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**Physical activity and mental well-being during COVID-19 pandemic**

Abdelbasset WK *et al*. Physical activity and mental health during COVID-19

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**Abstract**

The COVID-19 pandemic has resulted in most nations deciding upon self-isolation and social distancing policies for their citizens to control the pandemic and reduce hospital admission.This review aimed at evaluating the effect of physical activity on mental well-being during the COVID-19 pandemic. It was concluded that the COVID-19 pandemic may lead to augmented levels of angiotensin-converting enzyme (ACE)-2 that led to cardiovascular and neurological disorders associated with highly inflammatory effects of viral infection affecting the brain tissues leading to damage of the nervous system and resulting in cognition dysfunction, insulin sensitivity reduction, and behavioral impairments. Anxiety and depression may lead to negative effects on various quality of life domains, such as being physically inactive. Regular physical activities may reduce inflammatory responses, improve ACE-2 responses, and improve mental well-being during self-isolation and social distancing policies related to the COVID-19 pandemic. Further studies should be conducted to assess the different intensities of physical activities on cardiovascular function, and mental well-being during the COVID-19 pandemic.

**Key Words:** COVID-19; Physical activity; Mental well-being; Pandemic; Angiotensin-converting enzyme-2

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**Core Tip:** The COVID-19 pandemic has resulted in most nations deciding upon self-isolation and social distancing policies for their citizens to control the pandemic and reduce hospital admission. This review aimed at evaluating the effect of physical activity on mental well-being during the COVID-19 pandemic. COVID-19 may lead to cardiovascular and neurological disorders associated with inflammatory effects of viral infection affecting brain tissues, leading to nervous system damage and cognitive dysfunction, insulin sensitivity reduction, and behavioral impairments. Regular physical activities may reduce inflammatory responses, improve angiotensin-converting enzyme-2 responses, and mental well-being during self-isolation and social distancing.

**INTRODUCTION**

The COVID-19 pandemic caused by the novel coronavirus SARS-CoV-2 appeared in China in 2019[1]. The infection probably resulted from a usual assortment of animal hosts prior to zoonotic spread that affected populations worldwide and caused thousands of deaths[2]. Through a cellular membrane receptor known as angiotensin-converting enzyme-2, SARS-C0V-2 influences host cells, affects lungs with insufficient oxygen supply, and accordingly may affect cardiac and brain tissues[3]. With the rapid progress of COVID-19, most nations decided upon self-isolation and social distancing policies for their citizens and residents to control the pandemic and reduce hospital admission, with a recommendation of self-isolation and social distancing to successfully control the pandemic outbreak[4].

At this time, it is important for all populations to understand the local characteristics of COVID-19 transmission and social distancing policy as the transmission of COVID-19 is predicted to occur up to 2024, and intermittent or extended social distancing may be continued to 2022 and will cause major lifestyle changes among people worldwide[5]. Therefore, it is doubtful during these policies that individuals can continue their sedentary behaviors to maintain their healthy condition[6]. Government policies of social isolation and distancing during the COVID-19 pandemic can increase disturbance of mental health, including anxiety and depression[7]. Figure 1 presents the negative effects of the COVID-19 pandemic on physical activity and mental health.

Nutritional deprivation may affect cognitive status and lead to mood disorders[8]. Poor physical activity levels during COVID-19 quarantine can also lead to sedentary behaviors that could lead to the development of chronic cardiovascular, metabolic and mood disorders[9,10]. Several studies have reported that regular physical activity and exercise training are considered effective nonpharmacological interventions in several chronic disorders[9].

**MENTAL HEALTH AND COMMUNITY**

Generally, the development and prevalence of mental health impairments are associated with social and physical determinants[11]. Community service integration may promote awareness of mental well-being, reduce discrimination and stigma, support social recovery, and prevent mental dysfunction[12,13].

International guidelines accentuate community care for mental well-being and the World Health Organization also has suggested stipulations of integrated and comprehensive social care for mental well-being, including prevention and interventional protocols in the community incorporating the perceptions of families and service providers[14]. It is reported that individuals with psychological impairment should be encouraged to live without assistance among populations[15].

**NEUROLOGICAL MANIFESTATIONS RELATED TO COVID-19**

Brain tissues may be affected by viral infection due to infected nerve cells through infected vascular endothelium, or leukocyte migration into the brain circulation[16]. Although headache and anosmia are the major prevalent neurological disorders related to COVID-19, neurophysiological impairments have been documented, including encephalopathy, seizures, consciousness impairment, and stroke[17,18].

It was reported that approximately 36% of COVID-19 patients suffered from neurological symptoms such as impaired consciousness and cerebrovascular disorders associated with inflammatory effects of viral infection[19]. This inflammation may affect the brain tissues leading to damage of the nervous system and cognitive dysfunction, insulin sensitivity reduction, and behavioral impairments[20]. Also, these inflammatory reactions associated with viral infection may develop primitive neurological manifestations[21].

Due to impaired neural plasticity, the initial fatality of nerve cells, and disturbed neurotransmitter production, psychoses, impaired memory, and post-traumatic stress disorders may occur with COVID-19[22]. In addition, angiotensin-converting enzyme (ACE)-2 is expressed with COVID-19 in several brain areas, such as the olfactory system, striatum, and cortex, and on various types of nerve cells such as astrocytes, microglia, neurons, and oligodendrocytes[23]. The primary projected mechanism that affects the function of the nervous system is ACE-2 activation associated with COVID-19 through augmentation of inflammatory responses[20,23].

**PHYSICAL ACTIVITY AND MENTAL HEALTH**

A recent cross-sectional study found that individuals who conducted a regular physical exercise for one month had good life satisfaction during quarantine, while the individuals who stayed at home and without physical exercise suffered from poor health conditions[24]. It was also reported that isolation and social distancing related to COVID-19 led to a greater incidence of anxiety and depression[25]. Accordingly, these reports suggest that individuals who conducted physical exercise during COVID-19 should be regularly observed as they may be particularly irritated by self-isolation. Therefore, exercise training for a long time does not indicate good mental well-being, but it may be a predictor of developing mood disorders[25].

It can be assumed that overtraining or prolonged exercise training may lead to pessimistic health conditions such as mood disorders[20]. The quarantine associated with COVID-19 may increase the development of a sedentary lifestyle among different populations including adolescents[26]. Regular exercise training improves immune function, lowers the severity of symptoms, and reduces the mortality rate in individuals exposed to viral infection[10]. Conducting physical activity or sports during the COVID-19 pandemic may provide a complementary and alternative treatment to develop mental well-being[27].

It is documented that COVID-19 may be associated with neurotropism, neuroinvasion, and neuroinflammation that could clearly affect the outcomes of mental well-being including acute myelitis, cerebrovascular disorders, encephalitis, and encephalopathy[28]. Several exercise training programs and different laboratory investigations should be conducted to assess the influence of exercise training on COVID-19 and how it prevents disturbances of mental well-being. Regrettably, studies that suggest or explain the ideal exercise protocol conducted during the COVID-19 pandemic and its influence on mental and cardiovascular well-being are limited, and therefore the relationship between exercise training, cardiovascular function, and mental well-being should be investigated.

Anxiety and depression are the most frequent mental disorders, with varied incidence rates among different ages, including adults, adolescents, children, and particularly aged individuals[29]. It is reported that anxiety and depression may lead to negative effects on various quality of life domains, such as being physically inactive[30]. The pathophysiology of anxiety and depression is still not clearly explained, and an abundance of biomarkers have been recommended to identify the sequences and development of mental disorders[30,31].

Recent studies have proved that adherence to physical activities and exercise training programs during COVID-19 quarantine is associated with better mental health and lower anxiety and depression levels. However, poor physical activity levels are associated with higher levels of anxiety and depression in addition to poor mental health and well-being[32-40] (Table 1).

Exercise training and physical activity have been suggested as nonpharmacological interventions to eliminate the complications associated with self-isolation and social distancing during the COVID-19 pandemic [27]. The effects of different exercise programs are not being clearly investigated during the COVID-19 pandemic. Physical activity may improve mental well-being and protect against the undesirable impacts of COVID-19. Regular physical activities should be encouraged to improve mental well-being during the COVID-19 pandemic[32-40]. Figure 2 shows the positive effects of regular physical activity on physical and mental well-being.

**CONCLUSION**

The COVID-19 pandemic may lead to augmented levels of ACE-2 that led to cardiovascular and neurological disorders associated with inflammatory effects of viral infection, affecting the brain tissues and leading to damage to the nervous system and cognitive dysfunction, insulin sensitivity reduction, and behavioral impairments. Anxiety and depression may lead to negative effects on various quality of life domains, such as being physically inactive. Regular physical activities may reduce inflammatory responses, improve ACE-2 responses and mental well-being during self-isolation and social distancing related to the COVID-19 pandemic. Further studies should be conducted to assess the different intensities of physical activities on cardiovascular function, and mental well-being during the COVID-19 pandemic.

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**Figure Legends**

Diagram

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**Figure 1 Negative effects of COVID-19 pandemic on physical and mental well-being.**

**Diagram

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**Figure 2 Positive effects of regular physical activity on physical and mental well-being.**

**Table 1 Physical activity and mental health during COVID-19 pandemic**

|  |  |  |
| --- | --- | --- |
| **Refs** | **Measures** | **Findings** **and** **recommendations** |
| Wright *et al*[32], 2021 | Incidence of fear, physical activity, and mental well-being indicators questionnaires | Physical activity may improve mental well-being and protect against the undesirable impacts of COVID-19. Regular physical activities should be encouraged to improve mental well-being during COVID-19 pandemic. |
| Xiao *et al*[33], 2021 | Lifestyle and home environment, physical and mental well-being, and occupational environment questionnaires | Significant reduction in physical and mental well-being including impaired physical activity, increased junk food intake, and absence of coworker communications |
| Faulkner *et al*[34], 2021 | Short form of IPAQ, WHO-5 well-being index, and depression, anxiety and stress scale-9 | Negative changes in physical activity before COVID-19 containment policies presented poor mental well-being, while positive physical activity behavior showed better mental well-being |
| Meyer *et al*[35], 2020 | Self-reported physical activity, anxiety and depression status, social connection, loneliness, and stress | Adherence to physical activity contributions and restrictive screening time during unexpected societal alterations may alleviate the consequences of mental well-being |
| Carriedo *et al*[36], 2020 | International Physical activity questionnaire (IPAQ), 6-item self-report scale of depression symptoms, Connor-Davidson CD-RISC resilience scale, and positive and negative affect schedule | Regular moderate or vigorous physical activity provide positive resilience and reduce depression symptoms during COVID-19 quarantine |
| Maugeri *et al*[37], 2020 | IPAQ and psychological general well-being index | Reduced physical activity have a greatly undesirable effects on psychological status and mental well-being. Adherence to a regular physical activity program is the main approach for improving physical and mental well-being during COVID-19 confinement. |
| López-Bueno *et al*[38], 2020 | Short form of physical activity vital sign and single-item question for mood and anxiety | Adherence to regular physical activities associated with better mood and lower anxiety with WHO recommendations during COVID-19 quarantine |
| Duncan *et al*[39], 2020 | Online survey on perceived changes in physical activity due to COVID-19 mitigation and mental well-being using 10-item perceived stress scale and 6-item anxiety subscale | COVID-19 mitigation policies may affect physical activity and mental well-being. Participants with reduced physical activity levels showed higher anxiety and stress levels. |
| Jacob *et al*[40], 2020 | Self-reported physical activity questionnaire, Beck anxiety and depression inventories, and 7-item short Warwick-Edinburgh mental well-being scale | During COVID-19 social distancing, participants adherent to vigorous and moderate physical activity showed better mental well-being |



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