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## The impact of physical activity on mental health

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**Abstract**

This article critically evaluates the interconnectedness of physical activity and mental health, drawing on a diverse body of evidence from observational studies, controlled trials, and emerging neuroscientific research. We explore how engaging in regular exercise is associated with improved mood regulation, reductions in anxiety and depressive symptoms, and better coping strategies under stress. By examining a range of exercise modalities, intensities, and durations across various age groups and demographic contexts, we shed light on the differential impacts of physical activity on mental well-being. Neuroscientific findings including those from neuroimaging and biomarker analyses offer insights into the biological mechanisms behind these improvements, revealing alterations in neural circuits and neurotransmitter systems that underpin emotional resilience and cognitive functioning. We further consider the psychological and social benefits that accompany regular physical activity, such as enhanced self-esteem, feelings of belonging, and the establishment of positive routines.

Finally, we identify gaps in existing research, including the need for more tailored, evidence-based exercise prescriptions and an improved understanding of how to optimize interventions for individuals with specific mental health profiles. Overall, this review underscores the imperative of incorporating strategic physical activity programs into mental health prevention, treatment, and policy initiatives.

**Keywords:** mental health, mental disorder, exercise, physical activity, sports

**List of abbreviation:** **BDNF** - brain-derived neurotrophic factor, **HPA** - hypothalamic-pituitary-adrenal, **PA**- physical activity **WHO** - World Health Organization,

## **Introduction**

According to the World Health Organization (WHO) definition, mental health is „state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community” [1]. It is a fundamental aspect of health and well-being that supports our personal and shared capacities to make choices, foster connections, and influence the environment we inhabit. According to the WHO, nearly one in eight people worldwide. approximately 970 million individuals.were living with a mental disorder in 2019. The COVID-19 pandemic led to a marked increase in mental health conditions. WHO estimates show a 25% rise in the prevalence of anxiety and depression worldwide during the first year of the pandemic [2]. Mental disorders can exert a profound influence on numerous aspects of an individual’s life, affecting emotional well-being, social relationships, educational and occupational functioning, and overall quality of life [3,4]. Pharmacological interventions, such as antidepressants and antipsychotics continue to serve as the primary approach for managing symptoms in mental health conditions. Nevertheless, doubts have been raised regarding the long-term benefits of these treatments [5]. Despite extended use of psychotropic medications many individuals do not experience sustained clinical improvement. Moreover, the array of side effects - including notable weight gain, increased blood glucose levels, reduced sexual desire and other complications can be considerable. These unwanted outcomes frequently lead to medication discontinuation and distress, ultimately undermining patient’s quality of life [6].

The World Health Organization defines physical activity as „**any bodily movement produced by skeletal muscles that requires energy expenditure**” [1]. It is a key contributor to overall health and well-being, reducing the risk of chronic diseases, enhancing mental health, and improving quality of life. As a complementary or adjunct intervention, exercise can positively influence mood, cognitive function, and emotional regulation, supporting individuals with conditions such as depression, anxiety, and even more severe disorders like bipolar disorder and schizophrenia [7].

Increases	Decreases
Assertiveness	Alcohol abuse
Confidence	Anger
Emotional stability	Anxiety
Independence	Confusion
Intellectual functioning	Depression
Internal locus of control	Dysmenorrhea
Memory	Hostility
Mood	Phobias
Perception	Psychotic behaviour
Positive body image	Stress response
Self-control	Tension
Well-being	Work errors
Work efficiency	

**Table 1.** Psychological benefits of physical activity

### Physical activity levels

Technological advancements have revolutionized daily life, offering unprecedented convenience and efficiency. While these innovations have undoubtedly enhanced productivity and transformed global societies, they have also contributed to a declining need for physical labor. As a result, many individuals are now less inclined to engage in routine physical activities - such as walking, cycling, and other forms of active travel - favoring instead private vehicles, screens, and various forms of electronic entertainment. Evidence indicates that low-income and middle-income countries currently have higher rates of active travel (e.g., walking and cycling) than high-income countries [8,9]. However, as these countries continue to develop and adopt advanced technologies, they are predicted to experience a significant reduction in their physical activity levels [10]. This shift mirrors patterns already observed in many high-income nations. Despite clear public health guidelines, about one third of Europeans do not meet the World Health Organization’s (WHO) recommendations for physical activity [11]. According to the “Health Behaviour in School-aged Children” (HBSC) research, over 45% of girls and roughly two-thirds of boys fail to achieve the recommended 60 minutes of moderate daily activity [11]. Accelerometer data further shows that 11-year-olds are generally more active than 15-year-olds, highlighting a sharp decline as children progress into adolescence.

Preschool children (3–5 years)	Physical activity throughout the day
Children and adolescents (6-17 years)	≥60 minutes of moderate to vigorous PA daily
Adults (18-64 years)	≥150 minutes of moderate-intensity PA weekly
Older adults (65+ years)	≥150 minutes of moderate-intensity aerobic PA weekly
Adults with chronic disabilities	150 minutes of moderate-intensity aerobic activity weekly

Pregnant and postpartum women	150 minutes of moderate-intensity aerobic activity weekly
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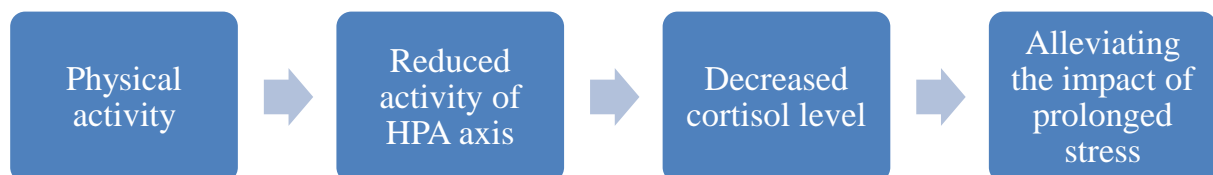
**Table 2.** WHO-recommended physical activity [12].

### The mechanism of the impact of physical activity on mental disorders

Physical activity affects mental disorders through a combination of biological, psychological, and social mechanisms [13]. Biologically, regular exercise regulates the levels of neurotransmitters such as serotonin, dopamine, and norepinephrine, which are crucial for mood stabilization and emotional regulation. Additionally, physical activity increases the production of brain-derived neurotrophic factor (BDNF), which supports neuroplasticity and enhances the brain's ability to adapt to stress [14]. Exercise also reduces the activity of the hypothalamic-pituitary-adrenal (HPA) axis, thereby lowering cortisol levels and mitigating the effects of chronic stress - a key contributor to the development and exacerbation of mental disorders. It is also believed that reduce the toxicity of beta-amyloid associated with the progression of Alzheimer's disease. Improved blood flow to the brain during physical activity further supports cognitive functions and emotional stability [15,16].

From a psychological perspective, engaging in physical activity promotes a sense of achievement, self-efficacy, and personal control, which are protective factors against depression and anxiety. It also provides an opportunity to break away from negative thought patterns and focus on the present moment, particularly in activities like yoga or mindfulness-based exercise [17].

Socially, physical activity encourages interaction and connection with others, fostering social bonds and reducing isolation - both of which are critical for mental health. Group activities, such as team sports or fitness classes, create a sense of community and belonging, which further contributes to emotional well-being [18].



**Figure 1.** The impact of physical exercise on the HPA axis

There is no clear agreement on the relative significance of the psychological and physiological hypotheses mentioned earlier in explaining the relationship between physical activity and mood enhancement [15,16,17,18].

### Yoga as a complementary approach

Yoga, originating from ancient Hindu traditions, has garnered increasing scientific interest in the West due to its potential therapeutic effects. As a mind-body intervention, yoga aims to harness the mind's capacity to modulate physical functions, aligning with the National Center for Complementary and Alternative Medicine's definition of mind-body practices [19]. Beneficial outcomes from yoga may arise through activation of antagonistic neuromuscular systems, stimulation of the limbic system, reduction in sympathetic (fight-or-flight) tone.

These mechanisms are hypothesized to help alleviate anxiety and depression by promoting relaxation and psychological resilience [20].

Yoga is considered generally safe, with minimal risk of harmful side effects. Consequently, it is increasingly adopted as an adjunct therapy for neurotic-spectrum mental health issues, especially depression and anxiety. Many yoga interventions also incorporate meditation, which may elicit a “relaxation response” via reductions in physiological arousal. Neuroimaging studies suggest that meditation can alter activity in specific brain regions, potentially enhancing attention and modulating the autonomic nervous system [21]. Additionally, increased left anterior brain activity, linked to positive affect, has been observed during meditation. Nevertheless, there is limited evidence indicating that meditation might exacerbate psychosis in certain individuals through increased dopamine levels [22,23]. More robust, randomized controlled trials are needed to clarify both the benefits and potential risks of integrating meditation in patients with complex mental disorders.

### **Physical Activity in Schizophrenia**

Schizophrenia frequently manifests in late adolescence or early adulthood, often disrupting key productive years. Only a minority of cases achieve sustained remission, and more than 60% are prone to relapses accompanied by both positive symptoms (delusions, hallucinations, thought disorders) and negative symptoms (social withdrawal, flat affect, apathy). Existing treatments - particularly first-generation antipsychotics - may cause extrapyramidal side effects, while second-generation antipsychotics are associated with metabolic issues such as obesity and dyslipidemia. Persistent cognitive deficits and treatment non-compliance further complicate management [24].

Evidence underscores that increased physical activity can mitigate some psychotic symptoms, while also addressing metabolic comorbidities linked to antipsychotic use. The limited success of pharmacological treatments in remediating negative and cognitive symptoms supports exploring **yoga** as a complementary therapy. Research suggests yoga may beneficially influence endocrine function, cognitive performance, and body weight regulation. Notably, a randomized controlled trial comparing a **yoga intervention** with an **exercise control** found that yoga significantly reduced negative symptoms [25]. Further emphasizing the relevance of such findings, a meta-analysis of 17 studies indicates that regular physical activity markedly decreases negative symptoms of schizophrenia [26].

These studies collectively highlight the promise of integrating physical activity and yoga into routine schizophrenia care.

### **Physical activity in depression and anxiety**

Depression ranks among the most significant contributors to disability worldwide, with the World Health Organization identifying it as a leading factor in the global burden of disease. Despite the prevalence of both depression and anxiety disorders, only a relatively small proportion of affected individuals receive professional help, often due to financial barriers, lack of trained healthcare providers, or stigmatization [3,20].

For people whose conditions are less severe, regular engagement in physical activities may serve as a powerful tool in both the treatment and management of depression and anxiety.

Growing evidence suggests that exercise can alleviate symptoms of depression to a degree comparable to, if not exceeding, the impact of conventional antidepressant treatments. Nevertheless, the precise relationship between consistent physical activity and reduced risk of depression still requires further scientific inquiry [27].

One explanation for these improvements lies in the so-called “endorphin hypothesis.” This theory posits that intense physical activity prompts the release of endogenous opioid peptides (commonly called endorphins), which enhance mood and reduce pain perception. By lowering feelings of hopelessness and unease, endorphins may help decrease anxiety and elevate mood [28]. Studies across different age groups, including children and adolescents, show that regular exercise can alleviate symptoms of both depression and anxiety [29].

Aggregated global data indicates that physical activity is more effective than no treatment at all and may be considered a worthwhile option for managing depression [30]. Certain types of yoga, which emphasize breath work, self-awareness, and relaxation, appear to be particularly beneficial in mitigating depressive symptoms and enhancing overall well-being [31]. Nevertheless, the ideal type and volume of physical activity to achieve these mood-lifting effects remain subjects of debate and likely depend on multiple individual factors [32]. A meta-analysis of 23 randomized controlled trials involving 977 participants explored the impact of exercise on unipolar depression. While the initial effects appeared moderate, follow-up outcomes showed a smaller, though still noteworthy, influence on depressive symptoms. Notably, exercise interventions were significantly more beneficial than no treatment, and moderately more so compared to standard clinical care [33].

Similarly, a systematic review examining exercise as an added therapy for anxiety disorders concluded that although physical activity can be a valuable supplement, it may be somewhat less potent than standard antidepressant medications [34]. Taken together, these findings underscore the potential of physical activity, whether in the form of conventional exercise regimens or mind-body practices like yoga to serve as a helpful adjunct in the management of depression and anxiety.

### **Physical activity and alcohol use disorder**

Alcohol overuse can have profound effects on an individual’s psychological and physical health. Key signs of dependence include developing tolerance and losing control over drinking behavior. Recent findings suggest that incorporating structured physical activity can be a valuable asset in managing alcohol use disorder.

On one hand, exercise may directly influence various neurotransmitter pathways in the central nervous system; on the other, it can help mitigate some of the health problems commonly associated with chronic drinking, such as hypertension, diabetes, and cardiovascular complications [35].

People with alcohol dependence frequently exhibit minimal engagement in exercise, alongside low levels of cardiorespiratory fitness. Consequently, regular physical activity whether in the form of aerobic workouts, resistance training, or yoga can serve as a potent intervention, especially when paired with conventional therapies like counseling or craving-focused medication. Not only can structured exercise routines relieve stress and promote mental well-being, but they also offer a healthier alternative to using alcohol as a coping mechanism [36].

Nevertheless, the success of physical activity programs hinges on the individual's motivation and active participation factors that can pose challenges in populations coping with substance use. Tailoring exercise regimens to foster motivation and sustain engagement is often critical. In one exploratory study of 117 participants with alcohol use disorder, using a 12-minute cycle ergometer test as an intervention, about 40% experienced a notable reduction in cravings [37]. Moreover, a meta-analysis of exercise-based interventions for alcohol dependence showed promising outcomes in minimizing both overall alcohol consumption and binge-drinking patterns [38]. These collective results underscore the importance of integrating physical activity strategies into broader treatment plans for individuals affected by alcohol use disorder.

## **Conclusions**

Physical activity represents a powerful and versatile resource for enhancing mental well-being, whether through traditional exercise routines, structured rehabilitation programs, or mind-body practices like yoga. Mounting evidence highlights its capacity to alleviate symptoms of depression, anxiety, and even more severe conditions such as schizophrenia and alcohol use disorder. Biologically, exercise modulates critical neurotransmitters, influences neuroplasticity through increased production of BDNF, and reduces the physiological stress response by regulating cortisol levels. Psychologically, physical activity fosters a sense of competence, autonomy, and mastery key protective factors against mental health disorders. At a societal level, group exercise or yoga sessions encourage social connectedness, further bolstering emotional resilience. Although pharmacological interventions remain indispensable for many individuals, their limitations and potential side effects underscore the need for effective adjunct therapies.

Yoga and exercise programs address these unmet therapeutic needs by targeting negative and cognitive symptoms of conditions like schizophrenia and helping to mitigate common treatment challenges such as medication noncompliance and weight gain. In alcohol use disorder, structured physical activity can reduce cravings, ease stress, and offer a healthier way to cope all crucial for sustained recovery.

Yet, important questions remain. Identifying the optimal type and intensity of physical activity, accounting for individual differences in preference and capability, requires further research. Some groups such as individuals with severe psychiatric conditions or coexisting physical limitations may need carefully adapted programs and motivational strategies.

Randomized controlled trials that directly compare varied exercise modalities, track long-term adherence, and investigate potential risks in specific populations would greatly improve our understanding and guide clinical practice.

In conclusion, integrating physical activity into mental health care strategies not only promotes holistic recovery but also addresses significant gaps left by conventional treatments alone. By embracing evidence-based exercise protocols and yoga, mental health services can strengthen overall treatment efficacy, reduce symptom burden, and support a more comprehensive approach to well-being. Future endeavors should focus on personalized, inclusive, and sustainable interventions to ensure that these benefits extend across different age groups, cultural contexts, and clinical conditions.



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