



The effect of physical activity on mental health in teenagers- A narrative literature review

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Abstract

Teenagers is a formative developmental stage during which the basics of lifelong physical and psychological well-being are established. This paper presents a narrative literature review, structured according to conventions used in Scopus-indexed sports science and public health journals, examining the relationship between physical activity and mental health outcomes in adolescents aged approximately 10–19 years. Peer-reviewed systematic reviews, meta-analyses, randomized controlled trials, and international policy documents indexed in Scopus, PubMed, and Web of Science were synthesized to evaluate the effects of physical activity on depression, anxiety, stress, self-esteem, and overall psychological well-being. The evidence indicates that structured physical activity interventions produce small-to-moderate but regular developments in adolescent mental health, with particularly strong effects on stress reduction and social competence. Conversely, sedentary behavior and excessive recreational screen time are associated with poorer mental wellbeing, an association that intensifies beyond roughly two hours of daily use. Plausible biological mechanisms, including elevated brain-derived neurotrophic factor (BDNF) and neoplastic adaptation, together with psychosocial mechanisms such as enhanced self-concept and social connectedness, are discussed as pathways linking movement behavior to psychological functioning. The review concludes that physical education and school-based physical activity programming represent a low-cost, scalable, and evidence-supported strategy for adolescent mental health promotion, while noting methodological limitations across the literature, including heterogeneity in outcome measures and a relative scarcity of long-term longitudinal data

Keywords: Adolescents, physical activity, mental health, psychological well-being, school-based physical education

Introduction

Mental health disorders, including depression and anxiety, have become one of the leading contributors to the global burden of disease among young people, and Teenagers is now widely recognized as a critical period for the onset of such conditions. At the same time, physical inactivity among adolescents remains a pervasive global public health problem, with the large majority of adolescents worldwide failing to meet recommended activity levels. Against this backdrop, physical education and sport science research has increasingly turned its attention toward physical activity not merely as a determinant of physical fitness and disease prevention, but as a modifiable behavioral factor with direct implications for psychological well-being.

The relationship between physical activity and mental health is of particular relevance to the field of physical education, since schools represent one of the few settings in which nearly all adolescents can be reached through structured, curriculum-based movement programming. Understanding how physical activity influences mental health outcomes, and through which mechanisms, therefore has direct implications for the design of physical education curricula, school health policy, and community sport programming.

This paper synthesizes recent, peer-reviewed evidence — largely drawn from journals indexed in Scopus and allied databases such as PubMed, Web of Science, and SPORT Discus — to address the following objectives:

- To examine the overall association between physical activity and mental health indicators (depression, anxiety, stress, self-esteem, and psychological well-being) in adolescents.
- To evaluate evidence from randomized controlled trials and meta-analyses on exercise as an intervention for adolescent depression and anxiety.

- To consider the counterpart relationship between sedentary behavior/screen time and adolescent mental health.
- To outline proposed biological and psychosocial mechanisms linking physical activity to mental health.
- To discuss implications for physical education practice and identify limitations in the current evidence base.

Methodology

This review adopts a narrative literature review design rather than a formal systematic review protocol. Literature was identified through targeted searches of Scopus, PubMed/MEDLINE, and Web of Science, using combinations of the search terms “physical activity,” “exercise,” “mental health,” “depression,” “anxiety,” “self-esteem,” “screen time,” “sedentary behavior,” and “adolescents.” Priority was given to systematic reviews, meta-analyses, randomized controlled trials, and major policy documents (e.g., World Health Organization guidelines) published in indexed, peer-reviewed journals. Sources were evaluated for methodological rigor (e.g., use of PRISMA guidelines, GRADE evidence assessment, and Pedro quality scoring, where applicable) and synthesized thematically rather than through statistical pooling, consistent with the scope of a review article intended for a physical education audience.

Literature review and findings

1. Physical Activity Guidelines and the Scale of Adolescent Inactivity

The World Health Organization's 2020 guidelines on physical activity and sedentary behavior recommend that children and adolescents accumulate an average of 60 minutes per day of moderate-to-vigorous intensity aerobic

physical activity across the week, together with muscle- and bone-strengthening activity at least three days per week (Chaput *et al.*, 2020) ^[2]. These recommendations were derived from a systematic evidence synthesis using the GRADE framework, drawing on prior Canadian, Australian, and United States movement guidelines. Despite this evidence-based consensus, global surveillance data cited within this guideline literature indicate that a substantial majority of adolescents do not meet recommended activity levels, underscoring the scale of the public health challenge that underlies the present review.

2. Overall Associations between Physical Activity and Mental Health

The most direct and recent evidence comes from a 2025 ^[4] systematic review and meta-analysis of controlled intervention studies involving typically developing children and adolescents (Fu *et al.*, 2025). Pooling results from trials with control-group comparisons, the review found that physical activity interventions produced statistically significant improvements in mental health relative to control conditions, with the strongest effects observed for stress reduction and social competence, and additional benefits for anxiety, depression, and self-esteem. Moderator analyses in this review further indicated that effects were more pronounced among male adolescents and among students at the secondary school level, and that intervention frequency and the country in which a study was conducted were significant sources of variability between studies.

Complementary evidence from an earlier and influential review of reviews (Biddle, Ciaccioni, Thomas, & Vergeer, 2019) ^[1] similarly concluded that the literature supports a partial causal association between physical activity and reduced depressive symptoms in young people, and a clearer causal link between physical activity and improved cognitive functioning, although the authors judged the evidence for a causal relationship with self-esteem to be less consistent, reflecting the complexity of self-esteem as a multidimensional construct. Taken together, these two reviews, published roughly six years apart, suggest a strengthening and increasingly consistent evidence base linking physical activity to multiple domains of adolescent mental health.

Evidence extends to clinical and special populations as well. A large-scale systematic review and meta-analysis published in *JAMA Pediatrics* examined physical activity interventions among children and adolescents with neurodevelopmental disorders, synthesizing 76 studies involving over 3,000 participants (Liu, Liang, & Sit, 2024) ^[8]. The review found significant benefits of physical activity for overall mental health and its component domains — including cognitive function, psychological well-being, and internalizing and externalizing problems — suggesting that the psychological benefits of physical activity are not confined to typically developing populations.

3. Exercise as an Intervention for Depression and Anxiety

A body of randomized controlled trial evidence supports exercise as an effective adjunct treatment for clinical and subclinical depression and anxiety in adolescents. In one clinical trial, adolescents hospitalized for depression and anxiety were randomly assigned to a structured, supervised physical exercise program or a social relaxation control

activity delivered three to four times weekly over six weeks; the exercise group showed superior improvement on the Hospital Anxiety and Depression Scale relative to controls (Philippot *et al.*, 2022) ^[9]. A subsequent meta-analysis of randomized controlled trials focused specifically on exercise interventions for adolescent depression similarly reported favourable pooled effects, while noting substantial variation in the type, intensity, and duration of exercise protocols across included trials (Zhang, Cheng, Chen, Wang, Wei, & Sun, 2023).

With respect to anxiety specifically, a recent meta-analysis applying American College of Sports Medicine (ACSM) exercise-dosage recommendations to pediatric and adolescent populations found that studies in which participants adhered more closely to recommended exercise dosages produced larger reductions in anxiety symptoms than studies with low or uncertain adherence, pointing to a dose-related relationship between exercise volume and anxiety outcomes (Xian, Hu, & Jiang, 2026) ^[15]. This dose-related pattern is broadly consistent with the WHO's minimum activity recommendations discussed above and suggests that both the presence and the sufficiency of physical activity are relevant to its mental health benefits.

4. Sedentary Behavior, Screen Time, and Adolescent Mental Health

Because physical activity and sedentary behavior are behaviorally distinct but time-competing, several major studies have examined the inverse relationship. An early systematic review of 32 studies found consistent evidence linking greater leisure screen time to elevated depressive symptomatology in adolescents, alongside associations with anxiety, lower self-esteem, and psychological distress (Hoare, Milton, Foster, & Allender, 2016) ^[5]. A large, 42-country observational study using Health Behavior in School-aged Children survey data reported that detrimental associations between screen time and mental wellbeing emerged once daily recreational screen time exceeded approximately one hour, whereas physical activity showed a more consistently beneficial, dose-dependent relationship with wellbeing across the full range of measured activity levels (Khan, Lee, Rosenbaum, Khan, & Tremblay, 2021) ^[7]. Notably, this study also identified a synergistic pattern: adolescents reporting both high screen time and low physical activity showed the poorest mental wellbeing outcomes, while those combining low screen time with high physical activity fared best, suggesting that these two behaviors should be addressed jointly rather than in isolation within physical education and public health strategy.

5. School-Based Physical Education and Physical Activity Interventions

Because schools provide near-universal access to adolescents, several controlled trials have evaluated school-based physical activity or physical education interventions specifically targeting psychosocial outcomes. A cluster-randomized controlled trial of the “Be the Best You Can Be” program found favourable effects on aspects of children's psychological and physical well-being when the intervention was embedded within routine school programming (Standage, Cumming, & Gillison, 2013) ^[13]. Similarly, a large Danish multicomponent, school-based

physical activity intervention involving over 3,000 children examined the effects of increased in-school activity on psychosocial well-being using a phased design guided by the Medical Research Council framework for complex interventions (Smedegaard, Christiansen, Lund-Cramer, Bredahl, & Skovgaard, 2016)^[12]. A further non-randomised controlled trial targeting children of low socio-economic status, grounded in self-determination theory, found that a school-based intervention improved both moderate-to-vigorous physical activity and well-being, with effects partly explained by students' perceptions of greater autonomy support and psychological needs satisfaction provided by teachers (Shannon, Brennan, Hanna, Younger, Hassan, & Breslin, 2018)^[10]. Collectively, these trials suggest that the manner in which physical activity is delivered — particularly the degree of autonomy support and motivational climate created by educators — may be as important as the amount of activity itself in generating psychological benefits, a finding with direct relevance for physical education pedagogy.

6. Proposed Biological and Psychosocial Mechanisms

Several complementary mechanisms have been proposed to explain the association between physical activity and mental health in adolescents. At the neurobiological level, research attention has focused on brain-derived neurotrophic factor (BDNF), a protein involved in neuronal survival, synaptic plasticity, and neurogenesis, particularly within brain regions implicated in mood regulation. A controlled study found that higher-intensity exercise produced greater increases in BDNF and associated improvements in memory performance among adolescents compared with lower-intensity exercise (Jeon & Ha, 2017)^[6]. A more recent systematic review of randomized controlled trials examining exercise-BDNF relationships specifically in adolescents found that vigorous-intensity exercise protocols sustained for a minimum of six weeks were most likely to produce significant increases in circulating BDNF, although the authors cautioned that findings across the eight included trials were heterogeneous and that meta-analytic pooling was not feasible given variability in populations, exercise modalities, and blood-sampling timing (Fernández-Sánchez, Fernández-Rodríguez, *et al.*, 2025)^[3]. These neurobiological findings complement psychosocial explanations, including the proposition that physical activity enhances mental health through parallel neurobiological, psychosocial (e.g., improved physical self-concept and body image), and behavioural pathways (e.g., strengthened self-regulation and social skills), as outlined in conceptual models referenced within the neurodevelopmental disorders literature discussed above (Liu, Liang, & Sit, 2024)^[8]. In practice, both biological and psychosocial mechanisms likely operate concurrently and reinforce one another, particularly within socially structured settings such as team sports and physical education classes.

Discussion

The reviewed literature converges on several consistent conclusions. First, structured physical activity produces measurable, if generally small-to-moderate, improvements in adolescent mental health, with the most robust effects observed for stress and social competence, and meaningful but somewhat more variable effects on depression, anxiety, and self-esteem (Fu *et al.*, 2025; Biddle *et al.*, 2019)^[1].

Second, exercise-based interventions appear to be a viable adjunct treatment even within clinical populations experiencing diagnosed depression or anxiety, not solely a preventive strategy for the general adolescent population (Philippot *et al.*, 2022^[9]; Zhang *et al.*, 2023). Third, the relationship between movement behaviour and mental health is bidirectional in the sense that both increasing physical activity and reducing excessive sedentary screen time appear to matter, and their combined effects may be synergistic rather than merely additive (Khan *et al.*, 2021; Hoare *et al.*, 2016)^[5, 7].

For physical education practice, these findings carry several implications. Physical education classes and school sport programming represent an existing, scalable infrastructure through which the WHO-recommended 60 minutes of daily moderate-to-vigorous physical activity can be partially delivered to nearly all adolescents, regardless of socioeconomic background (Chaput *et al.*, 2020; Shannon *et al.*, 2018)^[2, 10]. Moreover, evidence that autonomy-supportive, need-satisfying pedagogical approaches enhance the psychological benefits of school-based activity programs (Standage *et al.*, 2013; Smedegaard *et al.*, 2016)^[12, 13] suggests that how physical education is taught — not only how much activity is accumulated — is central to maximizing mental health benefits. This reframes physical education not simply as a vehicle for physical fitness, but as a legitimate component of school-based adolescent mental health promotion.

Nevertheless, several limitations of the underlying evidence base warrant caution. Many included studies rely on relatively short intervention periods, limiting conclusions about the durability of psychological benefits over time. Substantial heterogeneity exists across studies in how mental health constructs are operationalized and measured, complicating direct comparison and pooled quantitative synthesis, a limitation explicitly acknowledged in several of the meta-analyses reviewed here (Fu *et al.*, 2025; Fernández-Sánchez *et al.*, 2025)^[3, 4]. Self-esteem, in particular, has been identified as a construct for which the causal relationship with physical activity remains less clearly established than for depression or cognitive functioning (Biddle *et al.*, 2019)^[1]. Additionally, most trials have been conducted in high-income countries, and effects may not generalize equally across cultural and socioeconomic contexts. Future research would benefit from longer-term longitudinal designs, standardized outcome measures, and greater representation of low- and middle-income country settings.

Conclusion

The convergence of evidence from systematic reviews, meta-analyses, and randomized controlled trials indicates that physical activity plays a meaningful, evidence-supported role in promoting mental health among adolescents, while excessive sedentary behavior and screen time are associated with poorer psychological wellbeing. Both neurobiological mechanisms, such as BDNF-mediated neuroplasticity, and psychosocial mechanisms, such as enhanced self-concept and social connectedness, appear to contribute to these effects. For the field of physical education, this evidence base provides a strong rationale for treating structured, well-delivered physical activity programming as a legitimate and cost-effective component of adolescent mental health strategy, alongside its

established role in physical fitness and disease prevention. Continued research using longitudinal designs and standardized mental health measures will be important for refining dosage, intensity, and delivery recommendations specific to psychological outcomes in this population.

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