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PHYSICAL ACTIVITY IN PSYCHIATRY: MECHANISMS AND EFFICACY IN THE INTEGRATED TREATMENT OF DEPRESSION

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ABSTRACT

Depression is a serious mental disorder that manifests itself primarily as sadness, lack of energy, and reduced activity, which often hinders normal functioning. People who struggle with depression often feel overwhelmed by their lives. This mental disorder can take a variety of forms, ranging from temporary mood swings in everyday life to a serious clinical condition with significant symptoms and additional signs that clearly differ from what is considered normal. Treatment includes both pharmacotherapy and psychological therapy. Evidence for the effectiveness of this approach is solid and supported by numerous studies. However, it is worth noting that each patient is unique in terms of mental health and should be treated individually. Therefore, alternative methods may be considered and their effectiveness in the prevention and treatment of mental illnesses of civilization, especially in the context of depression, may be tested. An analysis of the available literature indicates that high levels of physical activity and regular exercise have a protective effect against depression. In combination with other forms of treatment, exercise and physical activity can contribute to a faster improvement in patients' health. This publication is a review and focuses on standardizing the definition of depression in relation to its significance in combination therapy. Physiological mechanisms that show how physical activity affects well-being were examined. The work is based on scientific research in the context of clinical trials. Practical tips on physical activity in cases of depression are also included, and obstacles and limitations are discussed.
Methods: A review of the literature available in the PubMed and Google Scholar database was performed, using the key words: „depression", „major depressive disorder", "mood disorder", „physical activity", "exercise", "sport".

KEYWORDS

Depression, Major Depressive Disorder, Mood Disorder, Physical Activity, Exercise, Sport

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1. Introduction

Major Depressive Disorder (MDD) constitutes a category of conditions classified as affective disorders. It is marked by a chronic low mood, anhedonia, diminished energy and motivation, along with associated cognitive disturbances regarding self-perception and worldview. They frequently occur alongside disruptions in circadian rhythms and impulses. In the most extreme instances of depression, psychotic symptoms may manifest as well.

MDD is characterized in the diagnostic classifications ICD-11 (World Health Organization, 2022) and DSM-5-TR (American Psychiatric Association, 2022) as a collection of symptoms persisting for a minimum of two weeks, resulting in considerable dysfunction in social, occupational, or other critical domains of life. Table 1 presents the diagnostic criteria for depression according to ICD-11 and DSM-5.

Table 1. Comparison of Diagnostic Criteria for Depression (DMS-5 VS ICD-11)

Feature / Criterion	DSM-5 (2013) - Major Depressive Disorder	ICD-11 (WHO, 2022) - Depressive Episode
Minimum number of symptoms	≥ 5 symptoms including at least one of the two key symptoms: (1) depressed mood, (2) loss of interest/pleasure	≥ 5 symptoms including at least one of the three key symptoms: (1) depressed mood, (2) loss of interest/pleasure, (3) reduced energy or increased fatigability
Duration of symptoms	≥ 2 weeks, most of the day, nearly every day	≥ 2 weeks, most of the day, nearly every day
Additional symptoms	Change in appetite/weight, sleep disturbances, psychomotor agitation/retardation, fatigue, feelings of worthlessness or excessive guilt, difficulty concentrating, suicidal thoughts	Sleep disturbances, change in appetite/weight, low self-esteem, guilt, cognitive difficulties, suicidal thoughts, somatic symptoms
Exclusion criteria	Symptoms are not due to substance use or a medical condition; no history of manic/hypomanic episode	Symptoms are not solely due to substance use or a medical condition; no manic/hypomanic episode (unless substance- or medical condition-induced)
Severity levels	Mild, moderate, severe (based on number/severity of symptoms and functional impairment)	Mild, moderate, severe (based on functional impact and number of symptoms)
Special considerations	Possible specifiers (e.g., peripartum onset, seasonal pattern, with psychotic features, with atypical features, etc.)	Possible additional codes describing course and special features (e.g., somatic symptoms, psychotic features, association with a specific event)

The etiology of depression is considered multifaceted, encompassing biological, genetic, environmental, and psychosocial variables (Kouba et al., 2024). The illness was formerly believed to be mostly attributable to anomalies in neurotransmitters, specifically serotonin, norepinephrine, and dopamine. Recent hypotheses indicate that it is mostly linked to intricate neuroregulatory mechanisms and brain circuits, leading to secondary disruptions in neurotransmitter systems (S. Wu et al., 2022). Genetic factors contribute to roughly 30–40% of the disease's risk, however the manifestation of these predispositions is influenced by environmental factors. Psychological aspects encompass personality characteristics, stress management strategies, and early life trauma. Social determinants encompass isolation, chronic stress, poverty, and insufficient social support.

Depression is among the most commonly diagnosed mental disorders globally. The World Health Organization estimates that 3.8% of the population suffers from depression, comprising 5% of adults (4% of men and 6% of women) and 5.7% of individuals over 60 years of age. Approximately 280 million individuals globally suffer from depression. This disease occurs around 50% more frequently in women than in males. The peak frequency is observed between the ages of 20 and 40, with an increase in incidence being noted among the senior demographic. Depression is the primary cause of occupational incapacity and a major risk factor for suicide.

Depressive disorder markedly diminishes quality of life (QoL) and social competencies and roles. Systematic reviews and observational research indicate that depressive symptoms are associated with diminished functioning across psychological, social, vocational, and health dimensions; the chronicity or recurrence of episodes exacerbates the cumulative deterioration in quality of life (Hohls et al., 2021; Kupferberg & Hasler, 2023; Tang & Thomas, 2020). Depression leads to diminished work productivity, absenteeism, and challenges in sustaining social interactions (isolation, conflict), while also heightening the risk of concomitant physical ailments and suicide.

MDD incurs substantial direct (healthcare) and indirect expenses (reduced productivity, absenteeism, early mortality) (Greenberg et al., 2021). The WHO and its partners estimate that the economic losses linked to mental health problems globally amount to trillions of dollars over decades, primarily due to lost workdays and diminished productivity. Additionally, societal costs encompass the strain on families and caregivers, heightened demand for social and medical services, and enduring effects on social development (Jain et al., 2022).

Major depressive disorder can be treated by diverse approaches, including pharmaceutical, psychological, interventional, and lifestyle modifications. Clinical guidelines advocate for the customization of treatment and the integration of medication with psychotherapy based on severity and patient preferences (Sampogna et al., 2024). Cognitive behavioral therapy (CBT), interpersonal therapy (IPT), and various other psychotherapy approaches have demonstrated efficacy in mild to moderate episodes and serve as adjunctive treatment for more severe cases. The most often prescribed drugs comprise selective serotonin reuptake inhibitors (SSRIs), serotonin norepinephrine reuptake inhibitors (SNRIs), and tricyclic antidepressants. The selection of medication is contingent upon the patient's symptomatology, prior treatment response, adverse effect profile, and concomitant conditions. Educational initiatives, psychopharmacological treatment, and succinct psychological interventions in primary care enhance access to therapy. In refractory situations, transcranial magnetic stimulation (rTMS), electroconvulsive treatment (ECT), and investigational medicines with alternative mechanisms (e.g., ketamine/esketamine) are employed, necessitating patient selection and safety assessments (Huang et al., 2025; Pompili et al., 2025). Notwithstanding the availability of these treatments, a considerable percentage of patients encounter partial or complete treatment resistance, underscoring the necessity to investigate effective, supplementary therapeutic strategies.

In recent years, physical activity, encompassing aerobic exercise, strength training, yoga, and mindfulness practices, has garnered heightened interest as a potential adjunct in the management of depression (Ross et al., 2023). Current research demonstrates that consistent physical exercise can ameliorate depressive symptoms via biochemical mechanisms (such as elevated endorphin levels and brain-derived neurotrophic factor, BDNF), hormonal mechanisms (cortisol regulation), immunological mechanisms (decreased inflammation), and psychosocial mechanisms (enhanced self-esteem, sense of agency, and social connectivity).

This article aims to consolidate the existing research regarding the importance of physical activity as a supplementary treatment for depression. The analysis encompasses a review of biological and psychological mechanisms that may mediate therapeutic benefits, various exercise strategies and their dosages (intensity, frequency, duration), and practical suggestions for physicians and patients.

Depression is a prevalent, frequently persistent illness that has considerable clinical, social, and economic effects. This essay seeks to enhance the understanding and application of physical activity in depression treatment protocols as an effective, accessible, and holistic adjunct for mental health.

2. Physiological mechanisms of the impact of physical activity on mood

Severe anxiety, accompanied by fear associated with excessive activity of the amygdala, has a significant impact on human reactions. This can result in both excessive caution and avoidance of decisions, as well as impulsive actions that often seem senseless. Chronic stress significantly affects the nervous system, disrupting the balance of neurotransmitters such as serotonin and dopamine. Their deficiency leads to low mood, increased anxiety, and a lack of strength and motivation to act. As a result, people living under constant stress have difficulty making thoughtful decisions because they lack the mental resources needed to properly assess the situation and make a choice. Prolonged mental tension also affects the autonomic nervous system, weakening the interaction between its two components – the sympathetic and parasympathetic nervous systems. The predominance of the former manifests itself in the form of chronic muscle tension, which can result in back pain, neck stiffness, teeth grinding, and migraines. In addition, stress disrupts the natural rhythm of sleep and wakefulness, making it difficult to fall asleep, worsening sleep quality, and hindering effective relaxation, which intensifies feelings of physical and mental fatigue (TSYHANOVSKA et al., 2025).

One important factor is regular physical activity, which promotes natural cortisol control, reduces muscle tension, and improves overall mental well-being. Exercise also stimulates the production of endorphins, known as "happiness hormones," which contribute to better well-being and increase psychological resistance to stress. Equally important is a healthy and balanced diet, which provides the body with key nutrients such as B vitamins, magnesium, and omega-3 fatty acids, which support the proper functioning of the nervous system (TSYHANOVSKA et al., 2025).

Depression is a disorder that varies in nature and its mechanisms are only partially understood. Prolonged stress and its physiological effects play a key role because they affect many neurotransmitter systems (Dean & Keshavan, 2017). Brain imaging studies revealed atrophy in certain areas, particularly the prefrontal cortex and hippocampus, which are responsible for controlling emotions, mood, and cognitive processes. Many reports mention a decrease in the expression of growth factors in the brain, with brain-derived neurotrophic factor (BDNF) at the forefront (Borsoi et al., 2015). The relationship between prolonged stress and recurrent depression can be well explained by the phenomenon of activation of the hypothalamic-pituitary-adrenal axis (HPA). Its engagement in chronic stress results in increased production of natural glucocorticoids, resulting in the development of cortical receptor resistance to cortisol due to its constant release (Jin et al., 2019). Increased cortisol concentration leads to microglia activation and pro-inflammatory cytokine production in the central nervous system, which may contribute to oxidative stress and neurodegeneration observed in hippocampal structures (Saran et al., 2021).

There are many different ways in which physical activity is likely to positively affect brain function. Scientists suggest that this happens through improved blood flow to the brain, increased levels of chemicals that transmit information between nerve cells, and the effect of exercise on the control of nutrients for neurons.

Based on studies on animal models, it has been found that regular physical activity acts as a protective measure against the negative effects of chronic stress on the structure of the prefrontal cortex. Additionally, aerobic exercise has a beneficial effect on the morphology of neurons in the prefrontal cortex in animals that have not been exposed to prolonged stressors. These observations provide important evidence that physical activity during the prepubertal period can prevent stress-induced neuronal and behavioral disorders (Ghalandari-Shamami et al., 2019).

The impact of aerobic and strength training on cognitive abilities may be related to increased blood flow to the brain. Studies have shown that after intense strength training, elevated levels of stress hormones were found, which are associated with higher levels of activity, mental focus, and attention, all of which affect brain efficiency. Increased blood flow to the brain results in better oxygenation and delivery of nutrients to its areas (Sumińska, 2021).

3. Preventive Role of Physical Activity in Depression

The preventive and therapeutic benefits of physical activity in relation to depression are well established in the scientific literature (C. Chen et al., 2022). Exercise may act preventively through both general and targeted mechanisms, addressing determinants of depressive symptoms in the general population as well as in high-risk groups (Recchia et al., 2023). Epidemiological evidence consistently indicates that regular physical activity serves as a protective factor against the onset of depression (C. Chen et al., 2022; Recchia et al., 2023). In certain cohort studies, individuals engaging in consistent exercise demonstrated up to a 30% lower risk of developing depressive disorders compared with those not participating in structured physical activity programs (C. Chen et al., 2022; Pearce et al., 2022; Recchia et al., 2023).

Beyond general population effects, physical activity can be strategically employed in targeted prevention. For example, longitudinal research among older adults shows that those who remain physically active report fewer depressive symptoms than their sedentary counterparts, underscoring its potential to mitigate age-related vulnerability to mood disorders (Recchia et al., 2023).

Multiple neurobiological and psychosocial mechanisms have been proposed to explain the antidepressant and preventive effects of exercise. These include improvements in physical fitness and cardiovascular health, reduction of sedentary behaviors, enhancement of self-esteem, facilitation of social interaction, and upregulation of mood-regulating neurotransmitters such as endorphins, dopamine, and serotonin (C. Chen et al., 2022; Pearce et al., 2022; Recchia et al., 2023). Exercise further contributes to weight control (C. Chen et al., 2022; Choi et al., 2019; Pearce et al., 2022; Recchia et al., 2023) and enhances sleep quality and duration, both of which are independently associated with lower depression risk (Sampasa-Kanyinga et al., 2020)

While pharmacotherapy and psychotherapy remain first-line interventions for depression in most clinical settings, there is increasing recognition of exercise-based interventions as a cost-effective, non-invasive, and widely accessible therapeutic option (C. Chen et al., 2022; Choi et al., 2019; Pearce et al., 2022; Recchia et al., 2023; Sampasa-Kanyinga et al., 2020; Schuch et al., 2016). Randomized controlled trials have demonstrated the efficacy of exercise programs in alleviating depressive symptoms across age groups, with particularly robust effects in mild-to-moderate depression (Recchia et al., 2023). In some cases, the magnitude of improvement achieved through structured physical activity rivals that of antidepressant medications (Schuch et al., 2016).

Moreover, combining aerobic exercise with pharmacotherapy has been shown to produce additive benefits, particularly in enhancing cognitive function and restoring autonomic balance, compared with pharmacological treatment alone (Schuch et al., 2016). These findings position physical activity not merely as an adjunctive measure, but as a potentially integral component of both preventive and therapeutic strategies against depression.

4. Practical guidelines for physical activity in depression

According to the latest recommendations of the World Health Organization, regular physical activity is indicated for improving physical health, well-being, sleep quality, as well as brain function and cognitive abilities. Physical exercise has a positive effect on maintaining mental health in people with depressive disorders and anxiety symptoms, contributing to strengthening psychological well-being.

WHO recommends that children and adolescents engage daily, over the course of a week, in at least about 60 minutes of intensive physical activity, predominantly aerobic exercises such as team games, cycling, or running, including 3 days of increased intensity. Adults and those over 65 years of age should perform 2.5 to 5 hours of moderate physical activity or 75 minutes to 2.5 hours of very high-intensity activity, distributed throughout the week. Additionally, muscle-strengthening exercises are recommended twice a week.

According to the compiled recommendations of the American Psychological Association and the American College of Sports Medicine, in order to counteract symptoms of depression, optimal physical activity should be performed 3 to 5 days per week at moderate intensity, lasting 45–60 minutes. Such moderate exercise can improve the overall level of physical activity, positively influencing mental condition, which translates into greater satisfaction and joy in life (Craft & Perna, 2004).

In 2024, in a meta-analysis of 218 clinical studies published by M. Noetel and co-authors, involving a total of 14,170 participants, a comparison of different forms of training was carried out. It was confirmed that for physical exercise to bring progress and improvement in depressive disorders, it should be practiced regularly. The Hedges' *g* index was used in the analysis to compare physical activities, where a value of 0.75 indicates a large therapeutic effect for exercises such as walking or running. The best results in alleviating depression were achieved through activities such as dancing, running, or walking, while high-intensity weight training and yoga also showed high effectiveness. Additional forms of activity such as resistance training and yoga were more comfortable for patients. Other studies suggested that for people over 65 years of age, activities such as tai chi are recommended, as they are less dynamic and of moderate intensity, contributing to stress reduction and improved emotional regulation (Noetel et al., 2024; Ross et al., 2023).

When selecting physical exercises for specific groups of people, individual factors should be taken into account, such as the person's sports experience, the current phase of depression, comorbidities, the patient's current physical condition, a personalized choice of the appropriate type of exercise (White et al., 2024).

In an experiment conducted in 2018, a special online exercise program was developed, enabling training in a convenient location for people with depression. Already in the initial phase, within 1–2 weeks of starting, a positive effect was observed in alleviating depression symptoms, and thanks to the convenient form of training (e.g., at home), it was positively received by the study participants (Tustin et al., 2018).

The team of Zhao and co-authors concluded that for people over the age of 50, in order to prevent depression, physical activity should be adapted to their physical capabilities and preferences, for example, in the form of forest walks or gardening. This should evoke joy and a positive mood, but also help reduce tension and anxiety (White et al., 2024; Zhao et al., 2025).

Table 2. Summary and comparison of different forms of physical activity in alleviating symptoms of depression

	Hedges' g (95% CrI)	No	κ	SUCRA
Dance	-0.96 (-1.36 to -0.56)	107	5	0.95
Walking or jogging	-0.63 (-0.80 to -0.46)	1210	51	0.75
Cognitive behavioural therapy	-0.55 (-0.75 to -0.37)	712	20	0.58
Yoga	-0.55 (-0.73 to -0.36)	1047	33	0.57
Exercise + SSRI	-0.55 (-0.86 to -0.23)	268	11	0.85
Aerobic exercise + therapy	-0.54 (-0.76 to -0.32)	140	15	0.6
Strength	-0.49 (-0.69 to -0.29)	643	22	0.66
Relaxation	-0.44 (-0.71 to -0.16)	234	6	0.57
Mixed aerobic exercises	-0.43 (-0.60 to -0.25)	1286	51	0.51
Tai chi or qigong	-0.42 (-0.65 to -0.18)	343	12	0.62
Aerobic exercise + strength	-0.33 (-0.50 to -0.15)	326	20	0.38
Cycling	-0.26 (-0.60 to 0.07)	143	6	0.31
SSRI	-0.22 (-0.46 to 0.03)	432	16	0.36
Physical activity counselling	-0.07 (-0.30 to 0.16)	256	2	0.2
Waitlist control	0.35 (0.19 to 0.51)	1303	53	0.01

Collaboration of specialists in the treatment of depression

In the treatment of depression, the cooperation of many specialists from various fields is essential, including a psychiatrist, psychologist, physiotherapist, or personal trainer. Thanks to the synergistic work of the above specialists, it is possible to develop a personalized treatment plan for patients and achieve longer-lasting therapeutic effects.

Psychiatrist

The psychiatrist decides on the diagnosis and severity of depression and how the disease will be treated. They determine whether physical activity can be included in the given situation. A study conducted by Ross and others confirmed that pharmacological treatment should be carried out simultaneously with an individually tailored training plan for the patient (Noetel et al., 2024; Ross et al., 2023).

Physiotherapist / Personal trainer

Trainers and physiotherapists should have specialist qualifications to conduct appropriate therapies for patients with depression, depending on the severity of the condition. Their task is to match different physical activities to the patient's health status, also taking into account other comorbidities such as obesity, cardiovascular diseases, and overall fitness level. Studies have shown that a training plan designed and supervised by a qualified specialist was more effective, achieving better therapeutic results than in individuals without the support of a qualified person. Additionally, those with mentor support received emotional support from the trainer, which helped build trust and self-belief, contributing to an improvement in the mental condition of this group of patients (Heissel et al., 2023; Noetel et al., 2024).

Psychologist

The psychologist's work focuses on supporting and motivating patients with depression in coping with difficulties during psychotherapy and helping to maintain adherence to regular exercise therapy. They also provide mental support in social life, for example, in situations of low self-esteem and social anxiety, which may hinder regular sports activity. It has been confirmed that support provided by a psychologist during exercise therapy has a more beneficial impact on the patient than exercising alone (Bendau et al., 2024; Depression in Adults: Treatment and Management NICE Guideline, 2022).

5. Barriers and Limitations to Physical Activity among Individuals with Depression

Motivation and Anhedonia as Barriers

Regular exercise improves mood, enhances the ability to experience pleasure, increases motivation, and reduces anxiety- effects that are especially important for people with depression, who often suffer from loss of interest and energy. Paradoxically, these same symptoms that physical activity can alleviate often create barriers that prevent individuals from starting or maintaining an exercise routine. Low motivation, fatigue, low mood, and anhedonia make even small amounts of activity feel like a huge effort. Additionally, social anxiety and fear of judgment can reduce willingness to participate in group activities. As a result, a vicious cycle develops: people with depression need physical activity to improve their condition, but their current mental state makes it difficult to engage in it.

A study by Sun et al. (2022) found that an 8-week physical activity program, including running and stretching exercises, improved the ability to experience pleasure in individuals with moderate depressive symptoms (Sun et al., 2022). The running group (RG) showed increased arousal during reward anticipation and fewer negative memories related to loss. The stretching group (SG) recorded higher scores in the Anticipatory and Consummatory Pleasure subscales of the TEPS after training. Moreover, the running group exhibited reduced memory of negative emotions, which was associated with longer training duration, lower maximum heart rate, and higher caloric expenditure.

The results suggest that physical activity can be an effective and safe method to support the treatment of anhedonia and depression. It may serve not only as a form of support but also as an alternative for individuals struggling with side effects of antidepressant medications.

Stigmatization and Social Anxiety

Stigmatization of people with mental disorders remains a serious social issue that negatively affects their willingness to participate in various forms of therapy. Patients often fear judgment, rejection, or criticism, which discourages them from taking part in group activities, such as physical exercise. A study conducted by Wu and colleagues (2025) examined the impact of physical activity on social anxiety among youth. The study included 1,259 students (average age 13.7 years) (J. Wu et al., 2025). Results showed that physical activity was strongly associated with better mental resilience and simultaneously linked to lower levels of social anxiety. It should be emphasized that social relationships influence the connection between anxiety and physical activity- younger adolescents, supported by peers, are more likely to exercise and build self-confidence, while older adolescents more often fear criticism. Although social anxiety may somewhat limit physical activity, exercise strengthens self-efficacy and promotes engagement in activities. The minimal negative impact of social anxiety on physical activity suggests that exercise can partly "neutralize" the adverse effects of social anxiety.

Coexisting Somatic Diseases

Many patients with depression also struggle with chronic illnesses such as type 2 diabetes, hypertension, obesity or cardiovascular diseases. A 2024 study by Chen and colleagues investigated how chronic pain affects physical activity and the risk of mental health problems like depression and anxiety (J. Chen et al., 2024). The study involved 72,800 participants, about 27,000 (37%) of whom reported chronic pain. The average age was approximately 55.8 years, with over half being women (55.3%). More than two-thirds (70.6%) were overweight, the majority (95.1%) consumed alcohol, and 60.3% had never smoked. The study found that individuals with chronic pain had a higher risk of mental health issues- general psychiatric disorders were 28% more common, depression 70%, and anxiety 39% higher compared to those without chronic pain. This is likely related to reduced physical activity caused by pain. The prevalence of general psychiatric disorders, depression, and anxiety among people with chronic pain was higher than in the population without chronic pain. In patients suffering from somatic diseases, a vicious cycle develops, where moderate physical activity can reduce the risk of depressive disorders, but pain and fatigue associated with the illnesses lead to withdrawal from physical activity. The study also showed that activities such as neuromuscular exercises, stationary cycling, yoga, and dance help reduce symptoms of depression and stress in people with chronic pain. It should be noted that although the sample size is large, it is limited to a specific region and ethnic group. Measurement errors may arise from patients self-reporting mental health symptoms without verification by objective tools.

Potential Risk of Overtraining and Its Consequences

Overtraining in people with depression is particularly risky because their nervous and hormonal systems often operate under elevated stress. Dysregulation of the hypothalamic-pituitary-adrenal (HPA) axis leads to excessive cortisol secretion, and overly intense exercise without proper recovery can worsen fatigue, lower mood, and exacerbate depressive symptoms. Therefore, monitoring signs of overexertion, such as chronic fatigue, decreased motivation, muscle pain, or sleep problems, is crucial, as these may indicate the need to reduce training intensity. Exercise programs should be tailored to the patient's psychophysical condition and supervised by specialists to avoid overtraining and support depression treatment.

6. Perspectives and directions for further research

Need for Environmental and Therapeutic Support

Effective initiation and maintenance of physical activity in people with depression require support from both professionals and close ones. Research shows that an interdisciplinary approach, including psychiatrists, physiotherapists, trainers, and family members improves therapy outcomes and motivation to exercise (Loomes & Rosenbaum, 2023).

Neuroimaging in Assessing the Effects of Exercise on the Brain

Modern brain imaging techniques, such as functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), allow observation of changes in brain structure and function due to physical exercise in people with depression. In the future, such studies may help develop biomarkers that better tailor exercise therapy to individual patient needs. A study by Schwefel and colleagues (2025) showed that physical training can improve cognitive functions in people with major depressive disorder (MDD) (Schwefel et al., 2025). The study involved 86 patients (39 women), with a mean age of 37.3 years, randomly assigned to three groups for 12 weeks: high-intensity training (HEX), low-intensity training (LEX), or a waiting list control group (WL). After 12 weeks, both exercise groups showed better performance and faster responses in working memory tasks. The HEX group also improved physical fitness, and fMRI scans showed increased brain activity in the left hippocampus compared to the control group. However, no changes in brain volume were observed. These results suggest that physical training can enhance working memory in people with depression by supporting hippocampal plasticity.

Personalization of Exercise Therapy

Depression can manifest in various forms and symptoms, so exercises should be tailored to each patient's needs, considering intensity, type, and frequency.

Singh and his team (2023) analysed numerous studies on the effects of exercise on depression, anxiety, and other mental health issues (Singh et al., 2023). Their findings indicate that physical activity helps reduce symptoms of depression and anxiety across different populations. The best effects were observed in people with depression, pregnant and postpartum women also individuals with HIV and kidney diseases. The research showed that all forms of exercise had positive effects, but better results were obtained with shorter and medium-length training programs. The studies confirmed that different types of exercise work in different ways. Strength training best alleviates depression, while yoga and mind-body exercises are more effective for reducing anxiety. Moderate and high-intensity activities were more effective than low-intensity ones, possibly due to insufficient activation of mood-enhancing mechanisms at lower intensities.

Use of Technology to Support Physical Activity

Modern technologies such as mobile apps, smartwatches, and virtual reality (VR) create new opportunities to support people with depression. Kim and colleagues (2023) evaluated the effectiveness of a 4-week phone-based exercise program. Participants reported a significant decrease in symptoms of depression and stress compared to the control group, although no significant changes were found in psychological well-being or quality of life (Kim et al., 2023). Lee and colleagues (2024) assessed the impact of immersive virtual reality meditation (IVRM) on emotion regulation in 25 hospitalized patients with major depressive disorder (MDD) and generalized anxiety disorder (GAD) (Lee et al., 2024). They participated in IVRM sessions three times a week for 10 weeks. Emotion regulation was measured with HeartMath biofeedback (CAS), and depression and anxiety with PHQ-9 and GAD-7 questionnaires. GEE analysis showed that increased CAS was significantly associated with reduced symptoms of depression and anxiety, regardless of demographic factors.

The results suggest that IVRM may be an effective non-pharmacological method to support emotion regulation in psychiatry. It should be noted, however, that the study did not account for differences in pharmacological treatment among patients, and the mental state was assessed only through self-report questionnaires.

Research on Optimal Exercise Dosing and Preventing Overtraining

Despite growing evidence supporting the effectiveness of physical activity in depression, clear guidelines on optimal exercise dosing are still lacking. There are no precise recommendations on how much and how to exercise to ensure effectiveness and safety. Further research is needed to precisely define safe and effective training parameters such as intensity, duration, and frequency, considering individual differences. Particular attention should be given to understanding overtraining mechanisms and developing strategies to prevent it, as overtraining can have serious health consequences in the population with depression.

7. Summary

Physical exercise can serve as a preventive measure against the onset of depressive disorders, but it can also be a form of therapy. The improved well-being experienced after physical activities is the result of several processes occurring in the human body: the release of endorphins, the regulation of serotonin and dopamine levels, and improved sleep quality.

Scientific research shows that regular physical activity can serve as a form of treatment for depression without the use of standard therapeutic methods such as pharmacotherapy or psychological support. If there are contraindications in the form of comorbid conditions, then, after consultation with a physician, one may initially begin with shorter forms of activity. Most importantly, it is essential to engage in any form of physical exercise, adjusting it to the individual's abilities, skills, and age. However, the most effective form of exercise is a combination of strength training and aerobic activity. The synergistic effect of pharmacological and physical therapy provides much better results in improving the mental health of individuals struggling with depression.

Disclosure

Author's contribution: Katarzyna Oświeczyńska
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Methodology: Patrycja Jędrzejewska-Rzezak, Katarzyna Oświeczyńska
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Writing-Rough Preparation: Agnieszka Zaleszczyk
Writing-Review and Editing: Katarzyna Oświeczyńska
Visualisation: Agnieszka Zaleszczyk
Supervision: Agnieszka Kasprzak
Project Administration: Agnieszka Kasprzak.

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