

Physical activity as a tool for building resilience in women: a review of research on depression and psychological well-being

Nikodem Michalski^{1(A,B,C,D,E,F)}, **Alicja Chmielarska**^{1(A,B,C,D,E,F)}

¹Faculty of Medicine, University of Opole, Opole, Poland

Michalski N, Chmielarska A. Physical activity as a tool for building resilience in women: a review of research on depression and psychological well-being. Health Prob Civil. <https://doi.org/10.29316/hpc/217600>

Tables: 2

Figures: 1

References: 37

Submitted: 2025 Dec 22

Accepted: 2026 Jan 30

Address for correspondence: Nikodem Michalski, Faculty of Medicine, University of Opole, plac Kopernika 11a, 45-040 Opole, Poland, e-mail: nikodem.michalski05@wp.pl

ORCID: Nikodem Michalski <https://orcid.org/0009-0003-4600-535X>, Alicja Chmielarska <https://orcid.org/0009-0003-2858-3500>

Copyright: © John Paul II University in Białą Podlaska, Nikodem Michalski, Alicja Chmielarska. This is an Open Access journal, all articles are distributed under the terms of the Creative Commons AttributionNonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0) License (<https://creativecommons.org/licenses/by-nc-sa/4.0>), allowing third parties to copy and redistribute the material in any medium or format and to remix, transform, and build upon the material, provided the original work is properly cited and states its license.

Abstract

The aim of the study is to review the literature and synthesize the research results on the role of physical activity as a tool for strengthening mental resilience in women and its impact on the symptoms of depression and overall mental well-being. The analysis included empirical studies and reviews (systematics and meta-analyses) published between 2022 and 2025. Populations of women of different ages were included (students, perinatal, and menopausal women). The evaluation focused on exercise interventions, as well as the correlation between activity level, depression, stress, and resilience indicators. Research confirms that regular physical activity reduces the severity of depressive and anxiety symptoms and increases the level of mental resilience, sense of meaning, and self-efficacy. These effects were observed especially in women during periods of increased psychosocial burden. Resilience was found to be a key mediator in the relationship between activity and mental health, while social factors acted as moderators. The results highlight the need to include exercise programs in preventive and therapeutic interventions addressed to women at different stages of life. Future research should focus on personalizing activity programs and on the long-term biological and psychosocial mechanisms underlying resilience enhancement.

Keywords: psychological well-being, resilience, physical activity, depression, mental health

Introduction

Mental health is a key dimension of women's overall well-being and functional capacity. Depression remains one of the leading causes of disability and reduced quality of life worldwide. Modern women operate in an environment burdened with numerous stressors, resulting from, among other things, combining professional, family, and social roles, cultural pressures, as well as an increased risk of mood disorders and burnout [1-3]. Therefore, the concept of psychological resilience, understood as the ability to adapt, regenerate, and maintain mental well-being in the face of difficult life experiences, is becoming increasingly important. Physical activity is considered one of the most effective and accessible tools for supporting mental health. Numerous studies demonstrate its positive effect on reducing stress, depressive and anxiety symptoms, and improving self-esteem and sense of agency. The search for effective preventive and therapeutic strategies that can be implemented in educational and recreational environments (e.g. physical education) is of significant practical and scientific importance [4-7]. At the population level, physical activity is recommended as an intervention supporting

mental health, and a growing number of empirical studies and systematic reviews allow for a synthetic indication of which forms of physical activity work best in the female context [1]. The role of physical activity is multidimensional: it influences somatic parameters (fitness, performance, body weight) and mental and social processes. The mechanisms underlying these effects include neurobiological changes (e.g. regulation of the HPA axis, increased neurotransmitters), psychological changes (increased self-efficacy, self-esteem, tension reduction, body image), and social changes (peer support, sense of belonging) [8]. Data from the World Health Organization and empirical analyses confirm that depression is more common in women than in men [1]. In psychological literature, resilience is understood as: a personality trait, an adaptive process, and the result of interactions between the individual and the environment. The multidimensionality of resilience includes individual resources (e.g. emotional resilience, emotion regulation skills), interpersonal resources (social support), and systemic resources (environmental conditions) [9]. This review aims to assess the current state of knowledge regarding the impact of physical activity on building resilience in women. Despite growing interest in the topics of resilience and physical activity, there is still a need to systematically organize knowledge regarding the mechanisms through which physical activity contributes to building resilience in women and to identify forms of exercise that support this process. Therefore, addressing this topic is justified from both a scientific and practical perspective – it can provide a basis for designing effective preventive and therapeutic strategies targeted at women.

Aim of the work

The aim of the work was to review and analyze scientific research on the role of physical activity as a tool supporting the development of mental resilience in women and to assess its impact on the level of depression and overall mental well-being.

Research question

Does regular physical activity, compared to no or low levels of physical activity in women, contribute to increased psychological resilience, reduced levels of depression, and improved overall mental well-being?

Methods

A systematic review was conducted according to the PRISMA 2020 guidelines. The aim was to identify and analyze research studies assessing the role of physical activity as a tool for supporting psychological resilience in women and its impact on depression and psychological well-being. A literature search was conducted in selected databases (PubMed, Scopus, Web of Science, PsycINFO), covering publications from 2022 to 2025. The inclusion criteria were: (1) studies involving women, (2) use of physical activity as a primary intervention, (3) assessment of mental resilience and/or depressive symptoms and psychological well-being, (4) original articles, randomized controlled trials, systematic reviews, and meta-analyses. The selection process included screening titles and abstracts and reviewing full-text publications. All the selection steps were performed manually. Ultimately, 37 studies meeting the criteria were included in the review. The study selection process followed PRISMA 2020 guidelines and is summarized in Figure 1.

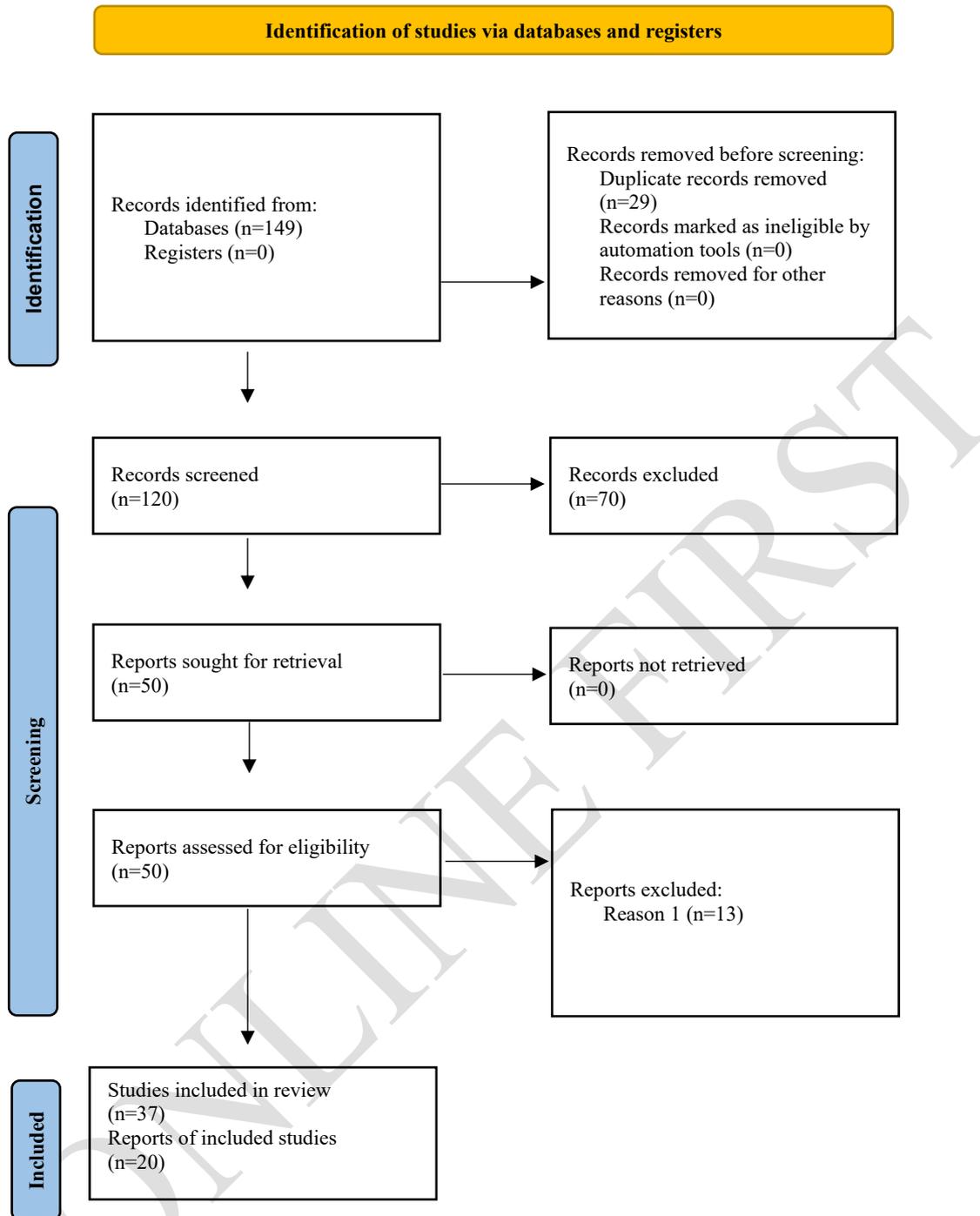


Figure 1. Selection process conducted in accordance with the PRISMA 2020 guidelines

Literature review results

Resilience and women's well-being

Resilience is a multidimensional concept describing an individual's ability to adapt, maintain, or quickly restore good mental functioning in the face of stress, adversity, or traumatic events. Resilience is defined both as a relatively stable individual characteristic (e.g. temperament, cognitive resources) and as a dynamic process shaped by interaction with the environment (interpersonal resources, social context). Resilience encompasses individual, relational and systemic resources that enable adaptive coping with stress [9].

Studies and systematic reviews have shown that higher levels of resilience are associated with better mental health and reduced severity of mood disorders. Meta-analyses demonstrate that individuals with affective disorders (depression, bipolar disorder) have, on average, lower levels of resilience than comparison populations, suggesting that resilience is protective against the onset and progression of these disorders. In population and clinical studies, resilience correlates negatively with the intensity of depressive and anxiety symptoms and positively with the level of life satisfaction and subjective well-being [10].

Women with higher resilience demonstrate better emotion regulation, higher self-esteem, and are less likely to report depressive and anxiety symptoms [5]. One of the key mediating mechanisms is the ability to effectively regulate emotions. Resilient individuals are more likely to use adaptive regulation strategies (e.g. cognitive reappraisal) and less likely to use dysfunctional strategies (e.g. emotional suppression, obsessive analysis of the problem situation). Effective emotion regulation reduces the intensity of long-term negative affect, which in turn reduces the risk of developing and maintaining depression. Empirical reviews highlight that training that supports emotion regulation skills (e.g. psychological skills training within psychoeducational programs or mindfulness practices) is associated with increased resilience and improved well-being [11]. Research analyses have shown that for many women, aspects of belonging and group support (e.g. sports activities, group forms of physical activity, support groups) are particularly important, as they help reduce isolation, improve well-being, and provide stress regulators (emotional support, practical help) [8].

Research has shown that resilience is modifiable – appropriately designed psychological and behavioral interventions can increase this. Interventions include psychoeducational programs, emotion regulation skills training, mindfulness training, and physical activity

programs, which contribute to increased mental resilience through psychological mechanisms (increased self-efficacy, reduced obsessive analysis), biological mechanisms (HPA regulation, increased neurotrophic factors), and social mechanisms (group support). In studies involving women, increased resilience was observed following programs combining physical activity with a social component (e.g. group exercise classes, group physical activity programs) [12-14].

Depression in women – conditions and effects

Epidemiological data show that women experience depressive disorders more often than men. Both biological and psychosocial factors contribute to the gender disparity in depression [15].

Biological mechanisms that increase women's susceptibility to depression include interactions between sex hormones, the HPA axis, and inflammatory processes:

- hormonal fluctuations: rapid changes in estrogen and progesterone levels (childbirth, perimenopause) can disrupt the regulation of neurotransmitters (serotonin, noradrenaline, dopamine) and affect the limbic system, increasing the risk of depressive episodes in susceptible women [16];
- neurobiology and sex differences in the brain: differences in the activity and structure of areas related to emotion regulation (hippocampus, amygdala, prefrontal cortex) between the sexes, which may modulate the course of depression and its symptoms in women [17];
- inflammatory markers and neuroendocrinology: elevated inflammatory markers and HPA axis dysregulation are observed in some women, which correlates with the severity and chronicity of depressive symptoms [17].

Psychological conditions include:

- rumination and emotion processing style: women are more likely to use passive coping strategies (rumination), which deepen and perpetuate negative mood, leading to a higher risk of chronic depression;
- history of trauma and violence: experiences of violence (sexual, domestic) and life trauma are strong predictors of later onset of depression; epidemiology shows that women are more likely to experience this type of exposure, which partly explains the increased incidence;

- social roles and burdens: psychosocial expectations and excessive workload (professional work and care work) increase chronic stress – studies from the COVID-19 pandemic period have shown a significant impact of conflict of duties and care burdens on the increase in depression rates in the female population [3].

Structural and environmental factors, such as poverty, lack of job control, employment instability, and limited social support, also demonstrate a strong association with the risk of depression. Cohort analyses and reviews indicate that differences in socioeconomic conditions and the unequal division of household and caregiving work significantly contribute to women's increased incidence of mood disorders. Symptoms of depression (low mood, anhedonia, reduced energy, sleep and appetite disturbances, and difficulty concentrating) lead directly to reduced quality of life and functional capacity. Recent symptom analyses show that mood changes and insomnia are central nodes triggering occupational and social functional impairment [2,18].

Impact of physical activity on women's mental health

Research confirms that regular physical activity reduces depressive symptoms in women of all ages. Aerobic exercise, strength training, and group classes have a positive impact on the neurochemical system (increasing the secretion of serotonin, dopamine, and endorphins) and on psychological processes, including increased self-esteem, a sense of control, and social belonging [13,19]. The effects were demonstrated both in groups with clinical symptoms of depression and in prevention (e.g. active vs. inactive women). It is important to take into account the specificity of gender (women) – hormonal, psychosocial and age factors [8,13,20,21]. Meta-analyses and numerous randomized controlled trials (RCTs) confirm that regular physical activity reduces depressive symptoms and improves overall mental well-being in the population of adult women.

According to reviews and meta-analyses, exercise demonstrated a moderate effect on reducing depressive symptoms compared to control groups; the authors highlighted the heterogeneity of interventions and the need for better reporting of mediators and moderators. A review by Noetel et al. [4] was conducted on mediators and moderators of the association between physical activity and mental health: psychological (e.g. improved self-esteem, self-efficacy), biological, and social mechanisms were found to frequently mediate these associations. Both aerobic exercise and strength training, as well as combined programs, have

been shown to provide significant benefits (often comparable to the effects of psychological therapy for moderate symptom severity) [4,5,8,22-24].

RCTs in a female population [24], have shown beneficial effects: aerobic and bikram yoga programs led to a reduction in depressive symptoms compared to control groups (e.g. an 8-week RCT comparing bikram yoga and aerobics vs. control showed a significant reduction in symptoms).

Physical activity acts as an effective element in the prevention of depression [3,6], triggers a number of biological processes that have a beneficial effect on the psyche – an analysis of the studies confirmed that the following biological mechanisms have a significant impact on the “physical activity = mood improvement” relationship [24]:

- neurochemistry and neurotransmitters: physical exercise increases the secretion of endorphins and affects monoamine systems (serotonin, noradrenaline, dopamine), which directly improves mood and reduces depressive symptoms;
- neurotrophic growth factors: exercise increases BDNF (brain-derived neurotrophic factor), which supports neuroplasticity and adaptive changes in brain areas involved in emotion regulation (hippocampus, prefrontal cortex);
- HPA axis regulation and inflammation: regular physical activity can normalize the HPA axis response to stress (reducing excessive cortisol secretion) and reduce the levels of pro-inflammatory cytokines (IL-6, CRP), which are associated with the pathogenesis of depression in some patients [24].

Table 1 presents selected RCTs conducted between 2022 and 2025 on the effects of aerobic, strength, and group exercise in the female population.

Table 1. RCTs on the effect of physical activity on depression in women (2022-2025) [3,6,25-28]

No.	Authors (year)	Study design	Population (n)	Intervention	Duration	Main findings
1	Han et al. (2024) [6]	Meta-analysis of RCTs	Postmenopausal women (n=2,170)	Aerobic exercises, yoga, stretching	12 weeks – 12 months	Significant reduction in symptoms of depression; yoga and aerobics most effective.
2	Cao et al. (2024) [25]	RCT	Middle-aged women (n=120)	Aerobics 3× per week, 40 min	10 weeks	Significant reduction in PHQ-9 scores, improvement in quality of life.

3	O'Sullivan et al. (2023) [26]	RCT	Young women (18–35 years old) (n=36)	Strength training 2× per week	8 weeks	Significant reduction in depressive symptoms (Hedges' g=1.0).
4	Lewis et al. (2023) [27]	RCT	Postpartum women (n=450)	Telephone-based exercise program with support groups	6 months	Reduction in stress, depressive symptoms, and improved well-being.
5	Giusti et al. (2023) [3]	RCT	Women aged 25-50 with mild depression (n=80)	Group classes (fitness, stretching, conversations)	8 weeks	Improved mood, increased resilience, and reduced post-pandemic stress.
6	Cunha et al. (2022) [28]	RCT	Older women (n=60)	Resistance training 2 × per week	12 weeks	Reduction of depression, increase of self-esteem, cognitive functions.

Notes: n – number of participants.

Regularly achieving training goals strengthens self-efficacy, which translates into better coping with stress and a reduction in the helplessness characteristic of depression (a sense of agency and self-efficacy). Physical activity influences body perception and satisfaction with appearance, which, especially in women, can significantly improve mood and social functioning (improved body image and self-esteem). Physical activity also promotes the use of more active coping strategies (active problem-solving, active stress-relief strategy) instead of passive strategies (rumination). Recent research (2022-2025) indicates that regular physical activity leads to a significant reduction in rumination and negative thinking. Lin's meta-analysis [5] showed that psychological resilience mediates the relationship between physical activity and mental health, including by reducing ruminative processes. More active individuals demonstrated higher levels of cognitive flexibility and lower rates of persistent negative thoughts. It was found that in female students, regular activity (especially aerobic and group activity) reduced the intensity of ruminations after stressful academic events, as well as increased resilience and self-efficacy [7]. Data from systematic reviews indicate that psychological mechanisms, such as increased sense of agency and social connectedness (e.g. group exercise) mediate the relationship between physical activity and women's psychological well-being. Social support and group belonging are important factors in building resilience. Group activities (aerobics, dance, group training) provide emotional and instrumental support, increase motivation, and facilitate maintaining activity, which enhances the therapeutic effect.

Participating in organized physical activity builds a positive identity (“I am a sporty/active person”), which promotes the maintenance of healthy habits and may protect against relapses of depression. Studies conducted in various groups of women (students, women after cancer treatment, menopausal women) showed that the aspect of social support is an important moderator of the intervention effects [7,13].

Physical activity as a factor in building resilience

Physical activity is a key component of interventions that reduce depressive symptoms and is an active factor in enhancing resilience. Mechanisms through which physical activity builds resilience in women include improved emotion regulation, increased self-efficacy, as well as social integration and group support. Physical activity affects the ability to regulate emotions at cognitive, neurobiological, and somatic levels. Regular practice increases cognitive flexibility and the ability to use adaptive strategies (e.g. cognitive reappraisal), while reducing the tendency toward persistent negative thinking (rumination). Neurobiologically, aerobic activity, and some forms of mind-body exercise (yoga, tai chi) increase BDNF levels, normalize the HPA axis response (cortisol), and modulate the monoaminergic system – mechanisms that support better affect regulation. Empirical evidence confirms that programs with a mindfulness or psychosomatic component (e.g. yoga, DMT – dance movement therapy) demonstrate strong associations with improved emotion regulation skills and reduced anxiety and rumination [7,13,14].

A review of the literature on Dance Movement Therapy showed that therapeutic movement promotes the expression of emotions, recognition of internal states, and affective integration, which is a significant source of increased resilience [21]. Research on group dance programs (square dance) indicates an intermediary role for resilience between participation and positive affect and life-satisfaction [29]. A key resource for resilience is self-efficacy, or the belief in one’s ability to successfully cope with tasks and challenges. Physical activity directly enhances self-efficacy through experiences of achievement (e.g. completing a training session, increasing distance, increasing the load), visible progress, and social reinforcement (praise, recognition). Strength training and programs with measurable progression criteria provide particularly strong signals of “efficacy” and improved self-esteem, which promotes resilience. Empirically, dance interventions and group programs improve self-efficacy, and this increase correlates with lower depressive symptoms and higher life satisfaction [14,29]. Physical activity

provides a context for building social connections – group classes, community dances, and local programs foster belonging, emotional support, and practical assistance. Social support is a well-documented moderator of an activity's effects on mental health: it increases program adherence, strengthens motivation, and enhances the therapeutic effects of exercise (e.g. reducing depressive symptoms). Studies conducted on large samples of women participating in group exercise programs (square dancing, dance groups, Pilates/Zumba) have shown an increase in perceived social support and a decrease in loneliness; these changes mediated improvements in well-being and resilience [5,14,29]. Results of RCTs from 2022-2025 [4,24] indicated that group and aerobic exercise had a greater effect than low-intensity training.

Practical implications for physical education

Physical education, broadly understood as the process of shaping pro-health attitudes and an active lifestyle, can serve both a preventive and therapeutic role in women's mental health. Current research indicates that regular physical activity has a protective effect against the development of depressive symptoms and can be an effective form of supportive treatment for women with previously diagnosed mood disorders [6]. Aerobic exercise (e.g. running, brisk walking, cardio training, swimming) is the most frequently studied type of activity in terms of its impact on mood and depression. It generates significant energy expenditure (high METs/min) and activates the cardiovascular system (affecting neurotransmitters such as serotonin and norepinephrine), improves cerebral circulation, and increases BDNF. It is widely available and relatively easy to implement (walking, jogging). A major network meta-analysis comparing different types of exercise found, among other things, that walking/jogging, yoga, and strength training showed impressive effects and that yoga and strength training were well tolerated/accepted across studies [4]. In a study of postmenopausal women, the network model showed a standardized mean difference (SMD) of -0.58 for aerobic exercise compared to control (SMD of -0.97 for mind-body in the same study) [6]. Strength training, or resistance training (e.g. weightlifting, bodyweight exercises), is gaining increasing evidence for its role in mental health, although it is less studied than aerobic exercise. Research analysis has shown that strength training effectively improves physical fitness and muscle strength, which translates into a greater sense of agency, improved self-esteem, and improved self-confidence. Resistance training can improve cognitive function by influencing muscle function, metabolism, and the immune system (brain health). Programs combining aerobic and strength training components

(and in some cases also incorporating stretching or mind-body elements) appear to offer the most comprehensive range of benefits, both physical (fitness, strength, metabolism) and psychological (mood, self-esteem, cognitive functioning) [4,30]. Mixed programs integrating aerobic and resistance training combine the benefits of both forms, resulting in improvements in aerobic capacity and muscular strength. They can be more engaging and varied, promoting motivation and long-term adherence. In expert reviews and meta-analyses, authors often indicate that mixed exercise programs should be recommended to maximize benefits [31,32]. In the years 2022-2025, RCTs conducted exclusively in women were published confirming the positive impact of regular physical activity on depressive symptoms, well-being, and resilience. The main results of these studies are summarized in Table 2.

Table 2. RCTs on the effects of physical activity on women's depression, well-being, and resilience (2022-2025) [33-36]

No.	Author (year)	Population	Type of activity/intervention	Length of intervention	Main psychological findings
1	Sanchez-Garcia et al. (2022) [33]	Postpartum women (program participants)	Hypopressive program (postural-respiratory), moderate training	12 weeks	Improvement in health-related quality of life (SF-36): significant increases in overall health, vitality, emotional role, and mental health components; exercise group superior to control.
2	Cunha et al. (2022) [28]	Training-active older women (>60 years), physically independent	Resistance/strength program/various exercise sequences (randomized crossover)	Phases: 12 weeks of preconditioning, 12 weeks of intervention (x2) + detraining (total 63 weeks)	Improvements in strength, functional and biochemical parameters; significant reduction in depressive symptoms (GDS) and anxiety (BAI) after training cycles; effect independent of the order of exercises.
3	Soori et al. (2022) [34]	Sedentary older women (mean ~62-63 years)	Aerobics vs. Pilates (three groups: aerobics, Pilates, control)	12 weeks	Both interventions improved mental health; in comparison, Pilates produced greater reductions in depression than

No.	Author (year)	Population	Type of activity/intervention	Length of intervention	Main psychological findings
					aerobics (as measured by the Goldberg GHQ/measure of depression).
4	Baena-García et al. (2022) [35]	Perimenopausal/middle-aged women (45-60 years)	Multi-component exercise program (aerobic + strength + functional); supervised sessions	16 weeks (3×/week × 60 min)	Improvement in menopausal symptoms, including beneficial effects on mental/psychological well-being and relationships; between-group differences in favor of the exercise group.
5	Coll-Risco et al. (2022) [36]	Perimenopausal women (FLAMENCO project section; RCT)	Exercise program (60 min, 3x per week) vs. counseling group	4 months (~16 weeks)	The FLAMENCO study documented the beneficial effects of the training program on psychological aspects and well-being; additional analyses showed positive changes in psychosocial function and symptomatology.

Discussion of the review results

Analysis of studies published between 2022 and 2025 clearly confirms that physical activity is an effective tool for building mental resilience and reducing depressive symptoms in women. The review results indicate that regular physical activity is associated with both immediate mood improvement and long-term strengthening of psychological resources that enable more adaptive coping with stress and life difficulties. The most consistent and stable psychological effects were observed in aerobic activity programs and combined programs (aerobic with strength training components). These interventions demonstrated significant effects on reducing depression and increasing resilience, likely through neurobiological mechanisms (regulation of the HPA axis, increased neuroplasticity) and psychological mechanisms, such as increased self-efficacy and control. Mind-body interventions (yoga,

Pilates, tai chi) demonstrated unique effectiveness in regulating emotions, reducing anxiety and rumination, and enhancing mindfulness and social support, making them particularly beneficial for women experiencing chronic stress or reduced psychological well-being. Another important finding from the analyses is that strength training – traditionally associated primarily with physical benefits – produces significant psychological benefits, particularly in the areas of self-esteem, sense of competence, and agency. Increased strength and physical fitness can enhance an internal locus of control, which is a key component of psychological resilience. Resilience was found to be a central mediator in the relationship between physical activity and psychological well-being in women. The mediating mechanisms included primarily emotion regulation, self-efficacy, social integration, and the ability to adapt to stressful situations. These results are consistent with previous reports indicating that physical exercise not only reduces the current severity of depressive symptoms but also strengthens stable psychological resources that protect against the recurrence of mood disorders [7,29].

The socio-cultural context of the implemented interventions also played a significant role. Group programs tailored to the specific needs of women (age, fitness level, cultural preferences) demonstrated the highest effectiveness. Dance classes and yoga groups improved not only physical fitness but also a sense of belonging and social support, which further enhanced psychological resilience [14,28]. Meta-analytical analyses [4-6] confirmed that even moderate levels of physical activity (approximately 150 minutes per week) lead to a significant reduction in the risk of depression (by 23-35%) and promote long-term psychological well-being. Particularly significant benefits were observed in women during periods of increased psychosocial stress, such as postpartum period, menopause, and intensive stages of academic education. At the same time, the results emphasize the need to consider population specificity and potential barriers to participation. For example, programs aimed at menopausal women were more likely to be effective with low-to-moderate intensity along with the presence of stretching and mind-body components, while interventions for younger women were more effective when they included a social and motivational component [6].

It is worth emphasizing that the presented conclusions should be interpreted with certain limitations in mind. The most significant include the methodological heterogeneity of the analyzed studies (different scales measuring depression and resilience, diverse training protocols), the short duration of most interventions (4-24 weeks), the limited number of long-term studies (>12 months), and the underrepresentation of women from lower socioeconomic status. Furthermore, in many studies, resilience served as a secondary variable or mediator

rather than the primary endpoint of the intervention. In light of the review, it seems justified to conduct further long-term studies to assess the durability of the effects of physical activity on women's resilience and mental health. It is also important to design experimental studies in which resilience is the primary measure of the intervention effect, rather than merely a mediating variable [4,37].

Another direction of research should be the standardization of training protocols and measurement tools, which will enable better comparison of results between studies. It is also worthwhile to consider moderating variables such as "locus of control", social support, socioeconomic status, and cultural context, which may influence the effectiveness of exercise interventions. It is also recommended that research be expanded to previously underrepresented populations, including women from rural areas, those with low economic status, and women with chronic conditions, for whom physical activity may be particularly protective.

The review findings have important implications for clinical practice, public health, and mental health prevention. Physical activity should be considered an integral component of programs supporting women's mental well-being, both in the prevention and adjunctive treatment of mood disorders. Designing interventions should take into account the diversity of women's needs, their exercise preferences, and the importance of the social component. Despite these limitations, the evidence from 2022-2025 clearly confirms that regular physical activity is an effective and accessible tool for enhancing psychological resilience and reducing the risk and severity of depression in women, thus contributing to improving their long-term mental well-being.

Conclusions

A review of scientific research from 2022-2025 confirms that regular physical activity is an effective tool for supporting psychological resilience in women, reducing depressive symptoms, and improving overall mental well-being. Sustainable psychological effects were observed in aerobic activity programs and combined interventions, while mind-body interventions demonstrated particular effectiveness in regulating emotions, reducing anxiety and rumination, and enhancing social support. Strength training, although less frequently analyzed in the context of women's mental health, produced significant benefits in self-esteem, a sense of competence, and empowerment. Psychological resilience plays a key mediating role in the relationship between physical activity and women's psychological well-being. Mediating

mechanisms include emotion regulation, increased self-efficacy, social integration, and increased adaptability to stressful situations. The effectiveness of physical activity-based interventions is largely dependent on the socio-cultural context and the tailoring of programs to women's specific needs, such as age, life stage, fitness level, and cultural preferences. Group programs and forms of activity that incorporate a social component demonstrate particularly high effectiveness. Even moderate levels of physical activity, consistent with current health recommendations, are associated with a significant reduction in the risk of depression and promote long-term mental well-being, especially in women experiencing periods of increased psychosocial stress. Despite the methodological limitations of the analyzed studies, the accumulated evidence clearly indicates that physical activity should be considered a crucial component of preventive and mental health-promoting strategies for women, constituting a valuable complement to traditional psychological and medical interventions. Further long-term studies, considering mediating mechanisms and different demographic groups of women, are essential.

Disclosures and acknowledgements

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

In preparing this work, the authors used ChatGPT (OpenAI) for the purpose of improving the initial English translation and language clarity. After using this tool, the authors have reviewed and edited the content as needed and accept full responsibility for the substantive content of the publication.

References:

1. World Health Organization. Depressive disorder (depression) – fact sheet [Internet]. Geneva: WHO; 2025 August 29 [access 29.10.2025]. Available from: <https://www.who.int/news-room/fact-sheets/detail/depression>

2. Zhou F, He S, Shuai J, Deng Z, Wang Q, Yan Y. Social determinants of health and gender differences in depression among adults: a cohort study. *Psychiatry Res.* 2023; 329: 115548. <https://doi.org/10.1016/j.psychres.2023.115548>
3. Giusti L, Mammarella S, Del Vecchio S, Salza A, Casacchia M, Roncone R. Deepening depression in women balancing work-life responsibilities and caregiving during the COVID-19 pandemic: findings from gender-specific face-to-face street interviews conducted in Italy. *Behav Sci (Basel).* 2023; 13(11): 892. <https://doi.org/10.3390/bs13110892>
4. Noetel M, Sanders T, Gallardo-Gómez D, Taylor P, Del Pozo Cruz B, van den Hoek D, et al. Effect of exercise for depression: systematic review and network meta-analysis of randomised controlled trials. *BMJ.* 2024; 384: e075847. <https://doi.org/10.1136/bmj-2023-075847>
5. Lin H, Zhu Y, Liu Q, Li S. The mediating effect of resilience between physical activity and mental health: a meta-analytic structural equation modeling approach. *Front Public Health.* 2024; 12: 1434624. <https://doi.org/10.3389/fpubh.2024.1434624>
6. Han B, Duan Y, Zhang P, Zeng L, Pi P, Chen J, et al. Effects of exercise on depression and anxiety in postmenopausal women: a pairwise and network meta-analysis of randomized controlled trials. *BMC Public Health.* 2024; 24(1): 1816. <https://doi.org/10.1186/s12889-024-19348-2>
7. Yang F, Gao Y, Liu F. Physical exercise and depression in university students: psychological resilience as mediator and family support as moderator. *Scientific Reports.* 2025; 15: 31293. <https://doi.org/10.1038/s41598-025-17317-2>
8. White RL, Vella S, Biddle S, Sutcliffe J, Guagliano JM, Uddin R, et al. Physical activity and mental health: a systematic review and best-evidence synthesis of mediation and moderation studies. *Int J Behav Nutr Phys Act.* 2024; 21(1): 134. <https://doi.org/10.1186/s12966-024-01676-6>
9. Fletcher D, Sarkar M. Psychological resilience: a review and critique of definitions, concepts, and theory. *European Psychologist.* 2013; 18(1): 12-23. <https://doi.org/10.1027/1016-9040/a000124>
10. Imran A, Tariq S, Kapczynski F, de Azevedo Cardoso T. Psychological resilience and mood disorders: a systematic review and meta-analysis. *Trends Psychiatry Psychother.* 2024; 46: e20220524. <https://doi.org/10.47626/2237-6089-2022-0524>

11. Dai Q, Smith GD. Resilience to depression: implication for psychological vaccination. *Front Psychiatry*. 2023; 14: 1071859. <https://doi.org/10.3389/fpsy.2023.1071859>
12. Li N. Mediating role of psychological resilience between depression and quality of life in maintenance hemodialysis patients in Baoding City, China: a cross-sectional study. *Int J Gen Med*. 2024; 17: 5929-5939. <https://doi.org/10.2147/IJGM.S494069>
13. La Rocque CL, Mazurka R, Stuckless TJR, Pyke K, Harkness K. Randomized controlled trial of bikram yoga and aerobic exercise for depression in women: efficacy and stress-based mechanisms. *Journal of Affective Disorders*. 2021; 280(Pt A): 457-466. <https://doi.org/10.1016/j.jad.2020.10.067>
14. Ben Waer F, Lahiani M, Alexe CI, Badau D, Onoi MP, Alexe DI, et al. The effects of pilates vs. zumba dancing on functional performance, mood and health-related quality of life in postmenopausal women. *Applied Sciences*. 2024; 14(7): 2886. <https://doi.org/10.3390/app14072886>
15. Badawy Y, Spector A, Li Z, Desai R. The risk of depression in the menopausal stages: a systematic review and meta-analysis. *J Affect Disord*. 2024; 357: 126-133 <https://doi.org/10.1016/j.jad.2024.04.041>
16. Dukic J, Johann A, Henninger M, Ehlert U. Estradiol and progesterone from pregnancy to postpartum: a longitudinal latent class analysis. *Front Glob Womens Health*. 2024; 5: 1428494. <https://doi.org/10.3389/fgwh.2024.1428494>
17. Mohammadi S, Seyedmirzaei H, Salehi MA, Jahanshahi A, Zakavi SS, Dehghani Firouzabadi F, et al. Brain-based sex differences in depression: a systematic review of neuroimaging studies. *Brain Imaging Behav*. 2023; 17(5): 541-569. <https://doi.org/10.1007/s11682-023-00772-8>
18. Zhou J, Zhou J, Feng L, Fen Y, Xiao L, Chen X, et al. The associations between depressive symptoms, functional impairment, and quality of life, in patients with major depression: undirected and Bayesian network analyses. *Psychol Med*. 2023; 53(14): 6446-6458. <https://doi.org/10.1017/S0033291722003385>
19. Kandola A, Ashdown-Franks G, Hendrikse J, Sabiston CM, Stubbs B. Physical activity and depression: towards understanding the antidepressant mechanisms of physical activity. *Neurosci Biobehav Rev*. 2019; 107: 525-539. <https://doi.org/10.1016/j.neubiorev.2019.09.040>
20. Navas A, Carrascosa MC, Artigues C, Ortas S, Portells E, Soler A, et al. Effectiveness of moderate-intensity aerobic water exercise during pregnancy on quality of life and

- postpartum depression: a multicentre randomized controlled trial. *Journal of Clinical Medicine*. 2021; 10(11): 2432. <https://doi.org/10.3390/jcm10112432>
21. Zhang X, Wei Y. The role of dance movement therapy in enhancing emotional regulation: a literature review. *Heliyon*. 2024; 10(15): e35733. <https://doi.org/10.1016/j.heliyon.2024.e35733>
 22. Carvalho Silva R, Meattini M, Perusi G, Carletto S, Bortolomasi M, Gennarelli M, et al. Disentangling the biological mechanisms underlying the effects of physical exercise in major depressive disorder: a comprehensive systematic review of randomized controlled trials. *Psychol Med*. 2025; 55: e197. <https://doi.org/10.1017/S0033291725100743>
 23. Liu Y, Zhao G, Guo J, Qu H, Kong L, Yue W. The efficacy of exercise interventions on depressive symptoms and cognitive function in adults with depression: an umbrella review. *J Affect Disord*. 2025; 368: 779-788. <https://doi.org/10.1016/j.jad.2024.09.074>
 24. Banyard H, Edward KL, Garvey L, Stephenson J, Azevedo L, Benson AC. The effects of aerobic and resistance exercise on depression and anxiety: systematic review with meta-analysis. *Int J Ment Health Nurs*. 2025; 34(3): e70054. <https://doi.org/10.1111/inm.70054>
 25. Wang W, Liu H, Feng Q, Peng Y, Si Y. Meta-analysis of the effectiveness of exercise as an intervention for suicidal tendency in depressed patients. *Front Psychol*. 2025; 16: 1517492. <https://doi.org/10.3389/fpsyg.2025.1517492>
 26. O'Sullivan D, Gordon BR, Lyons M, Meyer JD, Herring MP. Effects of resistance exercise training on depressive symptoms among young adults: a randomized controlled trial. *Psychiatry Res*. 2023; 326: 115322. <https://doi.org/10.1016/j.psychres.2023.115322>
 27. Lewis BA, Schuver K, Dunsiger S, Samson L, Frayeh AL, Terrell CA, et al. Randomized trial examining the effect of exercise and wellness interventions on preventing postpartum depression and perceived stress. *BMC Pregnancy Childbirth*. 2021; 21(1): 785. <https://doi.org/10.1186/s12884-021-04257-8>
 28. Cunha PM, Werneck AO, Nunes JP, Stubbs B, Schuch FB, Kunevaliki G, et al. Resistance training reduces depressive and anxiety symptoms in older women: a pilot study. *Aging Ment Health*. 2022; 26(6): 1136-1142. <https://doi.org/10.1080/13607863.2021.1922603>

29. Liu X, Du Q, Fan H, Wang Y. The impact of square dancing on psychological well-being and life satisfaction among aging women. *Sci Rep.* 2024; 14(1): 10405. <https://doi.org/10.1038/s41598-024-61143-x>
30. Miller KJ, Areerob P, Hennessy D, Gonçalves-Bradley DC, Mesagno C, Grace F. Aerobic, resistance, and mind-body exercise are equivalent to mitigate symptoms of depression in older adults: a systematic review and network meta-analysis of randomised controlled trials. *F1000Res.* 2020; 9: 1325. <https://doi.org/10.12688/f1000research.27123.2>
31. Yianni J, Roiser J. Which exercise interventions treat depression most effectively? A systematic review and network meta-analysis [Internet]. National Elf Service; 2025 Apr 2 [access 29.10.2025]. Available from: <https://www.nationalelfservice.net/treatment/exercise/which-exercise-interventions-treat-depression-most-effectively-a-systematic-review-and-network-meta-analysis/>
32. Wang H, Liu Q, Pan Y. Impact of combiner aerobic and resistance training on depression: a systematic review and meta-analysis of randomized controlled trials. *BMC Sports Sci Med Rehabil.* 2025; 17(1): 10. <https://doi.org/10.1186/s13102-025-01058-w>
33. Sanchez-Garcia JC, Aguilar-Cordero MJ, Montiel-Troya M, Marín-Jiménez AE, Cortes-Martin J, Rodriguez-Blanke R. Quality of life in the postpartum recovery of women who practice hypopressive exercise: randomized clinical trial. *J Clin Med.* 2022; 11(19): 5592. <https://doi.org/10.3390/jcm11195592>
34. Soori S, Heirani A, Rafie F. Effects of the aerobic and Pilates exercises on mental health in inactive older women. *J Women Aging.* 2022; 34(4): 429-437. <https://doi.org/10.1080/08952841.2021.1924576>
35. Baena-García L, Flor-Aleman M, Marín-Jiménez N, Aranda P, Aparicio VA. A 16-week multicomponent exercise training program improves menopause-related symptoms in middle-aged women. The FLAMENCO project randomized control trial. *Menopause.* 2022; 29(5): 537-544. <https://doi.org/10.1097/GME.0000000000001947>
36. Coll-Risco I, de la Flor Alemany M, Acosta-Manzano P, Borges-Cosic M, Camiletti-Moirón D, Baena-García L, et al. The influence of an exercise program in middle-aged women on dietary habits. The FLAMENCO project. *Menopause.* 2022; 29(12): 1416-1422. <https://doi.org/10.1097/GME.0000000000002071>

37. Rossi FE, Dos Santos GG, Queiroz Rossi PA, Stubbs B, Schuch FB, Neves LM. Strength training has antidepressant effects in people with depression or depressive symptoms but no other severe diseases: a systematic review with meta-analysis. *Psychiatry Res.* 2024; 334: 115805. <https://doi.org/10.1016/j.psychres.2024.115805>

ONLINE FIRST