A. & Abayomi, A. (2021). 'Long COVID': persistent COVID-19 symptoms in survivors managed in Lagos State, Nigeria. *BMC Infectious Diseases (2021)*, 21:304. Doi.org/10.1186/s12879-020-05716-x

Park, A. H., Zhong, S., Yang, H., Jeong, J., & Lee, C. (2022). Impact of COVID-19 on physical activity: A rapid review. *Journal of global health*, 12, 05003. https://doi.org/10.7189/jogh.12.05003

Paterson, D. C., Ramage, K., Moore, S. A., Riazi, N., Tremblay, M. S., & Faulkner, G. (2021). Exploring the impact of COVID-19 on the movement behaviors of children and youth: A scoping review of evidence after the first year. *Journal of sport and health science*, 10(6), 675–689. https://doi.org/10.1016/j.jshs.2021.07. 001

Peñas, C. Ceña, D. Mayordomo, V. Cuadrado, M. & Florencio, L. (2021). Defining Post-COVID Symptoms (Post-Acute COVID, Long COVID, and Persistent Post-COVID): An Integrative Classification, *Intentional Journal Environ Res Public Health*.٢٦٢١ :(٥)١٨ . doi:10.3390/ijerph18052621.

Pera, M. C., Luigetti, M., Pane, M., Coratti, G., Forcina, N., Fanelli, L., Mazzone, E. S., Antonaci, L., Lapenta, L., Palermo, C., Ranalli, D., Granata, G., Lomonaco, M., Servidei, S., & Mercuri, E. (2017). 6MWT can identify type 3 SMA patients with neuromuscular junction dysfunction. Neuromuscular disorders: NMD, 27(10), 879–882. https://doi.org/10 .1016/j.nmd.2017.07.007

Phelan AL, Katz R, Gostin LO. 2020. The novel coronavirus originating in Wuhan, China: challenges for global health governance. *Journal of the American Medical Association*, 323(8):709–710 DOI 10.1001/jama.2020.1097.

Piggin, J. (2020). What Is Physical Activity? A Holistic Definition for Teachers, Researchers and Policy Makers. *Frontiers in sports and active living*, 2, 72. https://doi.org/10.3389/fspor.2020.00072

Pizarro-Pennarolli, C., Sánchez-Rojas, C., Torres-Castro, R., Vera-Uribe, R., Sanchez-Ramirez, D. C., Vasconcello-Castillo, L., Solís-Navarro, L., & Rivera-Lillo, G. (2021). Assessment of activities of daily living in patients post COVID-19: a systematic review. PeerJ, 9, e11026. https://doi.org/10.7717/peerj.11026

Plisky PJ, Rauh MJ, Kaminski TW, Underwood FB. (2006). Star excursion balance test as a predictor of lower extremity injury in high school basketball players. J Orthop Sports Phys Ther.;36(12):911-9.

Rashedi, J. Poor, B. Asgharzadeh, V. Pourostadi, M. Kafil, H. Vegari, A. Tayebi-Khosroshahi, H. & Asgharzadeh, M. (2020). Risk Factors for COVID-19. *Le infezioni in medicina*. 28. 469-474.

Said, C. M., Batchelor, F., & Duque, G. (2022). The Impact of the COVID-19 Pandemic on Physical Activity, Function, and Quality of Life. *Clinics in geriatric medicine*, 38(3), 519–531. https://doi.org/10.1016/j.cger.2022.04.003

Sanchez-Ramirez, D. C., Normand, K., Zhaoyun, Y., & Torres-Castro, R. (2021). Long-Term Impact of COVID-19: A Systematic Review of the Literature and Meta-Analysis. *Biomedicines*, 9(8), 900. https://doi.org/10.3390/biomedicines90 80900

Schrimpf, A., Braesigk, A., Lippmann, S., & Bleckwenn, M. (2022). Management and treatment of long COVID symptoms in general practices: An online-based survey. Frontiers in public health, 10, 937100. https://doi.org/10.3389/fpubh.2022.937100

Shah, M. D., Sumeh, A. S., Sheraz, M., Kavitha, M. S., Venmathi Maran, B. A., & Rodrigues, K. F. (2021). A mini-review on the impact of COVID 19 on vital organs. Biomedicine & Pharmacotherapy, 143, 112158. doi:10.1016/j.biopha .2021.112158

Shah, R., Ali, F. M., Nixon, S. J., Ingram, J. R., Salek, S. M., & Finlay, A. Y. (2021). Measuring the impact of COVID-19 on the quality of life of the survivors, partners and family members: a cross-sectional international online survey. *BMJ open*, 11(5), e047680. https://doi.org/10.1136/bmjopen-2020-047680

Shanbehzadeh, S., Zanjari, N., Yassin, M., Yassin, Z., & Tavahomi, M. (2023). Association between long COVID, functional activity, and health-related quality of life in older adults. *BMC geriatrics*, 23(1), 40. https://doi.org/10.1186/s12877-023-03757-w

Sheikhi, K. Shirzadfar, H. & Sheikhi, M. (2020). A Review on Novel Coronavirus (Covid-19): Symptoms, Transmission and Diagnosis Tests. 10.33702/ridtm.2020. 2.1.1.

Silva Andrade, B., Siqueira, S., de Assis Soares, W. R., de Souza Rangel, F., Santos, N. O., Dos Santos Freitas, A., Ribeiro da Silveira, P., Tiwari, S., Alzahrani, K. J., Góes-Neto, A., Azevedo, V., Ghosh, P., & Barh, D. (2021). Long-COVID and Post-COVID Health Complications: An Up-to-Date Review on Clinical Conditions and Their Possible Molecular Mechanisms. *Viruses*, 13(4), 700. https://doi.org/10.33 90/v13040700

Sirayder, U., Inal-Ince, D., Kepenek-Varol, B., & Acik, C. (2022). Long-term characteristics of severe COVID-19: respiratory function, functional capacity, and quality of life. *International Journal of Environmental Research and Public Health*, 19(10), 6304.

Sivan, M. Parkin, A. Makower, S. & Greenwood, D. (2021). Post-COVID Syndrome symptoms, functional disability and clinical severity phenotypes in hospitalized and non-hospitalized individuals: a cross-sectional evaluation from a community COVID rehabilitation service. *Journal of Medical Virology*. 94. 10.1002/jmv.27456

Skube, S. Lindemann, E. Akre, M. Wick, E. & Melton, G. (2018) Characterizing Functional Health Status of Surgical Patients in Clinical Notes. *AMIA JT Summits Transl sci Proc*. 379–388.

Smith, P., Proesmans, K., Van Cauteren, D., Demarest, S., Drieskens, S., De Pauw, R., Cornelissen, L., De Ridder, K., & Charafeddine, R. (2022). Post COVID-19 condition and its physical, mental and social implications: protocol of a 2-year longitudinal cohort study in the Belgian adult population. *Archives of public health*, 80(1), 151. https://doi.org/10.1186/s13690-022-00906-2

Stockwell, S., Trott, M., Tully, M., Shin, J., Barnett, Y., Butler, L., McDermott, D., Schuch, F., & Smith, L. (2021). Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: a systematic review. *BMJ open sport & exercise medicine*, 7(1), e000960. https://doi.org/10.11 36/bmjsem-2020-000960

Tabacof, L., Tosto-Mancuso, J., Wood, J., Cortes, M., Kontorovich, A., McCarthy, D., Rizk, D., Rozanski, G., Breyman, E., Nasr, L., Kellner, C., Herrera, J. E., & Putrino, D. (2022). Post-acute COVID-19 Syndrome Negatively Impacts Physical Function, Cognitive Function, Health-Related Quality of Life, and Participation. American journal of physical medicine & rehabilitation, 101(1), 48–52. https://doi.org/10.1097/PHM.0000000000001910

Tabaczynski, A., Bastas, D., Whitehorn, A., & Trinh, L. (2022). Changes in physical activity and associations with quality of life among a global sample of cancer survivors during the COVID-19 pandemic. Journal of cancer survivorship: research and practice, 1–11. *Advance online publication*. https://doi.org/10.1007/s11764-021-01156-x

Townsend, L. Dyer, A. Jones, K. Dunne, J. Mooney, A. Gaffney, F. O'brien, K. (2020). Persistent fatigue following SARS-CoV-2 infection is common and independent of severity of initial infection. *PLoS One*. 15, e0240784 (2020).

Watson, A., Haraldsdottir, K., Biese, K., Schwarz, A., Hetzel, S., Reardon, C., & McGuine, T. (2023). Impact of COVID-19 on the physical activity, quality of life and mental health of adolescent athletes: a 2-year evaluation of over 17 000 athletes. *British Journal of Sports Medicine*, 57(6), 359-363.

World Health Organization. Regional Office for the Western Pacific. (2020). Mental health and psychosocial support aspects of the COVID-19 response, http://iris.wpro.who.int/ handle/10665.1/14515

Yanover, C. Mizrahi, B. Kalkstein, N. Marcus, K. & Akiva, P. (2020). What Factors Increase the Risk of Complications in SARS-CoV-2–Infected Patients? A Cohort Study in a Nationwide Israeli Health Organization, *JMIR Public Health Surveill*. 6(3). Doi: 10.2196/20872.

Yanti, B., Asril, A. R.., & Hajar, S. (2022). The relationship between disease severity and functional status of post-covid-19 patients in Banda Aceh, Indonesia. *Journal Ners*, 17(2), 176–182. https://doi.org/10.20473/jn.v17i2.36170

Zeng, Z., Bian, Y., Cui, Y., Yang, D., Wang, Y., & Yu, C. (2020). Physical Activity Dimensions and Its Association with Risk of Diabetes in Middle and Older Aged Chinese People. *International journal of environmental research and public health*, 17(21), 7803. https://doi.org/10.3390/ijerph17217803

Zhao, Y., Shi, L., Jiang, Z., Zeng, N., Mei, H., Lu, Y., Yang, J., Jin, F., Ni, S., Wu, S., Su, S., Zheng, Y., Yuan, K., Yan, W., Sun, S., Meng, S., Sun, J., Khan, Z., Aarsland, D., Shi, J., … Lu, L. (2023). The phenotype and prediction of long-term physical, mental and cognitive COVID-19 sequelae 20 months after recovery, a community-based cohort study in China. Molecular psychiatry, 1–9. *Advance online publication*. https://doi.org/10.1038/s41380-023-01951-1.

Appendices

Appendix (1)

الجامعة العربية الأمريكية
ARAB AMERICAN UNIVERSITY

Dear Participants,

The researcher, who is currently enrolled in the Master Program in Physiotherapy at the Arab American University, Jenin Branch, is conducting a study entitled (Long term effect of COVID 19 on physical and functional abilities among COVID-19 Survivors).

The tests are designed to collect the necessary data. Information provided will help the researcher better assessing the Long term effect of COVID 19 on physical and functional abilities among COVID-19 Survivors. I ask you kindly to participate. It will take no more than five minutes to perform the tests. Your response will be kept strictly confidential. Only the researcher will have access to the information. The information will be only used for scientific research purposes. Thank you very much for your time and cooperation. I greatly appreciate your help in furthering this research endeavor.

Researcher,

Lina Sbaihat

حضرات الأعزاء،

تجري الباحثة المسجّلة حاليًا في برنامج ماجستير العلاج الطبيعي بالجامعة العربية الأمريكية فرع جنين دراسة بعنوان (التأثير طويل الأمد لـــ COVID 19 على القدرات البدنية والوظيفية لدى الناجين من كوفيد -١٩).

الاختبارات مصممة لجمع البيانات اللازمة. ستساعد المعلومات المقدمة الباحثة في تقييم التأثير طويل المدى لـــ COVID 19 على القدرات البدنية والوظيفية بين الناجين من COVID-19. أطلب منكم التفضل بالمشاركة. لن يستغرق إجراء الاختبارات أكثر من خمس دقائق. سيتم الاحتفاظ بإجاباتكم بسرية تامة. ستتمكن الباحثة فقط من الوصول إلى المعلومات. سيتم استخدام المعلومات فقط لأغراض البحث العلمي.

شكرا جزيلا علي وقتك وتعاونك. أنا أقدر بشدة مساعدتك في تعزيز هذا المشروع البحثي.

الباحثة،

لينا صبيحات

Section one: demographic data

Please answer the following questions:

Gender: .....

Age: .....

Weight: .....

Number of coronavirus infections: .....

Long-term symptomatic period: .....

القسم الأول: البيانات الديموغرافية

يرجى الإجابة على الأسئلة التالية:

الجنس:.....

العمر: .....

الوزن: .....

عدد الإصابات بكورونا:.....

فترة الأعراض طويلة المدى: .....

Second section: the paragraphs of the questionnaire

- **Physical abilities before infection with Covid 19**

Please indicate which of the following statements applies to you the most.Please check only one box at a time.		**scale degree**
I had no impairment in my daily life or symptoms of pain, depression, or insomnia.	□	0
I had a negligible disability in my daily life where I could perform all the usual tasks/activities.	□	1
I had a disability in my daily life where I sometimes needed to avoid or reduce usual tasks/activities or needed to spread them out over time due to symptoms, pain, depression, or insomnia. With it I was able to perform all the activities without any assistance.	□	2
I had a disability in my daily life and was not able to perform all usual tasks/activities. Despite this I was able to take care of myself without any help.	□	3
I had severe limitations in my daily life: I was unable to care for myself, and I was dependent on nursing care and/or assistance from another person.	□	4

القسم الثاني: فقرات الاستبانة

- **القدرات الجسمية ما قبل الإصابة ب كوفيد ١٩**

درجـــــة المقياس		**يرجى الإشارة إلى أي من العبارات التالية ينطبق عليك أكثر .** ****يرجى وضع علامة على مربع واحد فقط في كل مرة.**
صفر	□	لم يكن لدي أي إعاقة لحياتي اليومية أو أعراض ألم، اكتئاب، أو أرق.
١	□	كان لدي إعاقة لا تذكر في حياتي اليومية حيث كان يمكنني أداء جميع المهام/ الأنشطة المعتادة.
٢	□	كنت أعاني من إعاقة في حياتي اليومية حيث كنت أحتاج أحياناً لتجنب أو تقليل المهام/ الأنشـــطة المعتادة أو الحاجة لتوزيعها على مدار الزمن بســـبب أعراض، ألم، اكتئاب، أو أرق. مع ذلك كنت قادرا على أداء جميع الأنشـــطة دون أي مساعدة.

كنت أعاني من إعاقة في حياتي اليومية ولم أكن قادرا على أداء جميع المهام / الأنشطة المعتادة. وعلى الرغم من ذلك كنت قادراً على الاعتناء بنفسي دون أي مساعدة.	□	٣
كنت أعاني من قيود شديدة في حياتي اليومية: لم اكن قادرا على رعاية نفسي، وكنت معتمداً على الرعاية التمريضية و/ أو المساعدة من شخص آخر .	□	٤

- **Functional abilities before infection with Covid 19**

Please indicate which of the following numbers applies to you the most. Determine the degree of difficulty you were facing before the infection with Corona, from 0-4					
I previously had difficulty standing up from a seated position	0	1	2	3	4
I previously had trouble standing for 2 minutes without help	0	1	2	3	4
I previously had difficulty sitting up from a standing position	0	1	2	3	4
I previously had difficulty picking something up off the ground from a standing position	0	1	2	3	4
I previously had difficulty turning 360 degrees in a standing position	0	1	2	3	4
I previously had difficulty standing on one leg	0	1	2	3	4

القدرات الوظيفية ما قبل الإصابة ب كوفيد ١٩

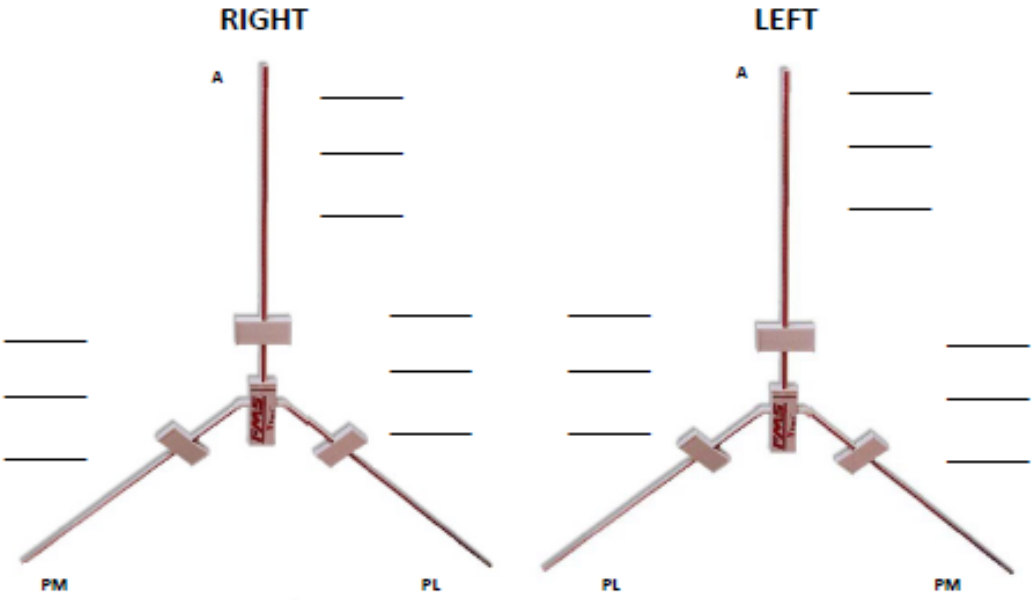
يرجى الإشارة إلى أي من الأرقام التالية ينطبق عليك أكثر . **حدد درجة الصعوبة التي كنت تواجهها ما قبل الإصابة بكورونا من ٠ – 4**					
كنت أواجه صعوبة في الوقوف من وضع الجلوس	٠	١	٢	٣	٤
كنت أواجه مشكلة في الوقوف لمدة دقيقتين بدون مساعدة	٠	١	٢	٣	٤
كنت أواجه صعوبة في الجلوس من وضع الوقوف	٠	١	٢	٣	٤
كنت أواجه صعوبة في التقاط شيء عن الأرض من وضع الوقوف	٠	١	٢	٣	٤
كنت أواجه صعوبة في الدوران ٣٦٠ درجة في وضع الوقوف	٠	١	٢	٣	٤
كنت أواجه صعوبة في الوقوف على رجل واحدة	٠	١	٢	٣	٤

Appendix (2)

Y-Balance Test – Score Sheet

St Luke's Sports Medicine

Right limb length in centimeters: _____
(Measure from right ASIS to right medial malleolus in supine after performing bilateral bridge)



Greatest Successful Reach

	Right	Left	Difference
Anterior (A)			
Posteromedial (PM)			
Posterolateral (PL)			

Composite Score

Right	
Left	

$$\frac{\text{(Anterior + Posteromedial + Posterolateral)}}{\text{3 x Right Limb Length}} \times 100$$

Appendix (3)

Timed Up and Go Test

Instruction Protocol

Components

1. Getting up from chair
2. Walking 3 metres
3. Turning
4. Walking 3 metres (return)
5. Sitting down

---

1. Patient is seated with back against the chair, arms resting on the arms of the chair and walking aid (if required) at hand.

2. The test is explained to the patient – "When I ask you to start, I would like you to get up out of this chair and walk (with your stick/frame) at a comfortable and safe pace to the mark on the floor 3 metres away. Cross the line, turn round and return to the chair and sit down again."

3. Ask the patient to repeat what you have asked them to do.

4. Tell the patient to start.

5. Timing starts from the moment the patient is asked to start.

6. Timing stops when the patient is fully seated

The patient should perform the test twice – one practice and the test following sufficient rest. Use a stopwatch for the test and where possible standardise the seat height for use consistently with the test (17 – 19 inches) If using in the patients own home, for continuity use the chair the patient sits in most of the time.

Older adults who take longer than 14 seconds to complete the test, or who appear unsteady have a high risk for falls. These individuals should have an assessment of their risk factors; see assessment protocol.

Patient Score:	_____Seconds	Chair height:	_____inches

_____

Appendix (4)

3 Step Test

3 MINUTE STEP TEST

The "3-Minute Step Test" is designed to measure your aerobic fitness. It assesses your fitness level based on how quickly your heart rate recovers after exercise. The more aerobically fit you are, the quicker your heart rate will return to normal after exercise. To improve your score, engage in cardiovascular exercise regularly. Cardiovascular exercise is any type of exercise that increases your heart rate and requires your lungs to take in more oxygen.

RESULTS:_____

MALE	Age		
Fitness Category	18-25	26-35	36-45
Excellent	<79	<81	<83
Good	79-89	81-89	83-96
Above Average	90-99	90-99	97-103
Average	100-105	100-107	104-112
Below Average	106-116	108-118	113-119
Poor	117-128	118-128	120-130
Very Poor	>128	>128	>130

FEMALE	Age		
Fitness Category	18-25	26-35	36-45
Excellent	<85	<88	<90
Good	85-98	88-99	90-102
Above Average	99-108	100-111	103-110
Average	109-117	112-119	111-118
Below Average	118-126	120-126	119-128
Poor	127-140	127-138	129-140
Very Poor	>140	>138	>140

الملخص

قد يستمر كوفيد-١٩ في إلحاق الضرر بشكل كبير بنتائج المرضى لأكثر من ١٢ أسبوعًا بعيدًا عن مرحلة العدوى الشديدة، وذلك وفقاً للأدلة. ومن غير الواضح حتى الآن كيف سيؤثر كوفيد-١٩ على نتائج المرضى على المدى الطويل. كان الهدف من هذه الدراسة هو النظر في كيفية تغير القدرات البدنية والوظيفية للناجين من كوفيد-١٩ بمرور الوقت.

تم استخدام النهج المختلط في هذه الدراسة؛ وتم اتباع أسلوب البحث الكمي حيث استخدم الباحث استبيانًا تم ملؤه من قبل الباحثين، كما تم استخدام النهج المقطعي حيث استخدم الباحث اختبارين تم تطبيقهما على أفراد العينة. شملت الدراسة (١٥٠) مريضًا بكورونا مسجلين في إحصاءات كورونا في فلسطين تتراوح أعمارهم بين ٢٠-٤٥ عامًا، والذين أصيبوا لمدة ٦ أشهر على الأقل أو أكثر. تم استخدام ثلاثة اختبارات بما في ذلك اختبار توازن Y للربع السفلي، واختبار(Timed Up and Go "TUG")، واختبار ٣ Step.

أظهرت النتائج أن التأثيرات طويلة المدى على المرضى المصابين سابقًا بـ COVID-19 أثرت على قدراتهم البدنية والوظيفية. تم العثور على فروق في القدرات الوظيفية بين الناجين من COVID-19 حسب متغير العمر لصالح الأفراد الأصغر سنًا. تم العثور على فروق في التأثير طويل المدى لـ COVID-19 على القدرات البدنية بين الناجين من COVID-19 حسب متغير الجنس لصالح الذكور. وتم العثور على فروق في القدرات الوظيفية تبعاً لمغير الوزن لصالح الأفراد ذوي الوزن الخفيف.

تبين النتائج ضرورة إجراء أبحاث إضافية للمساعدة في تحديد الأفراد الذين قد يستفيدون من المراقبة الدقيقة وإعادة التأهيل المركزة والذين هم أكثر عرضة للعواقب طويلة المدى، وتحديد درجة تأثيرات ما بعد COVID-19 التي تستمر لأكثر من ستة أشهر، وكذلك لتوضيح أصولها والحلول العملية لإدارة المرض.

أوصت الدراسة بإمكانية دمج برامج إعادة التأهيل في إطار العلاج بعد الإصابة بكوفيد-١٩ من أجل تقليل تأثيره على الحالة البدنية والوظيفية، كما أن مقاييس النتائج المستخدمة في هذه الدراسة موثوقة ويمكن استخدامها من قبل الباحثين وأخصائيي العلاج الطبيعي لقياس التأثير

الطويل الأمد لكوفيد-١٩ على القدرات البدنية والوظيفية للناجين، كما أن التشـــخيص والرعاية المبكرة والمناسبة ضرورية لكبار السن المتعافين بعد الإصابة بكوفيد-١٩.

الكلمات المفتاحية: كوفيد-١٩، القدرات البدنية، القدرات الوظيفية.