

Mental Health and Physical Activity during and after the COVID-19 Pandemic: A Review Salud mental y actividad física durante y después de la pandemia de COVID-19: una revisión

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Abstract. Globally, the COVID-19 pandemic has had a significant effect on people's mental health and levels of physical activity. The purpose of this review paper is to investigate the relationship between physical activity and mental health both during and after the pandemic. It gives an overview of the challenges faced by people during and after the pandemic, the effects on mental health, and how exercise helps to counteract the negative effects. Additionally, it covers possible tactics, strategies, and interventions to encourage physical exercise and mental health after the pandemic. The results emphasize how critical it is to treat mental health issues and encourage physical activity as vital elements of overall well-being in the face of adversity. It also emphasizes the integration of mental health and physical activity into public health policies and healthcare systems. By prioritizing mental health support and promoting physical activity, individuals can better cope with the challenges posed by the pandemic and emerge stronger in its aftermath.

Keywords: COVID-19, pandemic, mental health, physical activity, psychological well-being, public health, intervention.

Resumen. A nivel mundial, la pandemia de COVID-19 ha tenido un efecto significativo en la salud mental y los niveles de actividad física de las personas. El propósito de este artículo de revisión es investigar la relación entre la actividad física y la salud mental durante y después de la pandemia. Ofrece una visión general de los desafíos que enfrentan las personas durante y después de la pandemia, los efectos en la salud mental y cómo el ejercicio ayuda a contrarrestar los efectos negativos. Además, cubre posibles tácticas, estrategias e intervenciones para fomentar el ejercicio físico y la salud mental después de la pandemia. Los resultados enfatizan lo fundamental que es tratar los problemas de salud mental y fomentar la actividad física como elementos vitales del bienestar general ante la adversidad. También enfatiza la integración de la salud mental y la actividad física en las políticas de salud pública y los sistemas de salud. Al priorizar el apoyo a la salud mental y promover la actividad física, las personas pueden afrontar mejor los desafíos que plantea la pandemia y salir más fuertes después de ella.

Palabras clave: COVID-19, pandemia, salud mental, actividad física, bienestar psicológico, salud pública, intervención.

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Introduction

Globally, the COVID-19 pandemic has had a negative impact on mental health in addition to posing a serious threat to physical health. The enforced lockdowns, social isolation, fear of infection, and economic uncertainties have contributed to increased stress, anxiety, depression, and other mental health issues. Simultaneously, restrictions on movement and the closure of recreational facilities have disrupted individuals' regular physical activity routines. Okuyama et al., (2021) highlighted that children and adolescent experienced considerable psychological impacts due to restrictions imposed during the pandemic. They found that physical activity was correlated with improved psychological health in this population. Martínez-Lorca et al., (2023) indicated that the health students showed a higher level of positive effect on emotions and psychological distress compared to social science students. De Sousa et al., (2021) discussed the effects of physical exercise on mental health during the COVID-19 pandemic. They highlighted how physical exercise can improve psychological status by enhancing various molecular mechanisms. Violant-Holz et al., (2020) reported an association between mental health distress (e.g., anxiety, stress) and reduced physical activity levels during quarantine. Fugazzaro et al., (2022) suggested that rehabilitation interventions could lessen disability due to post-acute COVID-19 syndrome by improving anxiety, dyspnea, kinesiophobia, walking capacity, sit-to-stand performance, muscle strength, and quality of life. Samji et al., (2022) emphasized that access to entertainment options,

such as physical activities, was associated with better mental health outcomes among children. Sepúlveda-Loyola et al., (2020) study provided insights into social isolation's impact during COVID-19 lockdowns on older people's mental and physical well-being while highlighting exercise programs as essential for maintaining good overall well-being in this population. After taking into consideration stresses connected to COVID-19, Tandon et al.'s, (2021) cross-sectional survey study found that children's mental health during the pandemic was positively correlated with increased physical activity and decreased screen time. Zheng et al.'s systematic review and meta-analysis Zheng et al., (2022) observed increased sedentary time negatively correlating with global mental health issues like depression or anxiety across different age groups due to lockdown measures worldwide but particularly affecting children more than adults or older adults. In their Viewpoint article, Ai et al., (2021) put up a model that suggests that engaging in supervised exercise can improve mental health and happiness amid restricted spaces/facilities available for exercising due to various restrictions imposed because of COVID-19. In a systematic review and meta-analysis revealed that Pilates and yoga exercises as physical therapy in moderately improving quality of life in terms of vitality and mental health (López Mesa et al., 2023).

The purpose of this review is to clarify how physical activities and mental health interact both during and after the pandemic.

Impact of the COVID-19 Pandemic on Mental Health

The COVID-19 pandemic has had a profound impact on mental health across various demographic groups, including children and adolescents, frontline health and social care professionals, COVID-19 patients, the general population, medical students, pharmacists, and individuals affected by natural disasters such as earthquakes. Several studies have highlighted the psychological distress experienced by different populations during the pandemic. A systematic review focusing on adolescent and child mental health during lockdowns found that anger (30.0-51.3%), depression symptoms (2.2-63.8%), anxiety symptoms (1.8-49.5%), and irritability (16.7-73.2%) were common among adolescents and children (Panchal et al., 2023). Vulnerable groups with pre-existing mental health difficulties or special needs were at higher risk for anxiety during lockdowns (Panchal et al., 2023). Parent-child communication was identified as a protective factor against depression and anxiety in children (Panchal et al., 2023). Frontline health and social care professionals have also faced significant mental health challenges during disease outbreaks like COVID-19 (Pollock et al., 2020). Studies have reported high prevalence rates of stress (50-71%), burnout (14-59%), psychological distress (52%), depression (12-67%), anxiety (11-74%), post-traumatic stress disorder (17-25%), insomnia (17-61%) among anaesthetists (Deng et al., 2021). Factors related to poor mental health involved fear of infection exposure, quarantine requirements, insomnia, comorbidities, loneliness, uncooperativeness at work or home settings, and redeployment outside their area of clinical practice (Deng et al., 2021). COVID-19 patients themselves have been shown to experience high levels of anxiety (~47%), depression (~45%), and sleep disturbances (~34%) based on a meta-analysis conducted on infected patients [13]. Additionally, it was noted that there are no significant differences in prevalence estimates between genders but varied based on different screening tools used (Vindegard & Benros, 2020). Moreover, a study examining the long-term effects on mental well-being following COVID-19 infections revealed that most participants had either no symptoms at all or minor ones associated with PTSD (HADS), depression (PHQ-9), and long-term anxiety (GAD-7). Prevalence varied according to the type of measurement (Bourmistrova et al., 2022). Furthermore, a scoping review investigating the burden faced by pharmacists due to COVID-19 indicated that healthcare workers, including pharmacists, are experiencing significant psychological morbidity due to providing essential care services amidst pandemic conditions (Paterson et al., 2023). The impact has not only been limited to specific populations but has also affected individuals living through natural disasters alongside the pandemic outbreak; an example being Croatian medical students who experienced devastating earthquakes in addition to the ongoing crisis leading them into depressive states with over three-fourths reporting feelings associated with anxiousness while dealing with both crises simultaneously (Romic et al., 2021).

The pandemic has led to an upsurge in mental health

problems, including depression, anxiety, substance abuse, and post-traumatic stress disorder. Factors such as fear of infection, financial strain, social isolation, and loss of loved ones have contributed to psychological distress. The review examines the psychological impact across various population groups, including older adults, healthcare workers, children and adolescents, and individuals with pre-existing mental health conditions. The literature suggests widespread psychological implications resulting from the COVID-19 pandemic affecting various aspects such as the general population's well-being, morbidity amongst healthcare workers, personal experiences encountered by those infected alongside additional adversities faced by vulnerable groups like children/adolescents, natural disaster survivors, etc. Addressing these multifaceted issues requires comprehensive strategies encompassing preventive measures, social support systems, and tailored interventions designed for each group's specific needs.

Impact of the COVID-19 Pandemic on physical activity

The impact of the COVID-19 pandemic on physical activity has been a subject of growing interest. Jimeno-Almazán et al. discussed the potential benefits of exercise in managing post-COVID-19 syndrome, highlighting its role in improving symptoms and reducing long-term effects (Jimeno-Almazán et al., 2021). De Sousa et al. delved into the molecular mechanisms through which physical exercise may affect mental and cardiovascular health during the pandemic (De Sousa et al., 2021). Sepúlveda-Loyola et al. provided insights into the impact of social isolation on older people's mental and physical health, emphasizing the importance of multicomponent programs involving exercise for this population (Sepúlveda-Loyola et al., 2020). Coletti et al. focused on exercise-mediated reinnervation in skeletal muscle among elderly individuals, highlighting its potential to preserve muscle structure and function (Coletti et al., 2022). Nambi et al. found that high-intensity aerobic training was less effective than low-intensity aerobic training in improving psychological and clinical measures in community-dwelling older men with post-COVID-19 sarcopenia. The trial was a randomized controlled trial that compared low versus high-intensity aerobic training with resistance training (Nambi et al., 2022). Lastly, Wu et al.'s meta-analysis revealed a substantial decrease in daily steps throughout the quarantine period of the pandemic, underscoring the exacerbation of low levels of physical activity due to COVID-19 (Wu et al., 2023). Research indicates that engaging in regular physical activity is essential for reducing the impact of the COVID-19 pandemic on a number of health issues. From addressing post-COVID-19 syndrome to preserving muscle structure and function among elderly individuals with sarcopenia, exercise has shown promise as a therapeutic intervention across different populations affected by COVID-19-related health issues.

Relationship between Mental Health and Physical

Activity

The relationship between mental health and physical activity has been extensively investigated across various populations. Herbert demonstrated the possible advantages of physical activity programs for the mental health of college students. According to the findings, after a few weeks of intervention, aerobic activity-based exercise therapies may be the most effective in improving university students' mental health (Herbert, 2022). Okuyama et al., (2021) highlighted the psychological impact on children and adolescents due to COVID-19-related activity restrictions and recommended physical activity as a means to support their psychological health. Hossain et al., (2020) provided insights into the epidemiology of mental health problems during COVID-19, emphasizing the high burden of mental health issues associated with the pandemic. Fugazzaro et al., (2022) found that exercise-based rehabilitation interventions led to improvements in kinesiophobia, sit-to-stand performance, walking capacity, muscle strength, anxiety, dyspnea, and quality of life among individuals with PACS. During the COVID-19 epidemic, De Sousa et al., (2021) examined the molecular mechanisms by which physical activity improves mental health by enhancing anti-inflammatory effects and neuronal survival pathways. Peluso & Guerra de Andrade, (2005) review the association between exercise and mood in relation to mental health but also highlight that "overtraining syndrome" and "excessive exercise" are two disorders related to physical activity and poor mental health. This article emphasizes the need for further research into understanding the mechanisms involved in both beneficial effects as well as dangers associated with exercise on mental health. Sepúlveda-Loyola et al., (2020) discussed the impact of social isolation during COVID-19 on older people's mental and physical health while recommending multicomponent programs involving exercise for this population during confinement. White et al., (2017) explores the influence of domain-specific physical activity on mental health across different life domains. They found positive associations between leisure-time physical activity (LTPA), transport PA, work-related PA, school sport or PE activities with better mental health outcomes while highlighting differences across these domains regarding their impact on lower levels of ill-health. Zheng et al., (2022) reported that persistent breathlessness after acute COVID-19 infection was prevalent in approximately 26% - 41% of patients; however, rehabilitation exercises were suggested as potential interventions for reducing post-COVID breathlessness. Sanchis-Soler et al., (2022) indicated that healthy physical activity training programs improve the level of mental health and body composition of university students. Kandola et al.'s, (2018) comprehensive assessment article focuses on the biological and psychological processes that underlie the antidepressant effects of physical activity on oxidative stress, inflammation, neuroplasticity, and endocrine system modulation, among other factors linked to the pathophysiology of depression. Violant-Holz et al.'s review, (2020) indicated an association

between increased sedentary time during quarantine and reduced physical activity levels with negative psychological outcomes among adults during the lockdown period. Kandola et al., (2018) emphasizes current epidemiological research that suggests individuals with anxiety problems may be less likely to be active, as well as information from systematic reviews that training with exercise decreases symptoms condition resulting from extreme stress, fear, and anxiety disorders. During the pandemic, US children's mental health was shown to improve with increased physical activity and decreased screen usage, according to Tandon et al.'s cross-sectional survey study (Tandon et al., 2021). Kelly et al., (2020) special issue article, Martínez-Lorca et al., (2023) viewpoint paper, Piva et al., (2023) systematic review and meta-analysis, Ladlow et al., (2023)'s longitudinal study. Overall analysis suggests that engaging in regular physical activity is associated with improved mental well-being amid the challenges posed by COVID-19 across different age groups.

Physical activity has long been recognized for its positive influence upon mental well-being. Engaging in regular exercise and physical activities can alleviate symptoms of depression and anxiety, boost self-esteem, enhance cognitive function, and improve mood. The review explores the mechanisms through which physical activity exerts its beneficial effects on mental health, including neurobiological, psychosocial, and behavioural pathways. The evidence presented indicates a consistent trend towards improved mental health outcomes associated with increased levels of physical activity across various populations, including university students. However, there is also recognition within some studies about limitations such as lack of controls or diversity in participant demographics needing addressing. It is important to consider individual factors such as age, skeletal maturity, curve magnitude, modality intensity type exercises, etc., when designing effective interventions aimed at improving the overall quality of life, especially among specific population groups like adolescents suffering from major depressive disorder or those experiencing mild cognitive impairment.

Disruptions in Physical Activity during the Pandemic

The COVID-19 pandemic has had a significant impact on physical activity across various populations. Rossi et al. conducted a scoping review that indicated a decline in children's and adolescents' physical activity during the pandemic (Rossi et al., 2021). Wunsch et al.'s systematic review and meta-analysis also discovered that during the COVID-19 pandemic, physical activity significantly decreased globally in a variety of age groups (Wunsch et al., 2022). Jimeno-Almazán et al.'s narrative review emphasized the potential benefits of exercise for managing post-COVID-19 syndrome (Jimeno-Almazán et al., 2021). Luciano et al.'s study focused on Italian medicine students during the lockdown and observed decreased physical activity levels along with increased sedentary behaviour (Luciano et

al., 2021). Oliveira et al.'s systematic review specifically investigated and discovered a marked decrease in their levels of physical activity, which resulted in reductions in their physical fitness as well (Oliveira et al., 2022). Rodgers et al.'s study discussed how disturbances to daily routines and restrictions on outdoor activities caused by the COVID-19 epidemic have likely raised the incidence of eating disorders and their symptoms (Rodgers et al., 2020). Runacres et al.'s meta-analysis quantified changes in sedentary time during the COVID-19 pandemic across different age groups and found negative correlations between increased mental health outcomes and sedentary time (Runacres et al., 2021). Martínez-de-Quel's longitudinal study, focusing on Spanish adults' behaviours during lockdown, revealed negative impacts on their sleep quality, physical activity levels, and well-being (Martínez-de-Quel et al., 2021). Bozzola et al.'s literature review focused on the health of teenagers in the face of modifications to physical activity procedures following the global start of the COVID-19 pandemic; it outlined global decreases in physical activity levels associated with detrimental consequences on teenage mental health outcomes (Bozzola et al., 2023). Collie et al.'s case-control study demonstrated an association between uniform physical activity and increased vaccine efficacy besides severe COVID-19 outcomes among healthcare workers receiving vaccination against SARS-CoV-2 (Collie et al., 2023). Pérez-Gisbert's systematic review concluded that physical activity levels decreased significantly during Covid restrictions compared to pre-pandemic times among patients with chronic diseases (Pérez-Gisbert et al., 2021).

The COVID-19 pandemic resulted in a significant reduction in physical activity levels due to restrictions on movement, the closure of recreational facilities and gyms, and limited outdoor activities. The review discusses the consequences of reduced physical activity on mental health outcomes, including the aggravation of anxiety, stress, and depressive symptoms. It also highlights the disparities in access to physical activity resources and the effect upon marginalized populations.

Promoting Physical Activity for Mental Health during and after the Pandemic

This section examines strategies and interventions to encourage physical activity during and after the pandemic. It discusses the role of digital platforms, home-based exercise programs, outdoor activities, and community engagement in promoting physical activity. The review emphasizes the importance of tailored approaches, accessibility, and inclusivity to ensure that diverse populations can engage in physical activity for mental well-being.

The COVID-19 pandemic has had significant psychological effects on individuals globally. Several studies have highlighted the association between mental health distress (e.g., depressive symptoms, anxiety, stress) and reduced physical activity levels during quarantine (Violant-Holz et al., 2020, Hossain et al., 2020). Hossain et al. (2020) highlighted the high burden of mental health problems

associated with COVID-19, including depression, anxiety disorders, stress, and other psychological impacts. Hellwig & Domschke (2022) discussed post-COVID syndrome with a focus on fatigue and neuropsychiatric late sequelae commonly observed in COVID-19 patients. A systematic review of the association between emotional eating and mental health during the pandemic was carried out by Burnatowska et al. (2022). Ghosh et al. (2020) emphasized the psychosocial impact of COVID-19 on children and adolescents despite their lower susceptibility to the disease itself. Manferdelli et al. (2019) provided evidence supporting outdoor physical activity as beneficial for overall health and society. Bozzola et al.'s (2022) scoping review identified various risks associated with social media use by children and adolescents during lockdowns due to increased exposure to adverse content leading to psychological problems such as depression and anxiety. Infectious disease epidemics, including COVID-19, have been associated with increased prevalence of insomnia symptoms, anxiety, and depression across different populations (Lebel et al., 2020; Moreno-Pérez et al., 2020).

Moreover, evidence suggests that prolonged isolation can lead to an imbalance in activity levels among isolated individuals without access to mental healthcare resources (Bozzola et al., 2022). In contrast, despite participants' strong uptake, interventions including exercise and functional activity therapy designed especially for persons with early dementia or mild cognitive impairment did not significantly enhance quality of life or activities of daily living (Lebel et al., 2020). A short-term physical activities program shows benefits in mental health indicators as 30% decrease in depression symptomatology, 58% in stress and 44% in anxiety in post-COVID-19 patients (Flores et al., 2024). Harwood et al. (2023) all presented evidence supporting physical activity or green spaces as potential interventions for promoting mental well-being during or after pandemics like COVID-19. Despite these results showing detrimental effects on mental health among several populations, including pregnant women and children/adolescents, as a result of decreased physical activity during the pandemic, there is limited evidence supporting specific strategies for promoting physical activity to mitigate these effects and identifying potential interventions such as physical activity or access to green spaces that could promote better mental well-being amidst pandemics like COVID-19. Overall, while there is much evidence showing how the COVID-19 pandemic negatively impacted mental health in a variety of populations, more research is required to determine the best ways to promote physical activity as a way to enhance mental health both during and after the pandemic.

Future Directions and Recommendations

The impact of social isolation due to COVID-19 on mental and physical health has been a topic of interest across various populations. Sepúlveda-Loyola et al. (2020) outlined the detrimental effects of social distance for COVID-19 on older

adults' mental and physical health. They offered suggestions for a multifaceted program that includes psychological and physical techniques. J. Yang et al. (2022) indicated that engaging in physical exercise can help prevent and treat COVID-19 by easing the symptoms of post-acute COVID-19 syndrome, facilitating physical function recovery, and enhancing patients' psychological health. Ayenigbara (2022) highlighted coping mechanisms such as behaviour-based, activity-based (consistent physical activity), and personal care-based interventions as preventive measures against mental health disorders during the pandemic worldwide. Puangsri et al. (2021) talked about how the COVID-19 outbreak affected mental health patients, aggravating symptoms like sadness, suicidal thoughts, and psychosis; they suggested that care be moved to community-based psychiatry and telemedicine. Ghram et al. (2021) centred on particular populations, such as prisoners, refugees, and asylum seekers, who are at-risk groups with complicated medical needs impacted by restricted movement as a result of lockdowns; they talked about how physical activity may be recommended to strengthen their immune systems. Robinson et al.'s review article provided recommendations endorsing golf since it has numerous positive effects on both physical and mental health and argued that the benefits of playing outweigh the dangers of transmission when appropriate risk-reduction strategies are used (Robinson et al., 2021). All authors addressed different aspects related to sedentary behaviour or lack of physical activity among children or adolescents, providing insights into potential sequels associated with these behaviours. Given these findings, Further research should focus on elucidating mechanisms underlying how aerobic exercise impacts fear extinction learning processes at neurobiological levels. More empirical data are needed to establish standardized youth athlete development models based on robust longitudinal studies. Advancements are required in ambulatory assessment methods using digital technologies like the ecological momentary assessment to capture real-time data related to physical activity behaviours effectively. Research should continue investigating personalized approaches that consider demographic factors when designing interventions targeting mental health through physical activity engagement.

Conclusion

The COVID-19 pandemic has highlighted the importance of both physical activity and mental health. The review emphasizes the reciprocal association between physical activity and mental health, emphasizing the need for holistic approaches to well-being. As the world moves past the pandemic, persistent efforts are required to treat mental health issues and encourage physical activity. The review suggests avenues for future research, such as investigating the long-term mental health consequences of the pandemic, evaluating the effectiveness of digital interventions, and exploring the synergistic effects of combining mental health support with physical activity promotion. Despite some limitations, including varying quality evidence, these

findings collectively highlight the importance of integrating physical activity interventions into holistic healthcare approaches to address mental well-being in diverse patient groups. It also emphasizes the integration of mental health and physical activity into public health policies and healthcare systems. By prioritizing mental health support and promoting physical activity, individuals can better cope with the challenges posed by the pandemic and emerge stronger in its aftermath.

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Declaration of competing interest

The author declares that there is no competing interest.

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