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Abstract

Regular physical activity is tremendously known to be a gateway to various positive health outcomes. This includes the enhancement of mental health, alongside the prevention and management of mental health conditions. The COVID-19 pandemic has brought about an increase in fear and stress levels which could be harmful to the mental health and general wellbeing. A poor mental health state could affect an individual's control of their emotions, cognitive abilities and behavior towards others. This challenge could in turn affect the manner at which people perceive themselves and interact with other members of the society. Engaging in one or more forms of physical activities on a regular basis, with guidance from recommendations proposed by the World Health Organization could offer meaningful health benefits to the individual. Despite this knowledge, physical activity is currently under-utilized for this purpose. The aim of this narrative review is to explore the existing literature on how physical activity impacts mental health during the COVID-19 pandemic. In order to achieve this, a literature search was conducted using Google scholar, PubMed, and Scopus to locate papers that focused on the physical activity and mental health factors and influences during the COVID-19 pandemic. Twenty three articles were included in this narrative review. A common outcome across the studies was the fact that an increase in engagement in physical activities was positively associated with better mental health outcomes and overall wellbeing. The challenging nature of the COVID-19 pandemic qualifies the need to boost ones health to the maximum as practically achievable. Physical activity is an inexpensive and easily accessible method of achieving this goal and encouraging its participation could promote positive health outcomes during the COVID-19 pandemic.

Key words; Covid-19, pandemic, physical activity, mental health, psychological challenges, mental wellbeing. Fear, anxiety, exercise, movement.

ACKNOWLEDGEMENT

This review is dedicated to my dear father who passed away from the COVID-19. He inspired the original idea for this study. I will like to send across a heartfelt gratitude to my friends and family who supported me throughout this study. This paper would not have been possible without their constant care, dedication and well wishes. I wish to acknowledge my supervisor who approved and supported this research study. Most importantly, I will like to express immense gratitude to my dear lovely mother who has been my rock as she stood by me and offered the right amount of support that I needed every step of the way during the process of this review.

ABBREVIATIONS

- WHO World Health Organization
- IPAQ International Physical Activity Questionnaire
- BREQ-3 Behavioral Regulation in Exercise Questionnaire
- MHC-SF Mental Health Continuum
- GAD-7 General Anxiety Disorder-7
- NRS Natural Relatedness Scale
- YSIS Youth Self Rating Insomnia Scale
- GAD-2 Generalized Anxiety Disorder scale
- DASS-21 Depression, Anxiety and Stress Scale
- OCI Obsessive Compulsive Inventory
- BAI Beck Anxiety Inventory
- **BDI** Beck Depression Inventory
- PSS-10 Perceived Stress Scale
- FDI Filgueiras Depression Inventory
- S-STAI Subscale of State-Trait Anxiety Inventory
- IES Impact of Event Scale

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1. BACKGROUND

1.1.DEFINITIONS

Physical activity: Physical activity is defined as 'any bodily movement' made by the skeletal muscle that brings about 'energy expenditure' [1]

Physical Inactivity: Engaging in less physical activity than the recommendations proposed by the WHO guidelines [2]

Regular Physical activity: Engaging in physical activities at a frequency of '5 or more times perweek' [2]

Mental Health: Mental health refers to the state of cognitive, behavioral and emotional wellbeing, which enables an individual to recognize their abilities, cope with normal life stresses, be productive and fruitful and make a meaningful contribution to their community [3]

1.2 INTRODUCTION

Since 2020, the COVID-19 was declared a pandemic by the World Health Organization (WHO) [4] and has had a global impact at an unprecedented rate leading to numerous lockdowns worldwide and changes in lifestyle patterns and habits, affecting the lives of many people living in various regions of the world [5,6,7,8,9,10,11]. The secluded nature of these lockdowns and related COVID-19 measures such as social distancing, avoiding non-essential inter-personal meetings, alongside associated socio-demographic factors, increased the prevalence of loneliness, mental and physical health impacts [12]. The COVID-19 pandemic has posed a potential mental health hazard, considering factors such as fear and anxiety about infection, loss of a loved one, contracting the virus and being a risk to members of the immediate community, self-Isolation, social stigmatization, loss of jobs and means of livelihood, effects of global economic hardship, alongside stress and pressure associated with the lockdowns [13, 14, 15, 16]. These factors have demonstrated the propensity of causing an aggravated emotional state and mental health repercussions, affecting the manner and quality of life among people who have encountered one or more of these challenges [17].

The numerous psychological issues that may occur as a result of the COVID-19 pandemic are currently not receiving adequate attention. This could translate to the chances of an escalated rate of associated mental health disorders across the world forming an additional 'pandemic'associated with mental health, in line with the global rise in mental health concerns [39]. People tend to respond to challenges differently with some responses ranging from fear, sadness, changes in appetite, disturbed sleep, aggravated irritability, social isolation, lack of motivation and disengagement to more severe responses such as anxiety, depression, eating

disorders, substance use or abuse and suicidal tendencies [72]. Physical inactivity has been identified as a significant parameter in the trajectory of developing mental health symptoms such as mood disturbances, depression and anxiety [18]. In a similar light, this paper explores the role of Physical activity in the enhancement of a positive mental health state admits the COVID-19 pandemic.

2. PHYSICAL ACTIVITY

2.1 Global Impact of the COVID-19 pandemic on Physical activity

The COVID-19 lockdowns have influenced global physical activity rates in various ways [19, 20, 21]. The closure of access points for physical activities such as gymnasiums, recreational facilities, outdoor parks in addition to self-isolation for people who may have been in contact with a COVID-19 case and the emphasis laid on staying indoors as being the safest measure to take in preventing the spread of the virus, has led to a reduction in physical activity options. This situation requires creativity and flexibility in adopting and maintaining meaningful physical activity levels with the predominance of indoor based options [22].

A cross sectional study in China compared the changes in physical activity levels of over 8,115 participants, with participants recalling their information for physical activity before, during and after the lockdown while data collection occurred retrospectively at a single time point [21]. This study sorted to assess differences over time in the physical activity and sedentary levels of participants. The outcome measure used here was International Physical Activity Questionnaire (IPAQ). This study predominantly included full-time students and results suggested only minimal increase in physical activity levels after the lockdown was lifted in China with predominant hike in sedentary time before, during and after the lockdown. Despite lifting the lockdown, there was no change in sedentary time of participants, possibly due to the continued post lockdown precautions of limiting outdoor activities. Although, this study had a large sample size which reduces the chances of type II errors occurring in the reported findings, the retrospective nature of data collection raises concerns for recall bias during the process [21].

A Dutch prospective longitudinal cohort study, sorted to assess the impact of the COVID-19 lockdown on physical activity among members of this region. This study was conducted among 1565 Dutch Cardiovascular disease patients, comparing their pre-lockdown sedentary behavior and physical activity levels to post lockdown measures. Findings from this study suggests that there was a cumulative increase in mild to moderate level physical activities with a reduction in moderate to vigorous level physical activities and the highest increase was present in the amount

of time spent being sedentary. This study further found that there were higher scores in moderate to vigorous physical activity levels among the younger age groups in comparison to the older adults. This could have been due to more marked COVID-19 measures for the most vulnerable groups [19]. This study had a large sample size which limits the chances of type -2 errors in the reported findings. However, there was no particular mention of the specific validated questionnaires used in the measurement of outcomes before and after the COVID-19 lockdown, thereby impairing its reliability [19].

A cross sectional study in Canada assessed the Physical activity levels of 1098 participants in comparison to their motivation and overall wellbeing, before and during the lockdown [20]. Data collection occurred retrospectively during the lockdown. Outcome measures used in this study were Godin Leisure Questionnaire, Behavioral Regulation in Exercise Questionnaire (BREQ-3), Mental Health Continuum (MHC-SF), General Anxiety Disorder-7 (GAD-7) and Natural Relatedness Scale (NRS). This study found that participants who were previously inactive before the lockdown had an increased likelihood of remaining inactive during the lockdown, while participants who were previously active remained active and increased in activity levels during the lockdown had a more promising mental health score in comparison to inactive participants, while inactive participants who increased in activity levels had lower levels of anxiety. However, the retrospective nature of data collection in this study raises concerns of recall bias in the reported findings [20].

Although the COVID-19 pandemic has heightened an inclination towards remaining indoors, which limits choices for physical activities, growing knowledge on the COVID-19 pandemic and the development of related government guidelines and protocols alongside global vaccination strategies have enabled a direction on how to live admits the pandemic [74]. With Fewer reasons to remain in isolation, more people are able to engage in various forms of PA including outdoorbased activities in a safe manner [75].

2.2 WHO recommendations for Physical Activity

The current recommendations for Physical activity by the WHO are summarized below as follows [23]:

Children and adolescent aged 5 – 17 years						
• Engage in an average daily 60 minutes of moderate to vigorous intensity physical activities (predominantly aerobics) through the week.	• Limit the amount of time spent being sedentary with emphasis on amount of					

• Incorporate vigorous intensity aerobic activities	recreational screen time
that strengthen the muscles and bones at least 3	
days a week.	

Table 1

Adults aged 18 – 64 years						
 Engage in 150-300 minutes moderate intensity physical activity weekly And/or at least 75 – 150 minutes vigorous intensity physical activity, or a combination of both moderate and vigorous physical activities all through the week 	• Limit the amount of time spent being sedentary and replace sedentary time with physical activity of any intensity (including light intensity) which supplies health benefits.					
 Engage in muscle strengthening activities involving major muscle groups on 2 or more days a week for additional health benefits. Increase the amount of moderate and vigorous intensity physical activities beyond 150-300 minutes and 75-150 minutes weekly either independently or in combination for additional health benefits 	To help reduce the detrimental effects of sedentary behavior, all adults should aim to achieve beyond the recommendations for moderate-vigorous intensity physical activities.					

Table 2

Older adults aged 65 years and above

• Same as for adults

• In addition, older adults should incorporate variety of multi-complex activities emphasizing functional balance and strength or strength training as part of their weekly physical activity to enhance capacity and prevent falls.

Table 3

2.3 Health Benefits of Physical Activity

Regular physical activity offers a variety of irrevocable health benefits, some of which are outlined below [23];

- Enhanced life expectancy and overall quality of life
- Prevention of non-communicable diseases
- Improvement in bone health, movement and function
- Maintenance of a healthy body weight
- Decrease in the Risks of the following conditions:
 - \circ Cardiovascular diseases 25 35% [27]
 - Type II Diabetes 30 40% [28]
 - Mental ill-health 30% [29]
 - \circ Colon 30% and breast cancer 20% [30]
 - Joint aches and back pain [33]
 - Improve balance and reduce risk of falls and fear of falling -[24, 25, 26]
 - Fractures 68% [32]
 - Reduces the risk of all causes of mortality b 20-30% [31]

2.4 Practical options for physical activity

Physical activity is non-limited to a single specific activity but encompasses numerous activities in variety of intensities and complexities. These activities range from moderate intensity brisk walking and cycling to more vigorous intensity running or high impact sporting activities that bring about a greater increase in heart rate and respiratory rate [23]. Physical activity involves activities such as gardening, dancing, swimming, jogging, and yoga, working out and lifting weights in the gym or elsewhere, alongside various other forms of activities that involve body movements. This expresses the direct definition of physical activity being any body movement that brings about energy expenditure. The primary goal is to engage in a form of physical activity that is enjoyable to the individual to increase likelihood of continuity. Implementing variety as oppose to merely a single option, could be helpful to prevent getting bored from repetition and enhance adherence and longevity of an active lifestyle [71].

3. MENTAL HEALTH IMPACT AND CONCERNS DURING THE COVID 19 PANDEMIC

The COVID-19 pandemic has been identified as the most devastating public health threat since 1918, when the H1N1 influenza pandemic occurred. The severity of the disease impact currently exceeds related mortality and morbidity, extending on to psycho-social, economic, financial and related domains [35]. Mental health experts have identified a risk for both people who suffer known psychiatric disorders and people have no diagnosed mental health conditions [36]. The complexity of the pandemic and the ease of COVID-19 transmission, incurred significant public health measures such as those that impacted personal freedom, alongside financial losses. More concerns were fear of contracting the virus and infecting loved ones, contradictory information from authorities, emotional stress from isolation and quarantine, common symptoms of other illnesses such as fever and cough which could raise false alarm and panic for COVID-19, all of which served as stressors and increased the feeling of confusion, insecurity, emotional isolation and social stigma thereby impacting on mental health and wellbeing [37].

Even though, traumatic experiences such as natural disasters, technological accidents among others, could cause Post-traumatic stress disorder (PTSD), conditions arising due to natural causes such as a viral infection in the case of COVID-19, currently do not meet the criteria for the diagnosis of PTSD but are associated with anxiety disorders and depressive conditions [37]. Common Psychiatric conditions that have been associated with the COVID-19 pandemic include panic attacks, anxiety disorders, depression, symptoms closely linked to PTSD, somatic symptoms, psychosis, delirium and suicidal tendencies [45]. Although mental health risks in relation to the COVID-19 pandemic cuts across all population groups, some people are at a greater risk of associated mental health concerns such as the frontline healthcare providers, people who have been infected by the virus and the more vulnerable groups such as elderly adults including those who have a suppressed immune function, people with pre-existing health conditions, psychiatric history or substance abuse problems. Frontline healthcare providers are of peculiar vulnerability due to their heightened risk of exposure to the virus, lack of sufficient personal protective equipment's (PPEs), physical demands from prolonged use of PPEs, lengthened work hours, increased work demands, the mental contrast between concerns for safety, while desiring to provide adequate care, compassion and support to patients and social the stigmatization received from working in high risk environments [37]. It is therefore paramount to inculcate measures to combat the mental health repercussions of the pandemic utilizing risk

assessment strategies and plausible interventions with additional emphasis paid to individuals at a greater risk of mental health concerns.

4. RECOGNISED STRATEGIES FOR MENTAL HEALTH ENHANCEMENT

Some practical strategies which are evidently recognized for enhancing mental health are outlined below:

SLEEP

Sufficient sleep enables adequate recovery from mental and physical stress and exertion. Common mental health issues such as anxiety and depression can often lead to sleep disturbances. Achieving sufficient amount of sleep may be a challenging lifestyle goal in people with shift based work patterns and lifestyle habits that do not prioritize sleep [40]. In a similar sense to how adequate quality sleep is beneficial to mental and overall health and wellbeing, lack of sufficient sleep could lead to poor mental and general health outcomes such as depressed mood, poor concentration and energy levels [40]. Practical ways to drive in good quality sleep into daily life habits include; scheduling a committed time for sleeping and getting out of bed, which meets the recommended sleep duration for the related age, setting daily reminders and alarms for when it is bed time as a nudge to support consistency, setting the tone for a comfortable and relaxing sleeping environment such as switching off all noise, disturbing sounds and distractions, establishing a suitable ambience and reducing or switching off the lights [40].

EXERCISE

Exercise enhances mental health through enhancing self-efficacy, self-esteem and cognitive function, meanwhile suppressing negative moods, anxiety and depression [41]. Exercise has also been associated with benefiting instances of low self-esteem and social withdrawal. Exercising offers mental health benefits to people who have been diagnosed with a mental health condition as well as the general population and demonstrates additional benefits to people with Schizophrenia considering their vulnerability to obesity as various anti-psychotic medications tend to cause weight gain. Exercising regularly offers significant mental health benefits which include; mental clarity, enhanced mood, increased focus and concentration, mental alertness, increased energy and stamina and an enhanced overall productivity.

DIET

Maintaining a balanced diet and practicing healthy eating habits is another means to enhance mental health. Excessive loading on heavy carbohydrates could lead to easy fatigability, disturbed concentration and irritability. In a similar manner, moderating food consumption could benefit mental as well as physical health outcomes. Poor diet has additionally been associated with increased risks of depression [42] which further magnifies the importance of an adequate healthy balanced diet as a strategy to enhance mental health and wellbeing

COMMUNITY INVOLVEMENT

According to the Patient Centered Outcome Research Institute, getting committed to community projects, socializing, sharing more and expressing ones thoughts and views particularly when surrounded by other people with a common goal can offer significant mental health advantages [43].

HOBBIES

Engaging in an enjoyable activity particularly if one is passionate about it and good at it is a useful means to prevent and address anxiety, depression and mental health related concerns. The self-efficacy derived from engaging in an activity that one is good at, can boost continuity and self-esteem meanwhile alleviating depressed moods and negative thoughts. The physiologic effect of healthy excitement from engaging in hobbies stimulates the release of neuro-transmitters such as dopamine and serotonin thereby, yielding a calming effect on the body system and promoting positive mental and general health outcomes [44]. Low intensity physical activity for up to 30 - 35 minutes is known to offer meaningful mental health advantages [45]. Hobbies that involve social interaction could be useful for building and enhancing communication and interpersonal skills [45].

5. PHYSICAL ACTIVITY AND MENTAL HEALTH

Physical activity engagement to any level of intensity and complexity is beneficial to the individual. It is known that meeting the current recommendations for physical activity offers significant health benefits including the enhancement of mental health and wellbeing [29]. In recent time, there has been growing attention channeled towards mental related outcomes that could be derived from physical activity engagement [46,47]. Hillman and colleagues in a systematic review, studied how physical activity and physical fitness could impact on the brain structure, function and cognition, in addition to physical education possibly influencing attitude to work and academic performance among school children aged 5 - 13 years. Findings from this study revealed an improvement in cognitive function derived from physical activity and physical activity function derived from physical activity and related interventions although, lack of sufficient evidence to support learning enhancement and academic performance considering that there was merely a single cross sectional study that met the inclusion criteria of the authors. However, this study revealed only limited evidence that supported consistency and similarities across the findings with a few study results being clearly presented 47].

Regular participation in physical activities offers numerous advantages to the mental health which include; mood enhancement, reduction in stress levels, enhancement of self-esteem and improvement in cognitive function. The reduction of stress levels through regular physical activities can help to control and prevent negative mental health states and conditions such as anxiety and depression [48, 49, 50]. Additionally, physical activity improves the quality of life of people who have been diagnosed with a mental health illness alongside those who have no diagnosed mental health disorders [51, 52]. Physical activity is a recognized means for mood enhancement, particularly beneficial when a person's mood was initially low, prior to engaging in some form of activity [53]. Various studies have looked into the influence of different levels of physical activities on mood changes. The majority of evidence suggested that moderate intensity physical activity performed for 30 - 35 minutes daily on at least 3 - 5 days a week, for a minimum duration of 10 - 12 weeks; rendered the best results for mood enhancement, further emphasizing the sub-components of enthusiasm and alertness [54, 55].

5.1. Physical activity and Stress control

In highly stressful situations, physiologic changes occur in the body due to the release of adrenaline and noradrenaline hormones, which increase the heart rate and blood pressure as the body prepares in response to emergency. This state otherwise known as fight or flight additionally causes a reduction in blood flow to the skin and delayed gastro-intestinal activities [56]. Physical activity supports the release of serotonin which serves as a mood enhancer and natural body pain killer. A large cross-sectional study on over 46,573 adults studied the effects of physical activities on stress levels among public sector employees. This study found lower stress levels in participants who were more physically active in comparison to the less physically active participants [57]. Physical activity plays a crucial role in stress control and should be inculcated for the purpose of mood enhancement and stress reduction.

5.2. Physical activity and self-esteem

Self-esteem refers to the manner at which an individual perceives them self and feels about their self-worth [58]. It serves as a vital determinant for mental well-being and the ability to cope with life stressors [58]. A high self-esteem is essential to enhance self-confidence and self-respect. How this translates to daily living is that when self-esteem is sufficiently high, it brings about a sense of happiness, self-satisfaction, which impacts on how the individual would relate with others, alongside their level of productivity. Low self-esteem on the opposite end, has been traditionally demonstrated as a negative characteristic where a person does not feel good about them self, thereby limiting their coping mechanisms to life stressors [59]. Evidence suggests that physical activity is effective for enhancing self-esteem and a sense of self-worth beneficial across all population groups ranging from children to elderly adults alongside males and females [60].

5.3. Physical activity impact on cognitive decline and dementia

Over time, healthcare advancements have led to an increase in the life expectancy with evidence suggesting a gradual growth in the population of elderly adults above 65 years in the United Kingdom [61]. This increase also extends to the number of people who live with dementia and cognitive decline in these settings [62]. The primary symptom of dementia is memory loss. However, cognitive decline in attention and concentration also affects elderly adults who do not have dementia [63]. For elderly adults who live with dementia, physical activity can help to impede associated functional decline, thereby improving quality of life and life expectancy [64]. Evidence suggests an estimated 20 - 30% reduction in risk of depression and dementia among adults who engage in their daily physical activities [65]. Additionally, physical activity suppresses cognitive decline in elderly adults who do not have dementia [66]. Physical activity illustrates a positive effect by boosting cognitive and functional outcomes in older adults including those who have developed dementia, thereby supporting the need for its encouragement for this purpose among this population.

5.4. Physical activity impact on depression and anxiety

Physical activity can be utilized as an alternative intervention for depression [67]. It has been used to suppress anxiety levels in people with mild anxiety [68] and could be beneficial as a course of care in addressing clinical anxiety [69]. It could be implemented independently or as part of a variety of treatments that include use of medications alongside psychological therapy [70]. Physical activity is particularly advantageous as it has limited side-effects in comparison to medication use, in addition to less stereotype and social stigma attached to the use of anti-depressants or psychotherapy counselling even though concurrently beneficial. Physical activity is easily accessible and practical at little to no cost with significant benefits which include self-efficacy and empowerment to facilitate self-management alongside a sense of independence and control all of which could be used to tackle fear and anxiety.

6. IMPORTANCE OF PHYSICAL ACTIVITY DURING THE COVID-19 PANDEMIC; IS MOVEMENT THE HIDDEN SECRET?

The COVID-19 pandemic has caused the inclination towards spending more indoor time and avoiding unnecessary meetings. Although the introduction of vaccines comes with hope, it does not guarantee the end of the pandemic therefore the importance of continued adherence to the safety measures as recommended by the WHO [34]. Different forms of exercise alongside general physical activity routines offer numerous mental and overall health benefits. For example, aerobic exercises and vigorous activities that cause a greater increase in heart rate and respiratory rate such as jumping jacks and mountain climbers, performed at least 2 -3 times

weekly, are particularly useful for tackling the symptoms of depression. In a similar light, strength training activities such as weight lifting or other forms of resistance training, which could be performed using exercise equipment's i.e. dumbbells, resistance bands, weights, or house hold items i.e. textbooks, canned food items, filled jug etc., are useful for tackling symptoms of anxiety in individuals who have been diagnosed with anxiety disorders as well as individuals who have no history of anxiety disorders [73].

In children and adolescents, moderate to vigorous physical activities such as jogging, running, cycling, active sports like football, tennis and basketball, have been associated with enhancing their self-esteem through the self-efficacy and satisfaction derived upon performing these forms of exercise. For older adults living with one or more chronic health conditions, daily walks are recommended to attain regular physical activity levels and aid with management of these conditions. Additionally, strength training using low-moderate weight at higher repetitions is beneficial for enhancing function and quality of life among older adults. Moderate to vigorous physical activity like brisk walking and jogging has been associated with the reduction in alcohol consumption as well as substance use or abuses.

Engaging in regular physical activity and exercise could be a useful technique to combat mental distress and mental health challenges such as fear, social isolation, disengagement, anxiety and depression associated with the COVID-19 pandemic. Every day is a brand new opportunity to participate in more physical activities to help impact positively on stress levels, sleep, physical and mental health through cultivating emotional resilience, mental and physical strength. Continuity could be enhanced by motivation level, peer and family support alongside social platforms that offer exercise training and programs [73].

7. AIM OF THE NARRATIVE REVIEW

Physical activity is currently being less used than the size of its advantages which could be derived from regular engagement. Among the numerous health benefits of physical activities, mental health enhancement is a viable and particularly essential point of need considering the impact of the COVID-19 pandemic on mental health and wellbeing of various population groups.

The main purpose of this narrative review is to explore the current literature on the extent of use of physical activities in relation to the mental health outcomes and the mental health benefits achieved from regular engagement in physical activities during the COVID-19 pandemic.

8. METHODS

A literature search was conducted in March 2020 using the following data base; Google scholar, PubMed and Scopus; Studies were included if they; centered the theme of the review, were conducted among human beings, were articles in English language and had clearly delineated outcome measures. With reference to type of publication, articles published in scientific journals and book chapters were included. Papers selected included studies that aligned with the purpose of this study with peculiar emphasis on studies that addressed the benefits of physical activity in the context of mental health admits the COVID-19 pandemic. The literature search was limited to studies published between January 2020 and May 2021. The Population, Intervention, Comparison and Outcome (PICO) strategy used were:

Population: People of all ages

Intervention: Physical activity

Comparison: COVID-19, pandemic

Outcome: Mental health, Psychological and mental wellbeing

A total of 205 articles were initially screened utilizing their titles and abstracts. Papers were excluded if they did not align with the theme of this review such as studies that did not explore physical activity as an intervention for potential use during the pandemic in the improvement of mental health and wellbeing. Following the exclusion of 182 non-closely related articles, 23 full text studies were included which comprised observational studies with cross sectional and longitudinal designs alongside systematic reviews, in order to enable an exploration of the mental health benefits of physical activity during the COVID-19 pandemic.

9. RESULTS

The 23 articles that fulfilled the inclusion criteria for this study from the abstract review phase are summarized and demonstrated below in table 4 as follows:

SUMMARY OF ARTICLES INCLUDED					
TITLE	AUTHORS	TYPE OF STUDY/ME THODS	SAMPLE (IF OBTAINA BLE)	STUDY SETTING AND MAIN RESULT S	OUTCOM E
The mental health benefits of physical activity in older adults survive the COVID-19 pandemic [76]	Naomi A.Arnold- Nedimalaa Leslie S. JordanM.S. GabrielS. PenaM.S. JunyeonWonM.A. JohnL.Woodard PhD J.CarsonSmith Ph.D.	Cross sectional Study	adults above 50 years old residing in North America.	Survey conducted between April 9 and April 30, 2020, during the COVID-19 pandemic, using the Physical activity scale, Geriatric Depression Scale and Geriatric Anxiety Scale as outcome	Higner physical activity levels were linked to lower scores on geriatric depression scale.
The importance of sleep and	Florian Chouchou Muriel Augustini	Cross sectional study	400 voluntary participants	An online survey administer	A reduction in wellbeing

physical	Teddy Caderby		in the	ed between	with
activity on	, , , , , , , , , , , , , , , , , , ,		Reunion	the 35th	increase in
well-being	Nathan Caron		Island	and 54th	anxiety
during	Nicolas A Turnin			days of	scores with
COVID-19				lockdown	reduced
lockdown:	Georges Dalleau			relative to	engagemen
reunion island				pre- and	t in
as a case study				per-	physical
[77]				lockdown	activities
				periods.	during
				Outcome	lockdown
				measures	in
				used	comparison
				include	to pre-
				IPAQ and	lockdown
				World	periods
				Health	
				Organizati	
				on Well-	
				Being	
				Index	
Montol Hoolth	Vac Zhang Haarn	Longitudinal	66 Chinaga	Longitudin	A diment
Mental Health	Yao Zhang, Haoyu Zhang, Vindong				A direct
Problems	Zhang, Andoing	conort study	college	of sixty-six	of physical
auring the			students	college	of physical
COVID-19 Dandomics and				students	activity in
Pandemics and the Mitigation					nnugating
The Minigation					amotions
Effects of					with
Exercise: A					with movimol
Lungituumai Study of					mitigation
Collogo					Intigation
Students in					occurring
China [78]					occurring
Uma [70]					occurring when physical
					occurring when physical activity
					occurring when physical activity was
					occurring when physical activity was
					occurring when physical activity was performed at up to

					weekly.
A mental health paradox: Mental health was both a motivator and barrier to physical activity during the COVID-19 pandemic [79]	Maryam Yvonne Marashi ,Emma Nicholson, Michelle Ogrodnik, Barbara Fenesi, Jennifer J. Heisz	Cross sectional study	1669 participants	An online survey with 1669 respondent s. The outcome measure used was The Physical Activity and Sedentary Behavior Questionn aire (PASB-Q)	Participants who maintained physical activity participatio n reported anxiety relief as a motivation for more physical activities
Changes in Physical Activity and Sedentary Behavior in Response to COVID-19 and Their Associations with Mental Health in 3052 US Adults [80]	Gabriele Giorgi, Luigi Isaia Lecca, Federico Alessio, Georgia Libera Finstad, Giorgia Bondanini, Lucrezia Ginevra Lulli, Giulio Arcangeli, and Nicola Mucci	Cross sectional study with an additional longitudinal component	3052 adults in the United States	An online survey answered by university students, faculty, staff and alumni	Not meeting the physical activity guideline recommend ations with increased screen time, was associated with worsening in depression, loneliness and stress levels.
Physical activity, mental	JamesFaulknera	Cross sectional	8,425 adults in UK,	An online survey was	Participants who

health and	Wendy J.O'Brien	study	Ireland,	administer	demonstrat
well-being of			New	ed	ed a
adults during	Bronagh McGranec		Zealand and	involving	reduction
initial COVID-	Daniel		Australia	the IPAQ,	in their pre-
19 containment	Wadsworthdf			World	lockdown
strategies: A				Health	physical
multi-country	John Battena			Organisati	activity
cross-sectional	Christopher			on-5 Well-	level, had a
analysis [81]	D Askew			being	depletion in
	D.ASKCW			Index; and	their
	Claire Badenhorst			the	mental
				Depression	health state
	ErinByrd			Anxiety	in
	Maura Coulter			and Stress	comparison
				Scale-9 as	to those
	Nick Draper			outcome	who either
	Catherine Elliot			measures	increased
	Catherine Enfot				or
	Simon Fryer				maintained
	Michael I Hamlin				their pre-
	Michael J.Hallilli				nbusical
	John Jakeman				activity
	Kally A				levels.
	Mackintosh				10,010,
	Mackintosh				
	Melitta A.McNarry				
	Andrew				
	Mitchelmore				
	John Murphy				
	r				
	Danielle Lambrick				
The effect of	Christoph Pieh	Cross	1005	An online	An increase
age, gender,	- -	sectional	participants	survey	in
income, work,	Sanja Budimira	study	in Austria	among	depressive
and physical	Thomas Probst			1005	symptoms
activity on				participant	and anxiety
mental health				s, with the	levels with
during				following	a reduction

coronavirus				outcome	in physical
disease				measures	activity
(COVID-19)				WHO-	levels
lockdown in				QOL	during the
Austria [82]				BREF),	COVID-19
				well-being	lockdown
				(WHO-5),	
				depression	
				(PHQ-9),	
				anxiety	
				(GAD-7),	
				stress	
				(PSS-10),	
				and sleep	
				quality	
				(ISI	
The	Louis Jacob	Cross	002 adulta	Outcomo	Dhysically
rolationshin	Louis Jacob	sectional	in the	massuras	active
hetween	Mark A.Tully	study	United	used	adults had
nhysical	V D //	study	Kingdom	include:	a better
activity and	Y vonne Barnett		mgaom	Beck	overall
mental health	Guillermo			Anxiety	mental
in a sample of	F.Lopez-Sanchez			and	health
the UK public:				Depression	score.
A cross-	Laurie Butlere			Inventory	
sectional study	Felipe Schuch			The Short	
during the	I			Warwick-	
implementatio	RubénLópez-			Edinburgh	
n of COVID-19	Bueno			Mental	
social	DaraghMcDermott			Well-being	
distancing	2			Scale	
measures [83]	Joseph Firth				
	Igor Grabovac				
	AnitaYakkundi				
	Nicola Armstrong				
	0				
	Timothy Young				

	LeeSmith				
Is Physical Activity Associated with Mental Health among Chinese Adolescents during Isolation in COVID-19 Pandemic? [84]	Sifan Kang, Yuliang Sun, Xinxin Zhang, Fangjun Sun, Bingqi Wang, and Wenfei Zhu	Cross sectional study	4898 Chinese adolescents	Online survey involving IPAQ questionna ire	Higher physical activity levels were associated with lower mood disturbance among participants
Physical Activity Protects Against the Negative Impact of Coronavirus Fear on Adolescent Mental Health and Well- Being During the COVID-19 Pandemic [85]	Laura J. Wright, Sarah E. Williams and Jet J. C. S. Veldhuijzen van Zanten	Cross sectional study	165 UK adolescents	Online Questionn aire. Outcome measures used include; Perceived Stress Scale, a non- exercise estimate of cardio- respiratory fitness (CRF)	Physical activity in contrast to fear was a positive mental health predictor among the adolescents
Mental health problems among Chinese adolescents during the COVID-19: The importance of	Xinli Chi, Kaixin Liang, SiTong Chen, Qiaomin Huang, Liuyue Huang,	Cross sectional study	1,794 Chinese adolescents	Survey conducted with Outcome measures; Chinese version of the fear of	Reduction in depressive and anxiety symptoms with active physical activities

nutrition and physical activity [86]	QianYu, CanJiao, Tianyou Guo, Brendon Stubbs, Md Mahbub Hossain, AlbertYeung, Zhaowei Kong, Liye Zou			COVID-19 scale, IPAQ-SF, Youth Self Rating Insomnia Scale (YSIS)	and an additional reduction in insomnia with greater physical activity engagemen t
Physical and mental health of older people while cocooning during the COVID-19 pandemic [87]	Bailey et al 2021	Cross sectional study	150 older adult patients	Survey of 150 older adult patients	Reduction in physical activity engagemen t was associated with worsening in mental health state and feeling of 'loneliness'
Is Physical Activity Associated with Less Depression and Anxiety During the COVID-19 Pandemic? A Rapid Systematic	Sebastian Wolf, Britta Seiffer, Johanna-Marie Zeibig, Jana Welkerling, Luisa Brokmeier, Beatrice Atrott, Thomas Ehring & Felipe Barreto Schuch	Systematic Review	42,293 participants	N/A	Increased physical activity engagemen t was associated with a reduction in anxiety and depression

Review [88]					
Associations of	Baeur et al 2020	Cross	4,271	Online	Less
exercise and		sectional	German	survey	exercise
social support		study	adults	using the	directly
with mental		-		following	linked to
health during				outcome	more
quarantine and				measures;	anxiety,
social-				PHQ-D –	depression
distancing				for anxiety	and sleep
measures				and	disorders.
during the				depression,	More
COVID-19				PAHCO -	physical
pandemic: A				for	activity
cross-sectional				physical	could be
survey in				activity	associated
Germany [89]				associate	with better
				health	mental
				competenc	health
				e	outcomes
Association of	Deng et al 2020	Cross	1607	Online	Regular
Association of Web-Based	Deng et al 2020	Cross sectional	1607 participants	Online Survey	Regular and
Association of Web-Based Physical	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing	Regular and sufficient
Association of Web-Based Physical Education	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the	Regular and sufficient exercise
Association of Web-Based Physical Education With Mental	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following	Regular and sufficient exercise elicited an
Association of Web-Based Physical Education With Mental Health of	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome	Regular and sufficient exercise elicited an enhanceme
Association of Web-Based Physical Education With Mental Health of College	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures;	Regular and sufficient exercise elicited an enhanceme nt in
Association of Web-Based Physical Education With Mental Health of College Students in	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21	Regular and sufficient exercise elicited an enhanceme nt in mental
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for	Regular and sufficient exercise elicited an enhanceme nt in mental state and
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During the COVID-19	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for assessing	Regular and sufficient exercise elicited an enhanceme nt in mental state and wellbeing
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During the COVID-19 Outbreak:	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for assessing stress,	Regular and sufficient exercise elicited an enhanceme nt in mental state and wellbeing
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During the COVID-19 Outbreak: Cross-	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for assessing stress, depression	Regular and sufficient exercise elicited an enhanceme nt in mental state and wellbeing
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During the COVID-19 Outbreak: Cross- Sectional	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for assessing stress, depression and	Regular and sufficient exercise elicited an enhanceme nt in mental state and wellbeing
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During the COVID-19 Outbreak: Cross- Sectional Survey Study	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for assessing stress, depression and anxiety	Regular and sufficient exercise elicited an enhanceme nt in mental state and wellbeing
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During the COVID-19 Outbreak: Cross- Sectional Survey Study [90]	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for assessing stress, depression and anxiety levels,	Regular and sufficient exercise elicited an enhanceme nt in mental state and wellbeing
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During the COVID-19 Outbreak: Cross- Sectional Survey Study [90]	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for assessing stress, depression and anxiety levels, pedometer	Regular and sufficient exercise elicited an enhanceme nt in mental state and wellbeing
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During the COVID-19 Outbreak: Cross- Sectional Survey Study [90]	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for assessing stress, depression and anxiety levels, pedometer step	Regular and sufficient exercise elicited an enhanceme nt in mental state and wellbeing
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During the COVID-19 Outbreak: Cross- Sectional Survey Study [90]	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for assessing stress, depression and anxiety levels, pedometer step counter for	Regular and sufficient exercise elicited an enhanceme nt in mental state and wellbeing
Association of Web-Based Physical Education With Mental Health of College Students in Wuhan During the COVID-19 Outbreak: Cross- Sectional Survey Study [90]	Deng et al 2020	Cross sectional study	1607 participants	Online Survey utilizing the following outcome measures; DASS-21 for assessing stress, depression and anxiety levels, pedometer step counter for physical	Regular and sufficient exercise elicited an enhanceme nt in mental state and wellbeing

				levels.	
Relationships between changes in self- reported physical activity, sedentary behavior and health during the coronavirus (COVID-19) pandemic in France and Switzerland [91]	Cheval et al 2020	Observationa l Longitudinal study	267 & 110 participants at first and second sets of data collection	Online survey among participant s in France and Switzerlan d. Outcome measures used include; PROMIS questionna ire	Maintainin g physical activity engagemen t and reducing sedentary time serves as a useful coping strategy for stressful events such as the COVID-19 pandemic
Protective elements of mental health status during the COVID-19 outbreak in the Portuguese population [92]	Moreira et al 2020	Cross sectional study	1280 Portuguese participants	Online survey among adults, utilizing the following outcome measures; Depression , Anxiety and Stress Scale (DASS-21), Obsessive Compulsiv e Inventory (OCI)	Higher physical activity had a positive impact on mental health and wellbeing in contrast to sedentary habits and increased scree time
Mental Health	Plomecka et al	Cross	13,332	Online	Daily

Impact of COVID-19: A global study of risk and resilience factors [93]	2020	sectional study	worldwide participants	survey	exercises, optimism and ability to open up and share thoughts predicted lower psychologi cal symptoms
Associations of moderate to vigorous physical activity and sedentary behavior with depressive and anxiety symptoms in self-isolating people during the COVID-19 pandemic: A cross-sectional survey in Brazil [94]	Schuch et al 2020	Cross sectional study	937 participants in Brazil	Online survey. The following outcome measures were used; Beck Depression /Anxiety Inventories (BDI and BAI)	Participants who engaged in more moderate to vigorous intensity physical activities were less likely to encounter symptoms of depression and anxiety
Factors linked to changes in mental health outcomes among Brazilians in quarantine due to COVID-19 [95]	Filgueiras and Stults- Kolehmainen	Longitudinal study	360 adult participants in Brazil	Online Questionn aires. Outcome measures include; Perceived Stress Scale (PSS-10), Filgueiras	Exercise engagemen t and Tele- psychother apy were beneficial stress modulators in contrast to poor diet and

				Depression Inventory (FDI) and a subscale of State- Trait Anxiety Inventory (S-STAI). Socio- demograph ic questionna ire	excessive consumptio n of COVID-19 information
Coping behaviors associated with decreased anxiety and depressive symptoms during the COVID-19 pandemic and lockdown [96]	Fullana et al 2020	Cross sectional study	5,545 Spanish Adult participants	Online Survey	Findings suggest physical activity is a positive coping behavious to combat and prevent anxiety and depressive symptoms during the COVID-19 lockdown
Elevated depression and anxiety symptoms among pregnant individuals during the COVID-19	Lebel et al 2020	Cross sectional study	1987 pregnant Canadian women	Online survey of Canadian pregnant women	Higher levels of Physical activity and psychosoci al support were associated with reduced

pandemic [97]					psychologi cal
					symptoms
Longitudinal	Planchuelo-Gómez	Longitudinal	4,724	2 online	Physical
evaluation of	et al 2020	study	participants	surveys.	activity
the				Outcome	positively
psychological				measures	impacted
impact of the				used	psychologi
COVID-19				include;	cal
crisis in Spain				DASS –	parameters
[98]				21 and	such as
				Impact of	stress,
				Event	anxiety and
				Scale	depression
				(IES)	

Table 4

10. DISCUSSION

The present narrative review aimed to establish the role of physical activities and the corresponding mental health impact admits the COVID-19 pandemic. The lockdowns during the COVID-19 pandemic have influenced physical activity levels such that in most cases, there has been a reduction in vigorous intensity physical activities with an increase in sedentary habits and screen time alongside some level of increase in moderate intensity physical activities. This study included 23 studies that fulfilled the inclusion criteria. Additionally, this narrative review comprises information on 100,175 people worldwide. Studies that found more engagement in physical activities, demonstrated results that were associated with an enhancement in mental health state, psychological parameters and overall wellbeing. Similarly, studies that found a reduction in physical activity participation during the COVID-19 lockdowns, found an associated increase in anxiety, stress levels, depression and negative mental health outcomes. The results demonstrated in this narrative review aligns with findings from similar studies and existing literature [88,93, 94,95,98] which shows that physical activity engagement demonstrates a positive influence on mental health outcomes and general wellbeing admits the COVID-19 pandemic.

11. CONCLUSION

The COVID-19 pandemic has introduced changes to the way of life as many people know it and adaptability to these changes may be more challenging to some people than others. Results from the studies in this narrative review demonstrate a positive relationship existing between physical activity engagement and psychological well-being. Physical activity participation has been irrevocably identified for numerous health benefits, which extend beyond the physical health and include mental health enhancement. Recently, there has been an Increase in attention towards the mental health benefits of physical activities in the literature. The devastating impact of the COVID-19 pandemic poses a significant mental health threat which dignifies the need for utilizing physical activity engagement as a means to tackle stress levels and associated mental health challenges that are directly linked to the pandemic. It is therefore paramount to encourage more physical activities admits the COVID-19 pandemic.

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