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REVIEW

Improving Mental Health through Physical Activity: A Narrative Literature Review

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Regular participation in physical activity, either recreational, or planned, structured, and repetitive is capable of yielding a multitude of health-improving benefits. Traditionally, physical activity has been recognized for its robust modulatory effects on cardiometabolic, neuromusculoskeletal, and immunological health and function. However, a sufficient quantity of emerging studies lends credence to its inclusion to improving mental health, warranting consideration as an adjuvant modality in treating mental illnesses and emotional and behavioral disorders. A series of studies evaluating the impact of physical activity on mental health revealed that achieving physical activity guidelines jointly set forth by the American College of Sports Medicine (ACSM) and Centers for Disease Control and Prevention (CDC) can reduce onset, incidence, and severity of depression as well as mitigating stress and anxiety. The findings of our review lend further support for physical activity as a means to bolster mental health and serve as a powerful resource for working populations.

Keywords: exercise; metabolic equivalents of task; literature review; work ability; depression; anxiety; COVID-19

Introduction

Physical activity has its roots in ancient times. It is speculated that the foundation of contemporary Yoga spawned from the Indus valley civilization during the nascent years of the Bronze Age around 3000 B.C. Ancient Chinese records dating to 2500 B.C. depict activities emulating animal movement, specifically the monkey, tiger, and the viper, which served as cornerstones for medical gymnastics that evolved into the practice of Kung Fu. Centuries later, physical activity was woven into ancient Greek culture, serving as a protuberant element within education curricula and if almost clairvoyantly, identified and promoted to treat disease, improve health, and prepare for athletic endeavors.

The health benefits of regular physical activity are extensive and profound. Participation in regular physical activity helped avert cardiometabolic disease, breast and colon cancers, osteoporosis, and reduced all-cause mortality risk — correlating fitness levels with death from any cause, including cardiovascular disease (Warburton, Nicol, & Bredin, 2006), citing an earlier examination of population exercise testing revealing exercise capacity and adulthood recreational activity were stronger predictors of mortality than smoking, hypertension, obesity and diabetes (Myers et al., 2004). Mechanical loading and repeated exposure to gravitational forces achieved through regular physical activity elicit improvements in a constellation of qualities such as muscular strength and muscular endurance (Kraemer, Ratamess, & French, 2002), bone mineral density (Skerry, 1997; Kohrt, Barry, & Schwartz, 2009) comprising neuromusculoskeletal fitness which facilitates activities of daily living necessary for prolonging a functional and independent life. The incorporation of exercise, which is generally defined as physical activity that is planned, structured, and repetitive (Caspersen, Powell, & Christenson, 1985), cultivates improvements in body composition as well as various fitness qualities and biomotor skills thus augmenting performance in athletic competition.

While physical activity has been traditionally accepted to ameliorate disease risk and confer tangible physical benefits resulting from regular engagement, its applicability in improving mental health has been less clear among medical, mental health, and exercise professionals. However, in acknowledgement of the mental health crisis the United States and the rest of the world is grappling with, the promotion and inclusion of physical activity as an adjuvant treatment of mental illness and emotional and behavior disorders is worthy of consideration. According to the National Institute of Mental Health, nearly one in five U.S. adults (52 million Americans) is dealing with mental illness per the 2019 National Survey on Drug Use and Health conducted by the Substance Abuse and Mental Health Services Administration. The convergence of public health, economic, and societal crises initiating in 2020 served as a watershed moment that inequality and disparities in resources exist, but more harrowingly that the United States is panged by an illness significantly more widespread than COVID-19 and less reported than the common cold. Recent survey data and studies unveiled that COVID-19 intensified the extant societal mental health crisis (Czeisler et al., 2020).

In its Stress in America™ 2020 report, the American Psychological Association reported that 78% of Americans consider COVID-19 as a significant stressor within their lives and one in five adults reported that their mental health is worse than it was the prior year.

Paralleling issues have been observed within the workforce over the past year as stress associated with perception of safety, pathogen transmission risk concerns and deployment of transmission risk mitigation measures resulting in quarantine, confinement and social exclusion, misinformation, and actual or potential financial impact and job insecurity (Hamouche, 2020). Additionally, dependent care needs mounted amid COVID-19 as many schools were closed nationwide as a preemptive measure to thwart the spread of the virus.

Healthcare workers were most adversely impacted by COVID-19. A meta-analysis comprising 189,159 subjects revealed a 16% percent prevalence of depression and a 15% prevalence of anxiety (Cenat et al., 2020). Another meta-analysis of cross-sectional studies involving healthcare workers with a cumulative sample size of 13,641 generated the following outcomes expressed as percentages of the subject pool: stress (40.6%), depression (32%), and insomnia (38%) (Varghese et al., 2021). Leisure and hospitality workers and those in customer-facing roles faced similar procedural driven depression and anxiety causing stressors as a result of COVID-19 (Fung Wong et al., 2021).

Physical Activity Effects the Brain

Acutely, physical activity modulates key central nervous system neurotransmitters that are associated with alertness (norepinephrine), the “pleasure and reward system” (dopamine), and anxiety level (serotonin). Physical activity also prompts the secretion of two distinct neurochemical factors — opioids and endocannabinoids — which collectively elicit a sense of euphoria and well-being, anxiolytic effects, sedation, and decrease sensitivity to pain in humans (Matta Mello Portugal et al., 2013). Optimized affect and blunted stress response have been observed for a period of up to 24 hours post exercise cessation (Basso & Suzuki, 2017). Streamlined executive functions dependent upon the prefrontal cortex encompassing attentional focus, procedural, semantic, and relational memory, cognitive flexibility, verbal fluency, decision making, and inhibitory control have been shown to last up to two hours post exercise cessation (Basso et al., 2015).

Singular bouts of exercise emit a nexus of neurotrophic factors, including brain-derived neurotrophic factor (BDNF), neurotrophin-3, glial cell line-derived neurotrophic factor, and nerve growth factor, that concomitantly facilitate the development, sustenance, and differentiation neurons as well as signaling growth factors such as insulin-like growth factor (IGF-1), vascular endothelial growth factor (VEGF), fibroblast growth factor (FGF-2), and epidermal growth factor that jointly regulate a host of metabolic processes. These trophic factors have been implicated in dictating a person’s cognition and behavior post-exercise.

Chronic adaptations to physical activity include increased basal levels of growth factors, cerebral blood perfusion, and cerebral angiogenesis (Zia et al., 2021). Heightened blood lactate accumulation, which occurs during intense exercise or intensity of exercise to which one is unaccustomed, is speculated to stimulate angiogenesis that is mediated by hydroxycarboxylic acid receptor 1 (HCAR1) (Morland et al., 2017). Regular participation in physical activity also streamlines hypothalamus-pituitary-adrenal (HPA) axis functioning in turn, lessening cortisol secretion, and synchronizing the equilibrium of leptin and ghrelin –two hormones that are regulated by the central nervous system and responsible for appetite – in the presence of suboptimal nutrition and exposure to stress (Stranahan, Lee, & Mattson, 2008). In consideration of the brain's immense oxygen demand and lipid-rich constituency, it is vulnerable to oxidative stress (Powers, Talbert, & Adhihetty, 2011). Stress inducing free radicals such as superoxide dismutase, catalase, and glutathione peroxidase are better tolerated and neutralized by persons who engage in regular physical activity (Radak, Chung, & Goto, 2008). The immunomodulatory benefits of regular physical activity include optimization of catecholamine and cortisol levels, thereby reducing systemic inflammation which has been postulated as a risk factor for developing depression (Lee & Giuliani, 2019). Regular participation in physical activity has proffered elevations in plasma BDNF which is postulated to allay amyloid beta toxicity that is implicated in the progression of Alzheimer's (Huang et al., 2021).

Review of the Literature

Sedentary behavior, characterized by protracted bouts of physical inactivity with an energy expenditure below 1.5 metabolic equivalents (METs) while in sitting, reclining, or lying posture (Tremblay et al., 2017), is a risk factor for depression (Huang et al., 2020). Seventy-five percent of occupations are dependent upon work on the computer (Giandonato, Tringali, & Policastro, 2015), resulting from an infusion of workplace technology and automated processes with an attendant decrease in occupations involving physical labor. While sedentary workers may be shielded from many of the hazards associated with more physically demanding occupations (e.g. manual laborers), they may gain less of the benefits of physical activity and be exposed to more of the detrimental effects of inactivity. As a measure to mitigate cardiometabolic disease risk and improve health associated with sedentary behavior, the American College of Sports Medicine (ACSM) and Centers for Disease Control and Prevention (CDC) recommend that all healthy adults aged 18–65 should engage in moderate intensity aerobic physical activity (≤3.0 to <6 METs) for a minimum of 30 minutes five days per week, accumulating 150 weekly minutes, or vigorous intensity aerobic activity (≤ 6 METs) (de Almeida Mendes et al., 2018) for a minimum of 20 minutes three days per week, totaling 60 weekly minutes. Additionally, the ACSM and CDC recommend the inclusion of activities aimed at maintaining or increasing muscular strength and endurance, performed at a minimum of two days per week (Piercy et al., 2018).

The effects of sedentary behavior on depression were analyzed in a survey of 962 adults, whose physical activity and sedentary behaviors, as well as depressive symptoms, were assessed utilizing the International Physical Activity Questionnaire (IPAQ) and combination of the Patient Health Questionairre-9 (PHQ-9) and Montgomery-Åsberg Depression Rating Scale Self-Report Version (MADRS-S), respectively (Zhai, Zhang, & Zhang, 2015). The MADRS-S was used to cull any depressive symptoms spanning the prior 14 days. Univariate logistic regressions showed that aspects of both physical activity (high PA used as reference category) and sedentary behavior (low SB as reference) were related to more depressive symptoms on both the MADRS-S ($p < .05$) and the PHQ-9 ($p < .05$). Further analysis using these variables as predictors of depression symptoms corroborated sedentary behavior as a risk factor of depression.

Failure to achieve the recommended physical activity guidelines resulted in greater depressive symptoms according to a cross-sectional analysis of physical activity patterns of 165 adults with mild to moderate depressive and/or anxiety disorder symptoms (scoring ≥10 on the PHQ-9). Diagnoses were made using Mini International Neuropsychiatric Interview (MINI) and symptom severity was measured with the Montgomery-Åsberg Depression Rating Scale (MADRS). The participants wore accelerometers for a week to evaluate physical activity patterns. Among the key findings were depressed participants tended to be less active and more sedentary (Zhai, Zhang, & Zhang, 2015). Only one-fifth of the sample followed public health guidelines regarding physical activity. Each one-point increase in MADRS was associated with a 2.4 minute reduction in light physical activity, independent of moderate-to-vigorous physical activity and sedentary time. MADRS was positively associated with a number of sedentary bouts.

Correlations between physical activity behavior and odds of developing depression were extrapolated from an examination of 49 prospective cohort studies comprising 266,939 participants (Schuch et al., 2018). Demographic and clinical data, data of physical activity and depression assessments, and odds ratios, relative risks, and hazard ratios with 95% confidence intervals were extracted. In comparison to people who participated in physical activity less frequently, regular participants had lower odds of developing depression. Among youths, physical activity was found to confer a protective effect against the emergence of depression. Protective effects of physical activity on depression among participants of multiple age groups spanned Asia, Europe, North America, and Oceania. Achieving the joint ACSM/CDC physical activity recommendations was found to reduce incident depression by 22%.

Correlations between aerobic and resistance training exercise with depressive symptom severity were established drawing from the US 2015 Behavioral Risk Factor Surveillance System which surveyed 17,839 adults (18–85 years) (Bennie, Teychenne, De Coker, & Biddle, 2019). Surveying was conducted via phone interviews which inventoried each subject's moderate-to-vigorous physical activity (MVPA), resistance training, and depressive symptom severity. Prevalence ratios of depressive symptom severity (mild, moderate, moderately severe, and severe) were determined across categories of physical activity guideline adherence, adjusting for a set of potential cofounders. When compared with those meeting neither guideline for mild, moderate, moderately severe, and severe depressive symptoms, the prevalence ratios were lowest among respondents meeting both aerobic and resistance training exercise guidelines (0.26–0.54), followed by aerobic exercise only (0.36–0.62) and resistance training exercise only (0.49–0.84). Achieving both the aerobic exercise and resistance training exercise guidelines resulted in the lowest likelihood of reporting depressive symptoms.

Per findings from the 2015–2016 Canadian Community Health Survey (CCHS), comprising the Patient Health Questionnaire (PHQ-9) with a 10+ dichotomization (indicating moderate-to-severe depression symptoms), self-reported diagnoses of mood and anxiety disorders, and self-perceived mental health culled from 110,000 respondents (aged 18+), regular recreational physical activity was found to enhance mental health (Zulyniak et al., 2020). Regular participation in physical activity was found to be most strongly associated with overall PHQ-9 scores and perceived mental health outcomes. The study's authors recommended that participation be influenced by preference and ability to cultivate adherence necessary to derive health-improving chronic adaptations to exercise though said beneficial adaptations can be achieved irrespective of enjoyment of physical activity (Raedeke, 2007).

Saavedra (2021) found that performing either aerobic exercise or resistance training exercise during working hours was capable of evoking predictable improvements in body composition via reductions in fat mass and concomitant increases in fat free mass, as well as bolstering cardiorespiratory fitness while improving mental health. The study included 47 healthy office workers (aged 45±11.95 years) who were divided into three cohorts: aerobic exercise, resistance training exercise, and a control. Both exercise interventions encompassed (3) weekly 30-minute sessions performed for 12-weeks. Aerobic exercise sessions required a brisk walk maintained at 100 strides per minute, whereas the resistance training exercise sessions involved movements targeting multiple muscle groups performed in a circuit-like cadence with progressing volume and inversely related work to rest ratios, titrating down from 2:1 during weeks 1–8 to 3:1 in weeks 9–12. Following the protocol, both resistance training and aerobic exercise groups reported improvements in stress, depressive symptoms, and anxiety (Saavedra, 2021). An earlier study involving an exercise protocol conducted two days per week for a period of 5-months demonstrated improvements in sleep quality (Manon Genin et al., 2017) which has been proven to impact mental health, particularly among non-clinical populations (Del Rio Joã et al. 2018).

Enabling employees to engage in physical activity within or proximate to the workplace during work hours as part of larger workplace health initiatives has captured the interest of business leaders within multiple sectors. Physical activity interventions have proven beneficial in educing and upholding health-related improvements contributing to work ability (Smolander, Blair, & Kohl, 2000). Work ability is a concept that was developed by Ilmarinen and a research group of the Finnish Institute of Occupational Health (FIOH) in the 1980s as a means to quantify a worker's physical and mental ability to manage the demands of their work. Overall, for work ability to remain sufficient, the demands of work should not exceed the individual's resources. Moreover, the sustainability of an individual's working life is strongly influenced by their work ability. Decreased work ability is predictive of reduced work performance, stress, depression, and emotional exhaustion in addition to long-term sickness absence and earlier retirement (Ilmarinen et al., 1997, Ilmarinen, 2001).

Work-related stress, which is often a consequence of high job demands, both physical and mental, role ambiguity, or lack of autonomy, has been associated with reduced work ability (Bethge et al., 2009, Li et al., 2015). This negative relationship between work-related stress and work ability exists in a variety of occupational groups (Li et al., 2015). Likewise, several common mental disorders can be predicted by job strain and high psychological demands and are associated with poor work ability. Physicians who reported higher levels of fatigue, anxiety, burnout, depression, and stress were 3.5–13.6 times more likely to have insufficient work ability (Ruitenburg et al., 2012). These findings underscore the significance of reduced work ability as a signal for poor or declining mental health. Moreover, earlier research suggests physical activity is a beneficial means to maintain and improve individual resources – including the mental reserves necessary for preserving work ability (Ilmarinen, 1997, Ilmarinen, 2001).

Discussion

In response to current employment trends, including the proliferation of remote and flexible work arrangements, institutional or corporate wellness programs remain uniquely positioned to promote the inclusion of physical activity to improve and uphold physical and mental health among large populations. Arguably, no entities confer greater influence on population health. Accordingly, workplace health promotion practitioners should formulate health messaging to encourage participation in physical activity, elucidate its benefits, and provide resources, actionable strategies, and offer creative, customized solutions to help their populations achieve greater physical and mental health as society and the working world transition back to normalcy.

Conclusion

Based on the reviewed literature, physical activity can serve as an effective intervention to preserve or improve physical and mental health. Within working environments, physical activity interventions offer an attractive, cost-effective opportunity for employers to support the physical and mental health of their workforce and in turn, produce a positive impact on employees' work ability.

Competing Interests

The authors have no competing interests to declare.

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