Annals of Case Reports
Altuwayjiri RS, et al. Ann Case Rep: 8: 1385
www.doi.org/10.29011/2574-7754.101385
www.gavinpublishers.com

Research Article

Memory Loss and Trouble Concentrating Associated With Long Covid

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Citation: Altuwayjiri RS, Aldhali RM, Alowss HM, Alrobaish SA, Al-Sowayan NS (2023) Memory Loss and Trouble Concentrating Associated With Long Covid. Ann Case Report 8: 1385. DOI: 10.29011/2574-7754.101385

Received Date: 24 July 2023, **Accepted Date:** 28 July 2023, **Published Date:** 31 July 2023

Abstract

Background and aims: "Long COVID" which is also known as "Post-COVID syndrome" refers to the occurrence of numerous symptoms in weeks or months after contracting covid-19 infection. The aim of this study is to investigate the effects of concentration and memory among females of specific ages recovered from covid-19 for three different periods. **Methods:** Data were collected from a sample size of 60 volunteers aged (18-28), 30 people who recovered from COVID-19 within two to three weeks, one to two months, and six to seven months, respectively were considered as an experimental group. And 30 people who were not infected with the Corona virus were selected as a control group. They were tested to measure the level of concentration and memory they had for all volunteers. **Results:** Our results are consistent with the most common complaints related to cognitive problems after recovery from COVID-19. Our results indicated that the neurological consequences of COVID-19 such as memory impairment and poor concentration could be persisted for 6 months even after recovery from COVID-19. **Conclusion:** Long COVID is a most important health issue. Therefore, it is very important to monitor the recovered patients from covid-19. Similarly, persistence of symptoms, their improvement, research on persistent neurological symptoms and other symptoms associated with long-covid-19 should be monitored in order to develop appropriate therapeutic approaches to all of these.

Keywords: Post-Acute COVID; Chronic COVID; Neurological Symptoms; Brain Fog; Microglial Cells; Cytokine Storm (CS); Blood–Brain Barrier (BBB)

Introduction

Coronavirus is a very dangerous virus, which causes different severe infections such as MERS (Middle East Respiratory Syndrome), SARS (Severe Acute Respiratory Syndrome) and common cold [1]. It has been a while since the coronavirus disease -2019 (Covid-19) prevalent, and people were in general worried by its risk of death when the pandemic started. After a while, people realized the psychological and social consequences of the pandemic [2]. The symptoms of (Covid-19) like fever, coughing, shortness of breath were know by all of us, while a variation was seen in the symptoms of shortness of breath from mild to moderate, and some of the infected needed medical treatment1. Recovery from mild SARS 2 infection usually takes 7-10 days after symptoms appear in mild state while in severe cases; 3 to 6 weeks are taken by the infected person [3]. However, some recovered patients reported new problems [4]. Furthermore, a considerable proportion of patients who have been recovered from COVID-19 still have one or more continued symptoms or develop persistent new symptoms, even weeks or months ago; this is referred to "long COVID".

The term "long COVID" means the presence of a wide range of symptoms for a long period of time after developing SARS-CoV-2 infection, independent of viral status. "Post-COVID syndrome" or "Long Haulers" are their others synonyms. It could be ongoing or recurrent and intermittent. It's possible that one or more acute COVID signs and symptoms will continue, or may be new symptoms will be occurred. The majority of patients with post-COVID Syndrome are PCR negative, indicating that their microbiological health has improved. The phase between microbiological and clinical healing is referred to as post COVID syndrome. The majority of COVID patients have recovered biochemically and radiologically. Post COVID is split into two stages based on the length of symptoms: post-acute COVID (symptoms lasting more than 3 weeks but less than 12 weeks) and chronic COVID (symptoms lasting more than 12 weeks) [3] (Figure1).

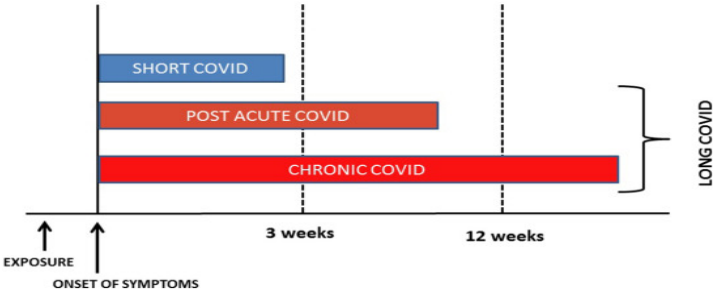

Figure 1: Classification of long COVID.

Deep weariness, cough, chest pain, palpitations, headache, joint pain, myalgia and weakness, insomnia, pins and needles, diarrhea, rash or hair loss, impaired balance and gait, and neurocognitive disorders such as memory and concentration impairments and worsened quality of life are all common symptoms of "Long COVID". One or more indications may be existed in patients with "long COVID." The five most prevalent symptoms of Long COVID-19, as stated by a recent meta-analysis, were fatigue (58%), headache (44%), attention disorder (27%), hair loss (25%), and dyspnea (24%) [3].

The brain has been linked to coronavirus illness in several studies (COVID-19) [5]. There is powerful evidence for brain-associated pathologies; most of them may be an outcome of viral neurotropism or virus-induced neuroinflammation, including the neurological and cognitive deficits demonstrated by patients [6].

In addition, some studies indicated that many patients suffered from persistent neurological symptoms such as dysexecutive syndrome 1 or cognitive slowdown 'brain fog' [5], The impact of COVID-19 on the brain and the likely presence of the coronavirus in the central nervous system have been demonstrated by radiological and post mortem tissue investigations [6]. In the current study, we investigated the memory loss and trouble concentrating in patients who have recovered from the COVID-19.

Materials and Methods

Participants

In this study, data were collected from those people who recovered from COVID-19. The people were of different ages who recovered in different time frame. Along with this, data were also collected from healthy volunteers in order to make a possible comparison between the infected and healthy people.

The ages ranged between (18-28), and periods of recovery were ranged between (two weeks to three weeks), (one month to two months) and (six months to seven months), A positive result on real-time polymerase chain reaction (PCR) testing confirmed the COVID19 diagnosis in all individuals.

Data collection

All samples were collected in the Kingdom of Saudi Arabia (Al-Qassim). Data were collected in one week, whereas the study was limited only to women, with informed consent obtained.

Other collected data included: the gender, age and the date of the confirmed infection examination. The samples were dedicated to female and the age ranged between (18-28), The sample size was 60 volunteers, 30 of whom were infected with Coronavirus (experimental group), where 10 of them spent a recovery period ranging between two to three weeks, other 10 of them had a recovery period ranging from one to two months, and while the last 10 of them got a recovery period of six to seven months. In case of control group, 30 volunteers were chosen. The recovered were asked about symptoms after their recovery. Loss of concentration and memory were the few symptoms reported by some of the recovered person [7].

Testing

Two tests are included in this study, 1- Measuring the level of memory, 2- Measuring the level of concentration. The volunteers were asked to perform both tests and the results were obtained within one week.

1-memory test: It is a program designed to test the level of memory power in a person (https://www.tathwir.com/p/m.html)

How to perform a memory test: It consists of gray squares, and within these squares there are two copies of each flag from the flags of some countries and peoples, these flags are placed randomly in fixed locations, and each flag appears and disappears after clicking on one of the gray squares according to the following rule. 1- Each flag appears and hides after Clicking on another if another flag that contradicts it appears. 2 - The notification boxes disappear

permanently when two copies of the flags are revealed with two successive clicks. What is required is to reveal all copies of the media in the fewest number of clicks possible, by making sure to remember the locations of the media well when they are appeared and disappeared successively (Figure 2).

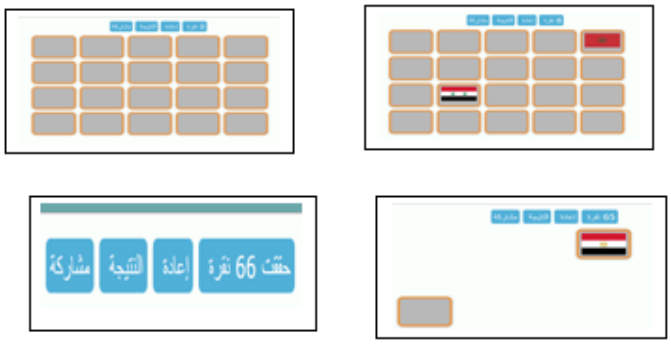

Figure 2: Memory Test

2- Concentration test

A program designed to measure the level of concentration (http://zzzscore.com/1to50/en/?ts=1) , where the numbers from 1 to 50 appear on the screen randomly and the volunteer answers to choose the numbers in order from 1 to 50, as it depends on the time the volunteer takes (Figure 3).

Figure 3: Concentration Test.

Statistical analysis

The mean +/- standard error of the mean was used to express the data. IBM SPSS Statistics for Windows, version 23 was used to analyze the data (IBM SPSS, IBM Corp., Armonk, N.Y., USA). To assess normal data distribution, the Shapiro– Wilk test was performed. Because the data were normally distributed, a one-way ANOVA test followed by a Tukey's test was employed to examine significant differences between the two groups. P-values of <0.05 were considered statistically significant

Results

Memory test was significantly prolonged in recovery 1-2 months and recovery 6-7 months groups versus control group (P <0.010 for both) (Table 1 and Figure 4).

Groups	Memory test
Control	38.20±2.74
Recovered 2-3 weeks	43.90±8.60
Recovered 1-2 months	55.40±14.49**
Recovered 6-7 months	55.50±11.80**
Data expressed as mean +/- standard error of mean. *; Significance versus control. **: P <0.010.	

Table 1: Memory test in different studied groups.

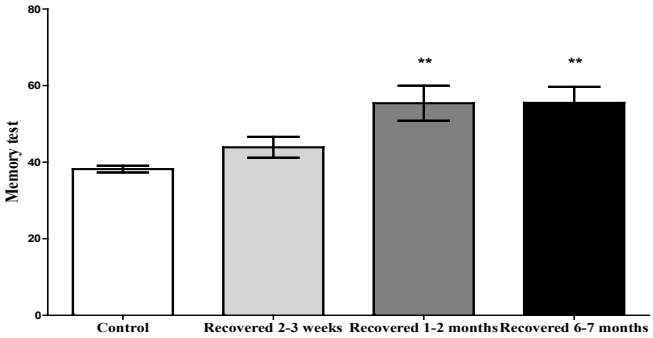

Figure 4: Memory test in different studied groups. Data expressed as mean +/- error of mean. *; Significance versus control. **P<0.010.

Concentration test was significantly prolonged in recovery 2-3 weeks, recovered 1-2 months and recovery 6-7 months groups versus control (P <0.001 for all) (Table 2 and Figure 5).

Groups	Concentration test
Control	59.60±5.71
Recovered 2-3 weeks	99.54±25.56***
Recovered 1-2 months	100.39±9.82***
Recovered 6-7 months	113.84±29.78***
Data expressed as mean +/- error of mean. *; Significance versus control. ***: P <0.001.	

Table 2: Concentration test in different studied groups.

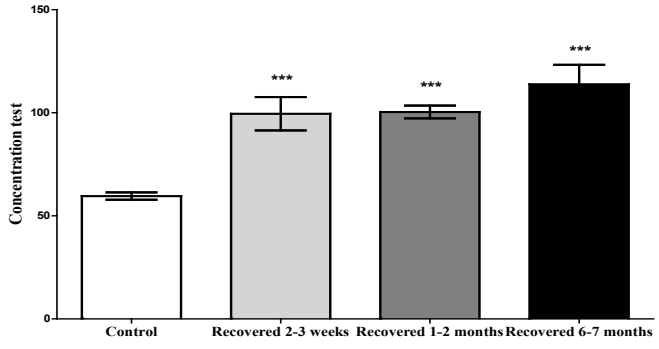

Figure 5: Concentration test in different studied groups. Data expressed as mean +/- error of mean. *; Significance versus control. ***P

Discussion

Our results are consistent with the most common complaints related to cognitive problems after COVID-19, including poor concentration and memory consistent in patients after recovery [8].

There were statistically significant changes between the recovery time of one to two months and the recovery group for 6-7 months vs the control group, according to the memory test findings ($P < 0.010$ for both). As the results of the volunteers indicated the effect of their memory after recovery in these periods, unlike the period of Recovery from 2-3 weeks, where no significant differences were observed compared to the control group, which indicates that the memory was not affected in this period after recovery in the volunteers

The findings of the concentration test revealed statistically significant differences across all recovery periods of 2-3 weeks, one to two months, and six to seven months compared to the control groups ($P<0.001$ for all). Over all recovery times ranging from two weeks to six months, in comparison to the control group.

A previous study showed that slow improvement was observed after a period of 6 months after recovery, but it was pronounced that recovery period was not fixed, female gender, increasing age and poor health, were known as characteristics and predictions for the continuous infection of long COVID-19. In addition, the frequency of COVID-19-related chronic neurological symptoms was linked to different races and countries. In one study, the neurological symptoms lasted for 12 months, when the patients were over 50 years old [9], and in another study, the effect of Covid 19 negatively affected memory even 8 months, when the patients were suffering from poor health [10]. An online poll done 7 months following COVID-19 infection in the UK and the US found that 85.1 percent of responders had brain fog; furthermore, cognitive disorder and memory impairments have been reported in 72.8% of respondents [9]. Despite the fact that an instantaneous effect of the virus persisting within the brain cannot be ruled out, proof from studies suggests that there's very little virus inside the brain in COVID-19 sufferers however, we've identified a widespread percentage instances of acute altered in mental status, which include neurological syndrome diagnoses, encephalopathy ,encephalitis [11] other neurological findings encompass headache, myalgia, rhabdomyolysis, Guillain-Barre syndrome [12] and disruption inside the Blood–Brain Barrier(BBB) caused by inflammation [9].

The virus's ability to trigger a huge inflammatory response known as a "Cytokine Storm"(CS) was proposed as a possible mechanism for the virus's effect on the brain and its link to long-term effects. The immune system is a remarkable system that can combat a wide range of ailments. The activation of the immune system's inflammatory pathways is required for a normal antiviral immune response; however, an abnormal or exaggerated immune response by the host can result in severe illness if left uncontrolled. Cytokines are important components of the inflammatory response. Several immune cells are used to make cytokines. During an innate immune response to a viral infection, Pattern Recognition Receptors (PRRs) recognize one-of-a-kind molecular systems that are specific to the invading virus. Molecular patterns associated to Pathogens Are Those Molecular Systems (PAMPs) The inflammatory response to the virus begins when PAMPs bind to PRRs. As a result, various signaling pathways are activated, as well as transcription factors that work as stimulators for the expression of genes that produce many proteins involved in the host immunological response to the virus, among these are genes that code for a variety of pro-cytokines. The key transcription factors activated by PRRs in inflammation are activation protein 1, nuclear factor-kB, and antiviral response factors three and seven. These transcription factors activate inflammatory cytokine genes. IL-1, TNF-, and IL-6 are the three most prominent pro-inflammatory cytokines in the innate immune response. A "cytokine storm" is defined as a quick increase in the levels of numerous pro-inflammatory cytokines such as IL-6, IL-1, TNF-, and interferon [13]. This increase causes a lot of immune cells to flow with devastating effects on tissues such as disruption of the Blood-Brain Barrier (BBB) caused by inflammation, this leads to increased entry of cytokines into the central nervous system [9] and this neuroinflammation cause oxidative stress and microglial cells activation and this contributes to affect cognitive and functional functions and delirium The long-term [9,14,15].

Our study was based on age ranging (18-28) of the female sex for three different periods of recovery up to 6-7 months. We may need to take longer recovery periods to confirm and know the extent of the continuity of symptoms for this age to expand the scope of the study.

Conclusion

Long COVID is a most important health issue affecting the general population worldwide, and long-term persistent symptoms have come in various forms. According to our findings, COVID-19 has been linked to chronic neurological problems following recovery. Our findings show the COVID-19's neurological effects, such as memory loss and decreased concentration, can last up to 6 months after recovery. Those recovering from covid-19 must be continuously followed, with researchers expanding study on chronic neurological issues and other symptoms associated with long-covid-19, and develop therapeutic approaches to this.

References

1. Coronavirus. Accessed May 7, 2022.
2. Asadi-Pooya AA, Akbari A, Emami A, Lotfi M, Rostamihosseinkhani M, et al. (2022) Long COVID syndrome-associated brain fog. Journal of Medical Virology 94: 979-984.
3. Raveendran AV, Jayadevan R, Sashidharan S (2021) Long COVID: An overview. Diabetes and Metabolic Syndrome: Clinical Research and Reviews 15: 869-875.
4. Ahmad S, Singh S, Wasim S, Anwar M, Shukla G, et al. (2021) Brain Fog and Neurological Aspects of COVID-19: A Review. Advances in Medical, Dental and Health Sciences 4: 1-7.
5. Nauen DW, Hooper JE, Stewart CM, Solomon IH (2021) Assessing Brain Capillaries in Coronavirus Disease 2019. JAMA Neurology 78: 760-762.
6. Douaud G, Lee S, Alfaro-Almagro F, Arthofer C, Wang C, et al. (2022) SARS-CoV-2 is associated with changes in brain structure in UK Biobank. Nature. 604: 697-707.
7. Guo P, Benito Ballesteros A, Yeung SP, Liu R, Saha A, et al. (2022) COVCOG 2: Cognitive and Memory Deficits in Long COVID: A Second Publication From the COVID and Cognition Study. Frontiers in Aging Neuroscience 14: 804937.
8. Zhao S, Shibata K, Hellyer PJ, Trender W, Manohar S, et al. (2022) Rapid vigilance and episodic memory decrements in COVID-19 survivors. Brain Communications. 4: fcab295.
9. Kim Y, Bitna-Ha, Kim SW, Chang H-H, Kwon KT, et al. (2022) Post-acute COVID-19 syndrome in patients after 12 months from COVID-19 infection in Korea. BMC Infectious Diseases 22: 93.
10. Søraas A, Bø R, Kalleberg KT, Støer NC, Ellingjord-Dale M, et al. (2021) Self-reported Memory Problems 8 Months after COVID-19 Infection. JAMA Network Open 4: e2118717.
11. Varatharaj A, Thomas N, Ellul MA, Davies NW, Pollak TA, et al. (2020) Neurological and neuropsychiatric complications of COVID-19 in 153 patients: a UK-wide surveillance study. The Lancet Psychiatry 7: 875-882.
12. Mukerji SS, Solomon IH (2021) What can we learn from brain autopsies in COVID-19? Neuroscience Letters 742: 135528.
13. Ragab D, Salah Eldin H, Taeimah M, Khattab R, Salem R (2020) The COVID-19 Cytokine Storm; What We Know So Far. Frontiers in Immunology 11: 1446.
14. Poletti S, Palladini M, Mazza MG, Lorenzo RD, Furlan R, et al. (2021) Long-term consequences of COVID-19 on cognitive functioning up to 6 months after discharge: role of depression and impact on quality of life. European Archives of Psychiatry and Clinical Neuroscience. 272: 773-782.
15. MS Ahmad, RA Shaik, RK Ahmed, WKZ Alghuyaythat, Almutairi SB, et al (2021) "LONG COVID": an insight. European Review for Medical and Pharmacological Sciences. Published online 2021:5561-5577.