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The Role of Physical Activity in the Prevention and Management of Mental Health Disorders: A Review

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Abstract

Introduction and Purpose:

Mental health disorders such as depression, anxiety, and stress-related conditions are major contributors to global disability. Growing evidence indicates that physical activity is an effective non-pharmacological strategy for preventing and managing these conditions. This review aims to summarize current knowledge on the impact of physical activity on mental health and the mechanisms through which it exerts its effects.

Material and Method:

A narrative review was conducted using PubMed, Scopus, and Google Scholar to identify studies from 2010-2025 examining physical activity and mental health outcomes in adults. Priority was given to randomized trials, systematic reviews, and meta-analyses exploring exercise-based interventions and their psychological or physiological effects.

Results:

The analyzed literature shows that regular physical activity - particularly aerobic and moderate-intensity exercise - supports mood regulation, enhances cognitive functioning, and increases resilience to stress. Reported mechanisms include neurobiological changes such as improved neurotransmitter balance, reduced inflammation, and enhanced neuroplasticity, alongside psychological benefits such as increased self-efficacy and reduced rumination. Structured exercise programs also demonstrate efficacy as adjuncts to psychotherapy and pharmacotherapy.

Conclusions:

Physical activity represents a valuable and evidence-based component of mental health promotion and treatment. Incorporating tailored exercise interventions into prevention strategies and clinical care may significantly improve psychological well-being and reduce the burden of mental health disorders.

Keywords: physical activity; mental health; depression; anxiety; prevention; exercise therapy

1. Introduction

Mental health disorders represent one of the most significant public-health challenges globally, affecting an estimated one in four individuals at some point in their lives. World Health Organization (2023) reports that depression and anxiety are among the most prevalent conditions and contribute substantially to the global burden of disease. Despite advances in pharmacological and psychotherapeutic treatments, many patients continue to experience incomplete remission, persistent symptoms, or relapse, highlighting the need for supplementary and preventive strategies beyond conventional care (*Mental Disorders*, b.d.; Vendrik et al., 2021).

In recent years, physical activity (PA) has emerged as a highly promising lifestyle-based intervention for both the prevention and management of mental health disorders. According to a dose-response meta-analysis by Matthew Pearce et al. (2022), adults engaging in higher volumes of physical activity had significantly lower risk of incident depression—those achieving approximately half the recommended volume (4.4 mMET-h/wk) had an 18 % lower risk, and those reaching the full recommended volume (8.8 mMET-h/wk) had a 25 % lower risk compared with inactive adults (Pearce et al., 2022; Singh et al., 2023a; White et al., 2024). Furthermore, the benefits appeared stronger at lower levels of activity, suggesting that even modest increases in PA may yield meaningful mental-health gains (Pearce et al., 2022).

Beyond epidemiological associations, an umbrella review by Ben Singh et al. (2023) synthesised 97 systematic reviews and more than 1,000 randomised trials, concluding that physical activity interventions produced moderate improvements in symptoms of depression and anxiety across diverse adult populations (Singh et al., 2023b). Together, these findings underscore the potential of structured PA programs to serve as effective adjuncts or alternatives to traditional psychotherapy and pharmacotherapy, with the added benefits of cost-effectiveness, low side-effect burden and broad accessibility(Heissel et al., 2023; Kvam et al., 2016) .

The mechanisms by which physical activity exerts its beneficial effects on mental health are multifaceted and include physiological and psychological pathways. From a physiological perspective, regular PA reduces systemic inflammation, modulates the hypothalamic–pituitary–adrenal axis, enhances brain-derived neurotrophic factor (BDNF) signalling, improves vascular function, and increases neuroplasticity. Psychologically, PA boosts self-efficacy, enhances mood regulation, decreases rumination, improves sleep quality, and strengthens social connectedness. A systematic review by R. L. White et al. (2024) identified strong evidence for mediators such as affect, self-esteem, resilience and social support, and highlighted how moderators like fitness level and exercise context influence the effect size of PA on mental-health outcomes (Pearce et al., 2022; White et al., 2024).

Given the magnitude of the problem and the accumulating evidence, integrating physical activity into the prevention and treatment of mental health disorders becomes increasingly important. This review aims to summarise current knowledge on how PA can mitigate the onset and severity of mental-health conditions, emphasising three core domains: (1) the underlying mechanisms of action; (2) the types and modalities of exercise and their relative efficacy; and (3) practical applications and integration of PA into treatment protocols and public-health strategies. By drawing on observational studies, randomised controlled trials and meta-analyses, the review provides a comprehensive and evidence-based perspective on the role of physical activity in mental-health promotion.

2. Methods

This narrative review was developed through a comprehensive literature search aimed at identifying current scientific evidence on the relationship between physical activity and mental health. The search was conducted across major academic databases, including PubMed,

Scopus, and Google Scholar, covering publications from 2010 to 2025. To ensure the relevance and precision of the retrieved studies, a set of targeted keywords was used, such as “*physical activity*,” “*mental health*,” “*depression*,” “*anxiety*,” “*exercise therapy*,” and “*prevention*.”

The selection process focused on research investigating the effects of various forms of physical activity on mental health outcomes in adult populations. Priority was given to high-quality sources, particularly meta-analyses, systematic reviews, and randomized controlled trials, as these provide the most robust and reliable evidence. Additional observational and interventional studies were considered when they contributed meaningful insights into mechanisms of action, preventive potential, or therapeutic effectiveness.

All included studies were screened for methodological rigor, relevance to the research question, and clarity of reported outcomes. Publications lacking empirical data, offering insufficient methodological detail, or addressing unrelated populations or interventions were excluded. The extracted data were then synthesized qualitatively, allowing for a structured evaluation of the existing evidence, identification of consistent patterns across studies, and highlighting of gaps requiring further investigation.

3. Physical Activity as a Preventive Factor in Mental Health Disorders

A large body of epidemiological research indicates that individuals who engage in regular physical activity have a lower risk of developing mood disorders, particularly depression. A meta-analysis of 49 prospective studies ($N \approx 266,939$) found that individuals with the highest levels of physical activity had significantly lower odds of developing depression compared with those who were least active (adjusted OR = 0.83), corresponding to approximately a 17% lower risk across all age groups and geographic regions (Schuch et al., 2018).

More recent dose-response analyses confirm that even relatively modest increases in activity yield significant benefits: individuals achieving half of the recommended weekly dose of physical activity showed an ~18% lower risk of depression compared to inactive individuals, while meeting full recommendations was associated with a ~25% reduction. The relationship is nonlinear, with the greatest benefits observed when moving from inactivity to low levels of activity (Pearce et al., 2022).

The mechanisms underlying this protective effect are multifactorial, encompassing both psychosocial factors (e.g., improved self-esteem, increased social integration, better sleep quality) and biological processes (neuroplasticity, modulation of inflammation, and neuroendocrine regulation). Physical activity can strengthen self-regulatory and cognitive control mechanisms (top-down regulation), thereby enhancing emotional resilience - particularly during adolescence (Belcher et al., 2021).

One key biological pathway involves the regulation of the stress response through the hypothalamic–pituitary–adrenal (HPA) axis. Dysregulation of the HPA axis—such as hyperactivity and impaired cortisol feedback—has been linked to increased risk and severity of affective disorders. Exercise has been shown to normalize HPA axis activity and related inflammatory and neurobiological mechanisms, partially explaining its protective effects (Menke, 2024).

The benefits of physical activity are evident across different age groups:

- **Youth and adolescents:** Physical activity during developmental stages supports neural network maturation and self-regulatory capacities, fostering improved emotional regulation and greater stress resilience. Cross-sectional and longitudinal studies report strong associations between higher activity levels, enhanced mental well-being, and reduced anxiety symptoms (Belcher et al., 2021).
- **Adults:** Prospective cohort studies consistently show an inverse relationship between physical activity and depressive symptoms, with the most pronounced effects occurring when individuals transition from inactivity to moderate activity levels (Pearce et al., 2022).
- **Older adults:** Among older individuals, regular physical activity is associated with lower risk of cognitive decline and better psychological functioning. Meta-analyses and interventional reviews indicate that aerobic and resistance training, in particular, improve global cognitive performance in those with mild cognitive impairment (MCI) and may concurrently alleviate depressive symptoms (Ahn & Kim, 2023).

In summary, evidence from prospective and meta-analytic studies strongly supports physical activity as a significant preventive factor against mental health disorders. Meaningful mental health benefits can be achieved even with small increases in physical activity among previously inactive individuals. The protective effects are mediated by both psychosocial factors (e.g., self-efficacy, social support) and biological processes (e.g., neuroplasticity, HPA axis regulation, inflammation modulation) (Ahn & Kim, 2023; Belcher et al., 2021; Menke, 2024; Pearce et al., 2022; Schuch et al., 2018).

4. Physical Activity as a Therapeutic Tool in Mental Health Management

4.1 Depression

Evidence from systematic reviews and meta-analyses of randomised controlled trials (RCTs) suggests that physical exercise can produce effects comparable to antidepressant medications in individuals with mild to moderate depression. For example, a network meta-analysis of 21 RCTs ($n = 2,551$) found no significant difference in symptom reduction between exercise interventions and antidepressant therapy ($SMD = -0.12$; 95% CI -0.33 to 0.10) in non-severe depression, supporting the notion that exercise may serve as an alternative or adjunctive treatment (Recchia et al., 2022). Further, added to standard treatment (antidepressants or psychotherapy), exercise produced a moderate pooled effect ($SMD = -0.62$; $p < 0.00001$) compared to standard treatment alone (Stubbs et al., 2016).

Both aerobic (e.g., walking, cycling) and resistance (strength) training have shown beneficial outcomes, though some studies indicate aerobic forms may be slightly more effective in mood enhancement, possibly via mechanisms such as increased neurotrophic factors, improved vascular regulation, and enhanced self-efficacy.

4.2 Anxiety Disorders

Physical activity also plays a significant therapeutic role in anxiety disorders. A systematic review and meta-analysis of prospective cohort studies found that higher levels of physical activity were associated with lower odds of developing anxiety disorders (OR for any anxiety disorder ~ 0.66 ; 95% CI 0.53 - 0.82) (Muth et al., 2022; Schuch et al., 2018). Additionally, in treatment contexts, exercise interventions have demonstrated moderate effects ($SMD \sim -0.66$;

95% CI -0.89 to -0.43) in reducing anxiety symptoms in older adults, with benefits observed for both aerobic and resistance training modalities (Agbangla et al., 2023; Cadore et al., 2014; Da Silva et al., 2022). The underlying mechanisms may include modulation of neurotransmitters such as γ -aminobutyric acid (GABA) and serotonin, improved autonomic balance, and enhanced neuroplastic adaptation, which contribute to a lower sensitivity to anxiety triggers and better emotional regulation.

4.3 Stress and Burnout

The role of physical activity in mitigating stress and occupational burnout is supported by emerging evidence. A recent systematic review found that physical activity interventions in workplace settings yield small but significant reductions in stress (effect size $d = -0.24$; 95% CI -0.83 to 0.35), highlighting the importance of tailored, sustained activity programmes for improving employee resilience and well-being (Abdin et al., 2018; Gunawan et al., 2025). Meta-analytic data on cortisol regulation demonstrate a small negative correlation between physical activity and the diurnal cortisol slope ($r = -0.043$; 95% CI -0.080 to -0.004), suggesting improved regulation of the HPA axis in physically active individuals (Moyers & Hagger, 2023). In healthcare workers, higher levels of physical activity were consistently associated with lower levels of emotional exhaustion and depersonalization, suggesting a protective effect against burnout (Budde et al., 2025).

Together, these findings support the use of physical activity not only as a preventive strategy (see Chapter 3) but also as a **therapeutic tool** in managing mental health disorders - across depression, anxiety and burnout/stress conditions. Clinicians and mental-health practitioners should consider prescribing structured activity programmes (aerobic and/or resistance) as part of an integrated treatment plan.

5. Mechanisms Linking Physical Activity and Mental Health

5.1 Neurobiological Mechanisms

Neurotransmitter regulation: Regular physical activity is associated with modulation of key neurotransmitter systems implicated in mood disorders. For example, exercise can enhance serotonergic, dopaminergic and endorphin-mediated signalling, contributing to improved affect and reduced depressive symptoms (Hossain et al., 2024; Phillips & Fahimi, 2018).

Neuroplasticity: Exercise promotes neuroplastic processes; a meta-analysis of 29 studies ($N = 1,111$) found a moderate effect (Hedges' $g \approx 0.46$) of a single exercise session on increases in brain-derived neurotrophic factor (BDNF), and greater effects when embedded in a chronic regular program (Hedges' $g \approx 0.59$) (Dinoff et al., 2016). Another review in people with major depressive disorder (MDD) reported that exercise interventions resulted in a SMD of ~ 0.44 (95% CI: 0.15–0.73) increase in BDNF compared to controls (da Cunha et al., 2023).

Inflammation reduction: Chronic low-grade systemic inflammation has been implicated in the pathophysiology of depression and other mental health disorders. Exercise training in adults with MDD produced reductions in pro-inflammatory markers (e.g., IL-6, TNF- α) alongside improvements in depressive symptoms (SMD for BDNF increase = 0.44; for kynurene SMD = 0.29; and depressive symptoms SMD = -0.72) (da Cunha et al., 2023). Physical activity thus contributes to a neuro-immune environment favourable for mental health (Carvalho Silva et al., 2025).

5.2 Psychological Mechanisms

Self-efficacy and mastery: Participation in physical activity increases an individual's sense of mastery over their body and health, boosting self-efficacy and self-esteem; a meta-analytic structural equation modelling of 20 studies ($n = 23,377$) found that self-efficacy significantly mediates the association between physical activity and wellbeing (standardised indirect effect = 0.196, $p < 0.001$) (Cui et al., 2025).

Distraction hypothesis: Exercise may serve as a behavioural activation strategy by temporarily diverting attention away from negative thoughts or ruminative processes, thereby reducing the cognitive burden of depression and anxiety. Although less quantified, reviews note improved sleep and mood regulation as downstream of this effect (Hossain et al., 2024).

Social interaction: Group-based or socially embedded physical activity enhances social support networks—known protective factors for mental health. Among high school students,

physical activity was positively correlated with life satisfaction and negatively correlated with depressive symptoms, with self-esteem and social support acting as mediators (e.g., β for depression via chain mediation = -0.0022) (Li & Hao, 2025).

5.3 Endocrine / HPA-axis Mechanisms

Regular physical activity influences the hypothalamic-pituitary-adrenal (HPA) axis and related endocrine pathways, which play a key role in the body's response to stress and the development of mental health disorders (Mahindru et al.).

Meta-analytic evidence indicates that higher physical activity participation is associated with a **steeper diurnal cortisol slope** (i.e., greater decline from morning peak to evening levels), which is considered an indicator of healthier HPA axis regulation ($r = -0.043$, 95% CI $[-0.080, -0.004]$) (Moyers & Hagger, 2023). This suggests that physically active individuals may recover more efficiently from daily stressors.

Other studies show that in individuals with mood disorders, exercise interventions can normalize dysregulated cortisol secretion patterns and improve negative feedback control of the HPA axis (Beserra et al., 2018). For example, in patients with depression, exercise resulted in reductions of basal cortisol levels and improvements in HPA axis feedback sensitivity (Gerber et al., 2020). These endocrine adaptations likely act in concert with neurotrophic and inflammatory mechanisms, promoting resilience and reducing vulnerability to stress-related psychopathology.

Thus, the HPA axis provides a mechanistic bridge between behavioural activity (exercise) and biological stress regulation, offering a plausible pathway through which physical activity can exert protective and therapeutic effects on mental health (Mahindru et al.).

6. Practical Implications for Prevention and Therapy

Health professionals should integrate physical activity into holistic mental-health promotion and treatment programmes. According to WHO guidelines, adults should achieve at least 150 minutes of moderate-intensity aerobic physical activity per week (or an equivalent combination of moderate and vigorous intensity) to gain substantial health benefits, including mental health outcomes (*WHO Guidelines on Physical Activity and Sedentary Behaviour*).

Clinicians should encourage individualised programmes, taking into account patient

preferences, comorbidities (e.g., cardiovascular disease, musculoskeletal limitations), current fitness levels, and motivational factors. For instance, mental-health clinicians report that physical activity is discussed with clients, but many feel they lack training to prescribe it effectively — only around 24 % of providers offer specific exercise instructions consistent with national guidelines (Escobar-Roldan et al., 2021).

In addition, interdisciplinary collaboration between psychologists, physiotherapists, exercise physiologists and educators is key to effective implementation of physical-activity programmes as part of mental-health care. A multidisciplinary approach can help address barriers such as lack of clinician training, patient motivational issues, and adherence challenges (Crichton & Fenesi, 2025).

Moreover, programmes should include strategies for behaviour change (e.g., goal setting, self-monitoring), integrate physical activity into patients' daily routines, and consider social support and environmental facilitators (e.g., group classes, supervised sessions) to maximise uptake and sustained engagement. Evidence from a recent systematic review confirms that higher physical activity levels are significantly associated with fewer mental-health complications (e.g., depression, anxiety) across populations, supporting its role in both prevention and therapy (Rahmati et al., 2024).

7. Limitations and Future Directions

Despite the substantial evidence supporting physical activity as both a preventive and therapeutic tool in mental health, several important limitations must be acknowledged. First, many studies rely heavily on self-reported physical activity measures, which are susceptible to recall bias, social desirability bias and misclassification of intensity or duration. For instance, a large meta-analysis of exercise interventions in children and adolescents noted that evidence quality was low largely due to non-randomised designs, inconsistent dosage reporting and reliance on self-report (Fu et al., 2025).

Second, the heterogeneity of interventions (type, intensity, duration, frequency) limits our ability to determine optimal “dose” for specific mental health disorders. For example, a systematic review of mediation studies found moderate evidence for many mediators and moderators but highlighted insufficient clarity on which types of activity yield the greatest effect for particular conditions (Hurley et al., 2018; White et al., 2024).

Third, long-term adherence and maintenance of physical activity post-intervention remain weakly addressed. One study in first-episode psychosis found that after a 10-week supervised exercise intervention, only 55% maintained weekly exercise at 6-month follow-up, and benefits in some domains (e.g., waist circumference, verbal memory) were lost when activity ceased (Firth et al., 2018; Shannon et al., 2020).

Fourth, there is limited integration into community, digital health or real-world settings, which restricts generalisability and scalability of findings. Behaviour change strategies and mechanisms to support sustained engagement in diverse populations are under-explored. A systematic review of long-term interventions noted small effect sizes and high heterogeneity in long-term PA behaviour change (Gasana et al., 2023; Leaviss et al., 2020).

Future research directions in the field of physical activity and mental-health interface should therefore progress along several complementary axes. Firstly, standardisation of measurement procedures must be prioritised: objective monitoring tools (e.g., accelerometers, heart-rate monitors), alongside consistent reporting of exercise modality, intensity and duration, are essential to enable comparability across studies and meta-analyses. For example, White et al. (2024) emphasise that heterogeneity in physical-activity measurement remains a major barrier to synthesising evidence (White et al., 2024).

Secondly, there is a need for rigorous randomised controlled trials (RCTs) investigating optimal exercise prescriptions for specific mental-health disorders: for instance aerobic versus resistance training, variations in frequency, dose and duration, as well as subgroup analyses stratified by age group, comorbidities and baseline fitness level. The editorial on physical-activity and fitness in mental-health outcomes highlights this gap in evidence and calls for more disorder-specific prescriptions (Noetel et al., 2024).

Thirdly, longitudinal and implementation-science studies are required to examine long-term adherence to physical-activity programmes, to identify barriers and facilitators of sustained engagement, and to evaluate cost-effectiveness in real-world settings. As Simpson et al. (2024) point out, while efficacy of exercise interventions is increasingly documented, translation into routine practice and maintenance of behaviour change remain poorly characterised (Simpson et al., 2024).

Fourthly, exploration of digital-health interventions, community-based programmes and transdisciplinary models is essential: these might integrate mental-health care with exercise specialists, use mobile apps or wearables for engagement and monitoring, and leverage peer or community support to enhance accessibility. The narrative review on physical-activity maintenance underscores the value of novel delivery modes for promoting sustained activity (Rhodes & Sui, 2021).

Finally, mediation and moderation analyses should be routinely embedded in intervention studies to delineate which mechanisms (neurobiological, psychosocial, endocrine) are most critical in particular populations and whether they differ by disorder, demographic group or cultural context. White et al. (2024) found strong evidence for mediators such as affect, self-esteem and resilience, but many moderators remain untested (Mahindru et al., b.d.; White et al., 2024)

By addressing these limitations through robust, well-designed research, the role of physical activity in mental health can be refined and its translational potential enhanced - moving from proof-of-concept toward scalable, sustainable implementation in prevention and treatment frameworks.

8. Conclusions

Physical activity emerges as a robust, evidence-based strategy for both the prevention and management of mental health disorders across the lifespan. The accumulated findings from epidemiological studies, randomized controlled trials, and meta-analyses consistently demonstrate that regular engagement in physical activity reduces the risk of developing depression and anxiety, alleviates existing symptoms, and enhances overall psychological well-being. These benefits stem from multiple interrelated mechanisms-including neurobiological adaptations, improved stress-regulation via the HPA axis, reduced inflammation, enhanced neuroplasticity, and strengthened psychosocial resources such as self-efficacy, social connectedness, and emotional resilience.

Importantly, even modest increases in activity yield measurable mental-health improvements, particularly for individuals transitioning from inactivity to low or moderate levels of exercise. This highlights physical activity as a low-threshold, high-impact intervention that can be effectively integrated into diverse clinical, community, and public-health settings. Its advantages-cost-effectiveness, minimal side-effects, and broad accessibility-make it especially valuable in addressing the substantial global burden of mental disorders.

However, the translation of these benefits into long-term, real-world practice requires overcoming key challenges, including adherence, heterogeneity of exercise prescriptions, and limited standardisation of measurement across studies. Strengthening interdisciplinary collaboration, integrating behaviour-change strategies, and leveraging digital-health and community-based approaches will be critical in maximising sustained engagement and therapeutic outcomes.

In conclusion, physical activity should be considered a central component of mental-health promotion, prevention, and treatment frameworks. Incorporating structured, evidence-informed exercise programmes into routine care has the potential to substantially improve mental-health outcomes at both individual and population levels, and represents an essential direction for modern, holistic mental-health policy and practice.

Disclosure

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