

# World Journal of *Psychiatry*

*World J Psychiatr* 2021 December 19; 11(12): 1167-1424



**EVIDENCE REVIEW**

- 1167 Child abuse and psychopathy: Interplay, gender differences and biological correlates  
*di Giacomo E, Santorelli M, Pessina R, Rucco D, Placenti V, Aliberti F, Colmegna F, Clerici M*

**REVIEW**

- 1177 Polyamines and polyamine-metabolizing enzymes in schizophrenia: Current knowledge and concepts of therapy  
*Bernstein HG, Keilhoff G, Laube G, Dobrowolny H, Steiner J*
- 1191 Nuclear receptors modulate inflammasomes in the pathophysiology and treatment of major depressive disorder  
*Wang H, Kan WJ, Feng Y, Feng L, Yang Y, Chen P, Xu JJ, Si TM, Zhang L, Wang G, Du J*
- 1206 Review of barriers and interventions to promote treatment engagement for pediatric attention deficit hyperactivity disorder care  
*Baweja R, Soutullo CA, Waxmonsky JG*

**MINIREVIEWS**

- 1228 Newer antipsychotics: Brexpiprazole, cariprazine, and lumateperone: A pledge or another unkept promise?  
*Barman R, Majumder P, Doifode T, Kablinger A*
- 1239 E-technology social support programs for autistic children: Can they work?  
*Wall NG, Smith O, Campbell LE, Loughland C, Wallis M, Henskens F, Schall U*
- 1247 Factors related to compliance with the COVID-19 health regulations among young people  
*Jaureguizar J, Redondo I, Galende N, Ozamiz N*
- 1259 Mechanism of olfactory deficit in neurotrauma and its related affective distress: A narrative review  
*Logan M, Kapoor S, Peterson L, Oliveira M, Han DY*
- 1267 Physical activity and mental well-being during COVID-19 pandemic  
*Abdelbasset WK, Nambi G, Eid MM, Elkholi SM*

**ORIGINAL ARTICLE****Basic Study**

- 1274 Differential aberrant connectivity of precuneus and anterior insula may underpin the diagnosis of schizophrenia and mood disorders  
*Aryutova K, Paunova R, Kandilarova S, Stoyanova K, Maes MH, Stoyanov D*

- 1288 Validity and reliability of the Dutch version of the displaced aggression questionnaire

*Smeijers D, Denson TF, Bulten EH, Brazil IA*

#### Case Control Study

- 1301 BDNF methylation and mRNA expression in brain and blood of completed suicides in Slovenia

*Ropret S, Kouter K, Zupanc T, Videtic Paska A*

- 1314 Developing a nomogram for predicting the depression of senior citizens living alone while focusing on perceived social support

*Byeon H*

#### Retrospective Study

- 1328 Affect regulation in psychoanalytic treatments of patients with a borderline personality disorder—psychoanalysis and psychodynamic psychotherapy—a comparison

*Steinmair D, Wong G, Frantal S, Rohm C, Löffler-Stastka H*

#### Observational Study

- 1346 Impact of lockdown relaxation and implementation of the face-covering policy on mental health: A United Kingdom COVID-19 study

*Rathod S, Pallikadavath S, Graves E, Rahman MM, Brooks A, Soomro MG, Rathod P, Phiri P*

#### SYSTEMATIC REVIEWS

- 1366 Autism spectrum disorder and personality disorders: Comorbidity and differential diagnosis

*Rinaldi C, Attanasio M, Valenti M, Mazza M, Keller R*

- 1387 Psychological impact of the COVID-19 pandemic on individuals with serious mental disorders: A systematic review of the literature

*Fleischmann E, Dalkner N, Fellendorf FT, Reininghaus EZ*

- 1407 Psychoeducation in bipolar disorder: A systematic review

*Rabelo JL, Cruz BF, Ferreira JDR, Viana BM, Barbosa IG*

**ABOUT COVER**

Editorial Board Member of *World Journal of Psychiatry*, Subho Chakrabarti, MD, FRCP, FAMS, Professor, Department of Psychiatry, Postgraduate Institute of Medical Education and Research, Chandigarh 16002, India. [chakrabarti.subho@pgimer.edu.in](mailto:chakrabarti.subho@pgimer.edu.in)

**AIMS AND SCOPE**

The primary aim of *World Journal of Psychiatry (WJP, World J Psychiatr)* is to provide scholars and readers from various fields of psychiatry with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

*WJP* mainly publishes articles reporting research results and findings obtained in the field of psychiatry and covering a wide range of topics including adolescent psychiatry, biological psychiatry, child psychiatry, community psychiatry, ethnopsychology, psychoanalysis, psychosomatic medicine, etc.

**INDEXING/ABSTRACTING**

The *WJP* is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Current Contents/Clinical Medicine, Journal Citation Reports/Science Edition, PubMed, and PubMed Central. The 2021 edition of Journal Citation Reports® cites the 2020 impact factor (IF) for *WJP* as 4.571; IF without journal self cites: 4.429; 5-year IF: 7.697; Journal Citation Indicator: 0.73; Ranking: 46 among 156 journals in psychiatry; and Quartile category: Q2.

**RESPONSIBLE EDITORS FOR THIS ISSUE**

Production Editor: *Xu Guo*; Production Department Director: *Yu-Jie Ma*; Editorial Office Director: *Jia-Ping Yan*.

**NAME OF JOURNAL**

*World Journal of Psychiatry*

**ISSN**

ISSN 2220-3206 (online)

**LAUNCH DATE**

December 31, 2011

**FREQUENCY**

Monthly

**EDITORS-IN-CHIEF**

Rajesh R Tampi

**EDITORIAL BOARD MEMBERS**

<https://www.wjgnet.com/2220-3206/editorialboard.htm>

**PUBLICATION DATE**

December 19, 2021

**COPYRIGHT**

© 2021 Baishideng Publishing Group Inc

**INSTRUCTIONS TO AUTHORS**

<https://www.wjgnet.com/bpg/gerinfo/204>

**GUIDELINES FOR ETHICS DOCUMENTS**

<https://www.wjgnet.com/bpg/GerInfo/287>

**GUIDELINES FOR NON-NATIVE SPEAKERS OF ENGLISH**

<https://www.wjgnet.com/bpg/gerinfo/240>

**PUBLICATION ETHICS**

<https://www.wjgnet.com/bpg/GerInfo/288>

**PUBLICATION MISCONDUCT**

<https://www.wjgnet.com/bpg/gerinfo/208>

**ARTICLE PROCESSING CHARGE**

<https://www.wjgnet.com/bpg/gerinfo/242>

**STEPS FOR SUBMITTING MANUSCRIPTS**

<https://www.wjgnet.com/bpg/GerInfo/239>

**ONLINE SUBMISSION**

<https://www.f6publishing.com>

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

Walid Kamal Abdelbasset, Gopal Nambi, Marwa M Eid, Safaa M Elkhohi

**ORCID number:** Walid Kamal Abdelbasset 0000-0003-4703-661X; Gopal Nambi 0000-0002-4203-5506; Marwa M Eid 0000-0002-2703-6033; Safaa M Elkhohi 0000-0002-1100-4301.

**Author contributions:** All authors conceptualized, designed the study, and wrote the first draft of the manuscript; Abdelbasset WK managed and supervised the literature searches; all authors reviewed and agreed to submit the final version of the manuscript.

**Conflict-of-interest statement:** No competing interests to disclose.

**Supported by** the Deanship of Scientific Research at Princess Nourah bint Abdulrahman University through the Fast-track Research Funding Program.

**Country/Territory of origin:** Saudi Arabia

**Specialty type:** Psychiatry

**Provenance and peer review:** Invited article; Externally peer reviewed.

**Peer-review model:** Single blind

**Peer-review report's scientific quality classification**

Grade A (Excellent): 0  
Grade B (Very good): 0  
Grade C (Good): C  
Grade D (Fair): 0  
Grade E (Poor): 0

**Walid Kamal Abdelbasset, Gopal Nambi,** Department of Health and Rehabilitation Sciences, College of Applied Medical Science, Prince Sattam Bin Abdulaziz University, Al-Kharj 11942, Riyadh, Saudi Arabia

**Walid Kamal Abdelbasset,** Department of Physical Therapy, Kasr Al-Aini Hospital, Cairo University, Giza 12613, Egypt

**Marwa M Eid,** Department of Physical Therapy, College of Applied Medical Sciences, Taif University, Taif 26571, Saudi Arabia

**Safaa M Elkhohi,** Department of Rehabilitation Sciences, Faculty of Health and Rehabilitation Sciences, Princess Nourah bint Abdulrahman University, Riyadh 11564, Saudi Arabia

**Corresponding author:** Walid Kamal Abdelbasset, PhD, Academic Research, Associate Professor, Department of Health and Rehabilitation Sciences, College of Applied Medical Science, Prince Sattam bin Abdulaziz University, 1 University District, Al-Kharj 11942, Riyadh, Saudi Arabia. [walidkamal.wr@gmail.com](mailto:walidkamal.wr@gmail.com)

### Abstract

The corona virus disease 2019 (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

©The Author(s) 2021. Published by Baishideng Publishing Group Inc. All rights reserved.

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

**Received:** April 1, 2021

**Peer-review started:** April 1, 2021

**First decision:** June 17, 2021

**Revised:** June 27, 2021

**Accepted:** September 22, 2021

**Article in press:** September 22, 2021

**Published online:** December 19, 2021

**P-Reviewer:** Mukherjee M

**S-Editor:** Wang LL

**L-Editor:** Kerr C

**P-Editor:** Li JH



**Core Tip:** The corona virus disease 2019 (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.

**Citation:** Abdelbasset WK, Nambi G, Eid MM, Elkhohi SM. Physical activity and mental well-being during COVID-19 pandemic. *World J Psychiatr* 2021; 11(12): 1267-1273

**URL:** <https://www.wjgnet.com/2220-3206/full/v11/i12/1267.htm>

**DOI:** <https://dx.doi.org/10.5498/wjp.v11.i12.1267>

## INTRODUCTION

The corona virus disease 2019 (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-COV-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].

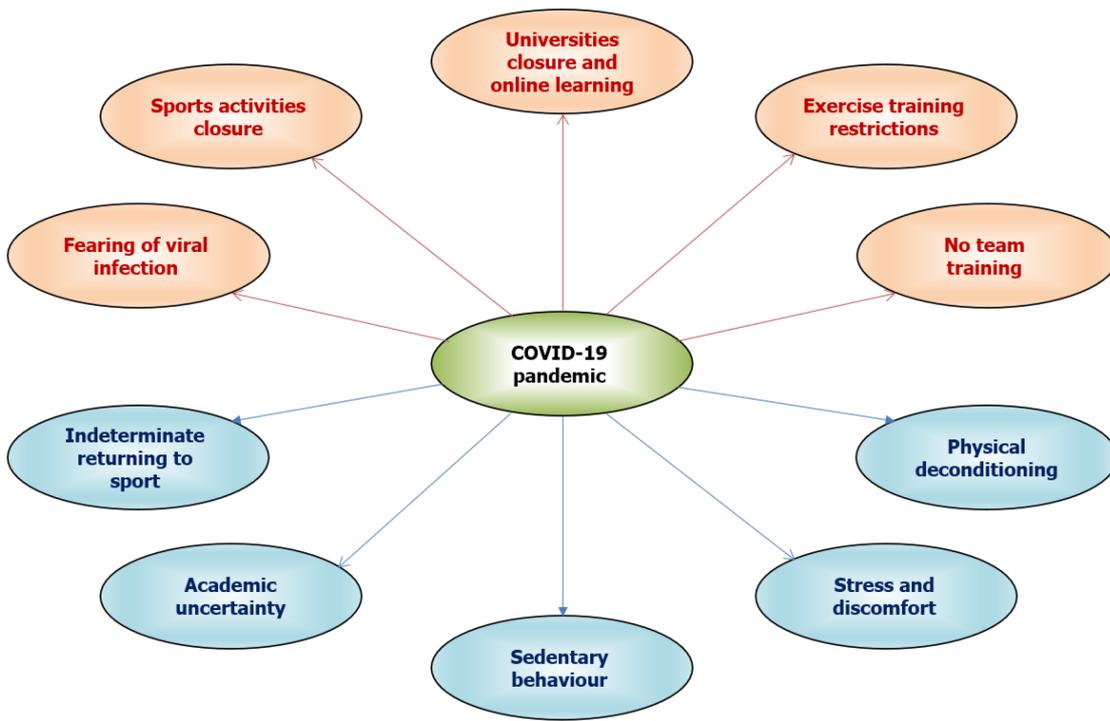


Figure 1 Negative effects of COVID-19 pandemic on physical and mental well-being.

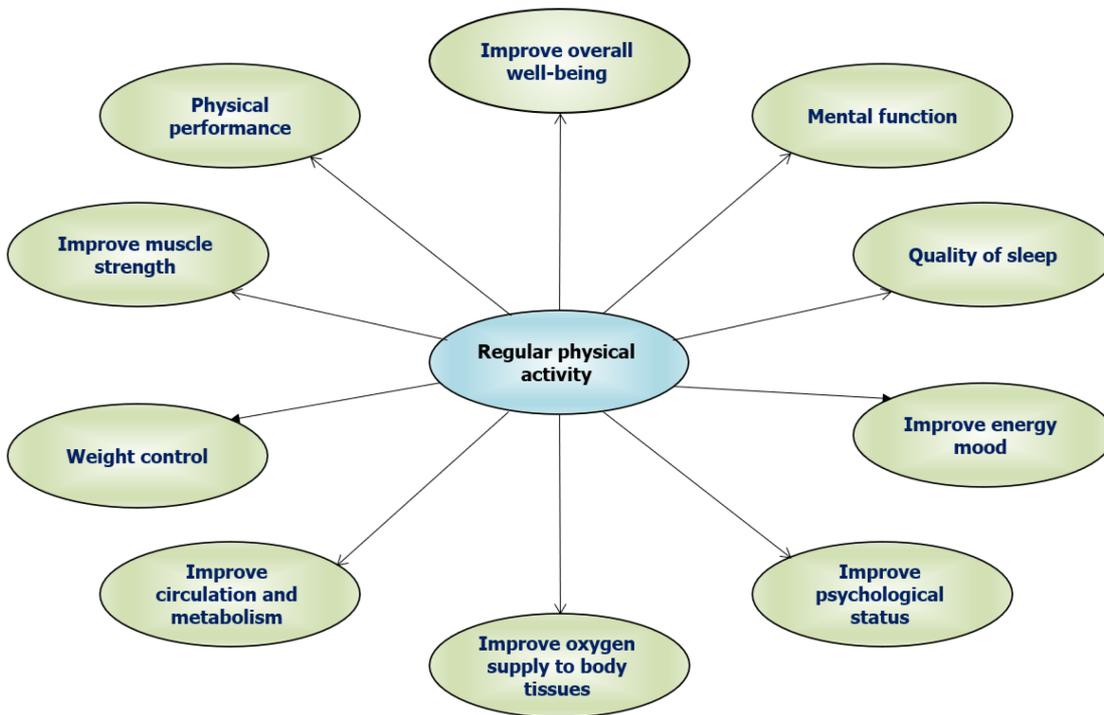


Figure 2 Positive effects of regular physical activity on physical and mental well-being.

## 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].

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

Refs	Measures	Findings and recommendations
Wright <i>et al</i> [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 <i>et al</i> [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 <i>et al</i> [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 <i>et al</i> [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 <i>et al</i> [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 <i>et al</i> [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 <i>et al</i> [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 <i>et al</i> [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 <i>et al</i> [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

COVID-19: Corona virus disease 2019.

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.

---

## REFERENCES

- 1 **van Doremalen N**, Bushmaker T, Morris DH, Holbrook MG, Gamble A, Williamson BN, Tamin A, Harcourt JL, Thornburg NJ, Gerber SI, Lloyd-Smith JO, de Wit E, Munster VJ. Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1. *N Engl J Med* 2020; **382**: 1564-1567 [PMID: 32182409 DOI: 10.1056/NEJMc2004973]
- 2 **Andersen KG**, Rambaut A, Lipkin WI, Holmes EC, Garry RF. The proximal origin of SARS-CoV-2. *Nat Med* 2020; **26**: 450-452 [PMID: 32284615 DOI: 10.1038/s41591-020-0820-9]
- 3 **Libby P**. The Heart in COVID-19: Primary Target or Secondary Bystander? *JACC Basic Transl Sci* 2020; **5**: 537-542 [PMID: 32292847 DOI: 10.1016/j.jacbts.2020.04.001]
- 4 **Kucharski AJ**, Klepac P, Conlan AJK, Kissler SM, Tang ML, Fry H, Gog JR, Edmunds WJ;

- CMMID COVID-19 working group. Effectiveness of isolation, testing, contact tracing, and physical distancing on reducing transmission of SARS-CoV-2 in different settings: a mathematical modelling study. *Lancet Infect Dis* 2020; **20**: 1151-1160 [PMID: 32559451 DOI: 10.1016/S1473-3099(20)30457-6]
- 5 **Kissler SM**, Tedijanto C, Goldstein E, Grad YH, Lipsitch M. Projecting the transmission dynamics of SARS-CoV-2 through the postpandemic period. *Science* 2020; **368**: 860-868 [PMID: 32291278 DOI: 10.1126/science.abb5793]
  - 6 **Hall G**, Laddu DR, Phillips SA, Lavie CJ, Arena R. A tale of two pandemics: How will COVID-19 and global trends in physical inactivity and sedentary behavior affect one another? *Prog Cardiovasc Dis* 2021; **64**: 108-110 [PMID: 32277997 DOI: 10.1016/j.pcad.2020.04.005]
  - 7 **Abdelbasset WK**. Stay Home: Role of Physical Exercise Training in Elderly Individuals' Ability to Face the COVID-19 Infection. *J Immunol Res* 2020; **2020**: 8375096 [PMID: 33354578 DOI: 10.1155/2020/8375096]
  - 8 **Sousa RAL**, Freitas DA, Leite HR. Cross-talk between obesity and central nervous system: role in cognitive function. *Interv Obes Diabetes* 2019; **3**: 7-9 [DOI: 10.31031/iobd.2019.03.000551]
  - 9 **Pedersen BK**, Saltin B. Exercise as medicine - evidence for prescribing exercise as therapy in 26 different chronic diseases. *Scand J Med Sci Sports* 2015; **25** Suppl 3: 1-72 [PMID: 26606383 DOI: 10.1111/sms.12581]
  - 10 **Abdelbasset WK**, Alqahtani BA, Alrawaili SM, Ahmed AS, Elnegamy TE, Ibrahim AA, Soliman GS. Similar effects of low to moderate-intensity exercise program vs moderate-intensity continuous exercise program on depressive disorder in heart failure patients: A 12-week randomized controlled trial. *Medicine (Baltimore)* 2019; **98**: e16820 [PMID: 31393414 DOI: 10.1097/MD.00000000000016820]
  - 11 **Sederer LI**. The Social Determinants of Mental Health. *Psychiatr Serv* 2016; **67**: 234-235 [PMID: 26522677 DOI: 10.1176/appi.ps.201500232]
  - 12 **Jorm AF**. Mental health literacy: empowering the community to take action for better mental health. *Am Psychol* 2012; **67**: 231-243 [PMID: 22040221 DOI: 10.1037/a0025957]
  - 13 **Evans-Lacko S**, Corker E, Williams P, Henderson C, Thornicroft G. Effect of the Time to Change anti-stigma campaign on trends in mental-illness-related public stigma among the English population in 2003-13: an analysis of survey data. *Lancet Psychiatry* 2014; **1**: 121-128 [PMID: 26360575 DOI: 10.1016/S2215-0366(14)70243-3]
  - 14 **Saxena S**, Funk M, Chisholm D. WHO's Mental Health Action Plan 2013-2020: what can psychiatrists do to facilitate its implementation? *World Psychiatry* 2014; **13**: 107-109 [PMID: 24890053 DOI: 10.1002/wps.20141]
  - 15 **Kohrt BA**, Asher L, Bhardwaj A, Fazel M, Jordans MJD, Mutamba BB, Nadkarni A, Pedersen GA, Singla DR, Patel V. The Role of Communities in Mental Health Care in Low- and Middle-Income Countries: A Meta-Review of Components and Competencies. *Int J Environ Res Public Health* 2018; **15** [PMID: 29914185 DOI: 10.3390/ijerph15061279]
  - 16 **Zubair AS**, McAlpine LS, Gardin T, Farhadian S, Kuruvilla DE, Spudich S. Neuropathogenesis and Neurologic Manifestations of the Coronaviruses in the Age of Coronavirus Disease 2019: A Review. *JAMA Neurol* 2020; **77**: 1018-1027 [PMID: 32469387 DOI: 10.1001/jamaneurol.2020.2065]
  - 17 **Vaira LA**, Salzano G, Deiana G, De Riu G. Anosmia and Ageusia: Common Findings in COVID-19 Patients. *Laryngoscope* 2020; **130**: 1787 [PMID: 32237238 DOI: 10.1002/lary.28692]
  - 18 **Orozco-Hernández JP**, Marin-Medina DS, Sánchez-Duque JA. [Neurological manifestations of SARS-CoV-2 infection]. *Semergen* 2020; **46** Suppl 1: 106-108 [PMID: 32439269 DOI: 10.1016/j.semerg.2020.05.004]
  - 19 **Mao L**, Jin H, Wang M, Hu Y, Chen S, He Q, Chang J, Hong C, Zhou Y, Wang D, Miao X, Li Y, Hu B. Neurologic Manifestations of Hospitalized Patients With Coronavirus Disease 2019 in Wuhan, China. *JAMA Neurol* 2020; **77**: 683-690 [PMID: 32275288 DOI: 10.1001/jamaneurol.2020.1127]
  - 20 **De Sousa RAL**, Improtá-Caria AC, Aras-Júnior R, de Oliveira EM, Soci ÚPR, Cassilhas RC. Physical exercise effects on the brain during COVID-19 pandemic: links between mental and cardiovascular health. *Neurol Sci* 2021; **42**: 1325-1334 [PMID: 33492565 DOI: 10.1007/s10072-021-05082-9]
  - 21 **Karwowski MP**, Nelson JM, Staples JE, Fischer M, Fleming-Dutra KE, Villanueva J, Powers AM, Mead P, Honein MA, Moore CA, Rasmussen SA. Zika Virus Disease: A CDC Update for Pediatric Health Care Providers. *Pediatrics* 2016; **137** [PMID: 27009036 DOI: 10.1542/peds.2016-0621]
  - 22 **Huarcaya-Victoria J**, Meneses-Saco A, Luna-Cuadros MA. Psychotic symptoms in COVID-19 infection: A case series from Lima, Peru. *Psychiatry Res* 2020; **293**: 113378 [PMID: 32805590 DOI: 10.1016/j.psychres.2020.113378]
  - 23 **Chen R**, Wang K, Yu J, Howard D, French L, Chen Z, Wen C, Xu Z. The Spatial and Cell-Type Distribution of SARS-CoV-2 Receptor ACE2 in the Human and Mouse Brains. *Front Neurol* 2020; **11**: 573095 [PMID: 33551947 DOI: 10.3389/fneur.2020.573095]
  - 24 **Zhang SX**, Wang Y, Rauch A, Wei F. Unprecedented disruption of lives and work: Health, distress and life satisfaction of working adults in China one month into the COVID-19 outbreak. *Psychiatry Res* 2020; **288**: 112958 [PMID: 32283450 DOI: 10.1016/j.psychres.2020.112958]
  - 25 **Pearson GS**. The Mental Health Implications of COVID-19. *J Am Psychiatr Nurses Assoc* 2020; **26**: 443-444 [PMID: 32815433 DOI: 10.1177/1078390320949563]
  - 26 **Lam K**, Lee JH, Cheng P, Ajani Z, Salem MM, Sangha N. Pediatric stroke associated with a sedentary lifestyle during the SARS-CoV-2 (COVID-19) pandemic: a case report on a 17-year-old.

- Neurol Sci* 2021; **42**: 21-23 [PMID: 33113054 DOI: 10.1007/s10072-020-04857-w]
- 27 **Jiménez-Pavón D**, Carbonell-Baeza A, Lavie CJ. Physical exercise as therapy to fight against the mental and physical consequences of COVID-19 quarantine: Special focus in older people. *Prog Cardiovasc Dis* 2020; **63**: 386-388 [PMID: 32220590 DOI: 10.1016/j.pcad.2020.03.009]
  - 28 **Yachou Y**, El Idrissi A, Belapasov V, Ait Benali S. Neuroinvasion, neurotropic, and neuroinflammatory events of SARS-CoV-2: understanding the neurological manifestations in COVID-19 patients. *Neurol Sci* 2020; **41**: 2657-2669 [PMID: 32725449 DOI: 10.1007/s10072-020-04575-3]
  - 29 **World Health Organization**. Depression and other common mental disorders: Global Health Estimates. World Health Organization 2017. [cited 20 February 2021]. Available from: <https://apps.who.int/iris/handle/10665/254610>
  - 30 **Vancini RL**, Rayes ABR, Lira CAB, Sarro KJ, Andrade MS. Pilates and aerobic training improve levels of depression, anxiety and quality of life in overweight and obese individuals. *Arq Neuropsiquiatr* 2017; **75**: 850-857 [PMID: 29236887 DOI: 10.1590/0004-282X20170149]
  - 31 **Strawbridge R**, Young AH, Cleare AJ. Biomarkers for depression: recent insights, current challenges and future prospects. *Neuropsychiatr Dis Treat* 2017; **13**: 1245-1262 [PMID: 28546750 DOI: 10.2147/NDT.S114542]
  - 32 **Wright LJ**, Williams SE, Veldhuijzen van Zanten JJCS. Physical Activity Protects Against the Negative Impact of Coronavirus Fear on Adolescent Mental Health and Well-Being During the COVID-19 Pandemic. *Front Psychol* 2021; **12**: 580511 [PMID: 33776827 DOI: 10.3389/fpsyg.2021.580511]
  - 33 **Xiao Y**, Becerik-Gerber B, Lucas G, Roll SC. Impacts of Working From Home During COVID-19 Pandemic on Physical and Mental Well-Being of Office Workstation Users. *J Occup Environ Med* 2021; **63**: 181-190 [PMID: 33234875 DOI: 10.1097/JOM.0000000000002097]
  - 34 **Faulkner J**, O'Brien WJ, McGrane B, Wadsworth D, Batten J, Askew CD, Badenhorst C, Byrd E, Coulter M, Draper N, Elliot C, Fryer S, Hamlin MJ, Jakeman J, Mackintosh KA, McNarry MA, Mitchelmore A, Murphy J, Ryan-Stewart H, Saynor Z, Schaumberg M, Stone K, Stoner L, Stuart B, Lambrick D. Physical activity, mental health and well-being of adults during initial COVID-19 containment strategies: A multi-country cross-sectional analysis. *J Sci Med Sport* 2021; **24**: 320-326 [PMID: 33341382 DOI: 10.1016/j.jsams.2020.11.016]
  - 35 **Meyer J**, McDowell C, Lansing J, Brower C, Smith L, Tully M, Herring M. Changes in Physical Activity and Sedentary Behavior in Response to COVID-19 and Their Associations with Mental Health in 3052 US Adults. *Int J Environ Res Public Health* 2020; **17** [PMID: 32899495 DOI: 10.3390/ijerph17186469]
  - 36 **Carriero A**, Cecchini JA, Fernandez-Rio J, Méndez-Giménez A. COVID-19, Psychological Well-being and Physical Activity Levels in Older Adults During the Nationwide Lockdown in Spain. *Am J Geriatr Psychiatry* 2020; **28**: 1146-1155 [PMID: 32919872 DOI: 10.1016/j.jagp.2020.08.007]
  - 37 **Maugeri G**, Castrogiovanni P, Battaglia G, Pippi R, D'Agata V, Palma A, Di Rosa M, Musumeci G. The impact of physical activity on psychological health during Covid-19 pandemic in Italy. *Heliyon* 2020; **6**: e04315 [PMID: 32613133 DOI: 10.1016/j.heliyon.2020.e04315]
  - 38 **López-Bueno R**, Calatayud J, Ezzatvar Y, Casajús JA, Smith L, Andersen LL, López-Sánchez GF. Association Between Current Physical Activity and Current Perceived Anxiety and Mood in the Initial Phase of COVID-19 Confinement. *Front Psychiatry* 2020; **11**: 729 [PMID: 32793013 DOI: 10.3389/fpsyg.2020.00729]
  - 39 **Duncan GE**, Avery AR, Seto E, Tsang S. Perceived change in physical activity levels and mental health during COVID-19: Findings among adult twin pairs. *PLoS One* 2020; **15**: e0237695 [PMID: 32790745 DOI: 10.1371/journal.pone.0237695]
  - 40 **Jacob L**, Tully MA, Barnett Y, Lopez-Sanchez GF, Butler L, Schuch F, López-Bueno R, McDermott D, Firth J, Grabovac I, Yakkundi A, Armstrong N, Young T, Smith L. The relationship between physical activity and mental health in a sample of the UK public: A cross-sectional study during the implementation of COVID-19 social distancing measures. *Ment Health Phys Act* 2020; **19**: 100345 [PMID: 32834833 DOI: 10.1016/j.mhpa.2020.100345]



Published by **Baishideng Publishing Group Inc**  
7041 Koll Center Parkway, Suite 160, Pleasanton, CA 94566, USA

**Telephone:** +1-925-3991568

**E-mail:** [bpgoffice@wjgnet.com](mailto:bpgoffice@wjgnet.com)

**Help Desk:** <https://www.f6publishing.com/helpdesk>

<https://www.wjgnet.com>

