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Review

The Effects of Physical Activity on Adolescent Mental Health and Well-Being: A Scoping Review

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Abstract: Adolescence is a critical period for establishing health behaviors, yet over 80% of adolescents worldwide are insufficiently physically active. This scoping review synthesizes recent evidence on the effects of physical activity (PA) on the physical and mental well-being of adolescents, aiming to identify key factors for effective interventions. Two reviewers conducted a scoping review following PRISMA-ScR guidelines across four databases (Medline, Scopus, Scientific Electronic Library Online, ScienceDirect) for studies published between June 2015 up to Decem-ber 2024. Inclusion criteria focused on adolescents (10-19 years) and the impact of PA on physical and/or mental well-being. The methodological quality of the 14 included studies was assessed using the Mixed Methods Appraisal Tool (MMAT). The evidence consistently shows that PA im-proves cardiorespiratory fitness, body composition, and acts as a mediator for health-related quality of life. Mentally, PA is associated with reduced symptoms of depression and anxiety, improved selfesteem, and enhanced emotional regulation. Aerobic exercise, sports participation, and mind-body activities like yoga were identified as particularly beneficial modalities. This review confirms that regular physical activity is a fundamental strategy for promoting holistic health in adolescents. To enhance effectiveness, future interventions should combine multiple components, reflect adolescents' preferences, and be embedded within school and community environments to support actionable public health strategies.

Keywords: physical activity, stress management, well-being, movement, development

1. Introduction

Physical activity (PA) is recognized for its substantial benefits in promoting physical health. Recent studies reveal that over 80% of adolescents do not reach recommended levels of PA, and mental health problems affect approximately 10-20% of this population worldwide [1,2]. Over the past decades, increasing research has focused on the positive impact of physical activity on mental health. Regular physical activity has been shown to improve mental health by reducing symptoms of anxiety and depression, enhancing self-esteem, and strengthening social skills [3].

PA also acts as a powerful tool for stress relief, strengthening coping mechanisms, reducing psychological distress, and contributing to suicide prevention. [4].

Participation in regular PA is associated with numerous health benefits, including improved cardiorespiratory fitness (CRF), body composition, cardio metabolic profile [5-7].

Beyond its physical benefits, regular participation in sports fosters self-esteem, promotes social integration, and supports emotional regulation, playing a key role in shaping healthy adolescent identities. [8].

Adolescence represents a critical period of development during which personal lifestyle choices and behaviour patterns establish, including the choice to be physically active. Physical inactivity, sedentary behaviour and low cardiorespiratory fitness are strong risk factors for the development of chronic diseases with resulting morbidity and

mortality, as well as reduced occupational productivity. The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) recommend at least 60 minutes of moderate-to-vigorous physical activity daily for adolescents to maintain optimal physical and mental health [2,9]. Worrying trends in adverse PA behaviours necessitate urgent and concerted action [10].

The increase in adolescent mental health problems can be attributed to various factors, including academic pressure, the influence of social media, family dynamics, and socioeconomic conditions [11,12]. Moreover, regular engagement in physical activity also helps in cultivating a habit of positive stress coping over the long term [13].

Regarding the physical and mental well-being of adolescents, studies further highlight the role that PE in school can play in protecting them from mental illness. PE can significantly reduce confusion and self-directed aggression, which may help lower suicide risk among adolescents [14].

Participation in PA influences cognitive functions, including working memory and cognitive flexibility. [15]

Adolescence is marked by significant physical, emotional, and social changes, growth spurts, and changes in identity. Therefore, the objective of the review is to evaluate the results of different studies and to identify several categories of factors that can better illustrate the directions on which to act more effectively through PA in adolescents.

Although the literature highlights numerous benefits of physical activity on adolescent health [16,17] there are still opportunities in the integrated approach of the simultaneous impact on the physical and mental dimensions. In this context, this paper aims to fill an existing gap in current research, by conducting a scoping review of relevant studies from the last decade. A scoping review was most appropriate for these outcomes because it is exploratory in nature and incorporates a variety of research designs, focusing on breadth rather than depth.

We opted for the scoping review because the literature is extremely heterogeneous in terms of types of interventions, evaluation instruments, and outcomes reported. The main objective is to map study types, outcome areas, and research gaps, not to estimate effects or compare interventions, which would be specific to a systematic review.

The main goal of this scoping review is to identify and analyze categories of factors associated with physical activity that may influence adolescents' physical and mental well-being, providing insights to guide future intervention programs adapted to their real needs.

2. Results

Of the 1440 articles initially identified, 14 studies were selected for inclusion in this review, published between June 2015 up to December 2024. Of these, seven focused on the effects of physical activity on physical well-being, and the other seven focused on the mental well-being of adolescents (see Table 3).

The included studies evaluated a variety of forms of physical activity, such as aerobic exercise, organized sports, yoga, and multicomponent programs. Outcome domains included physical health indicators (cardiorespiratory fitness, body composition, BMI) and mental health indicators (depression, anxiety, self-esteem, emotional regulation). Assessment instruments ranged from objective tests (VO_2max, accelerometers) to validated questionnaires (CES-D, SDQ, PedsQL).

2.1. Effects of physical activity on physical well-being

The included studies reported positive associations between physical activity and indicators of physical health in adolescents. For example, it was highlighted that a high cardiorespiratory fitness (CRC) can act as a mediator in the relationship between muscular fitness and health-related quality of life [37]. At the same time, high-intensity exercise has been correlated both directly and indirectly with improved mental well-being and quality of life, especially due to beneficial effects on CRC and body mass index [38].

Multicomponent weight management interventions have been shown to be effective in increasing physical activity levels, physical fitness, and self-perception of abilities in overweight or obese children and adolescents [39]. In the long term, physical activity is

correlated with maintained cardiorespiratory fitness [23]. Overall, these results indicate that regular physical activity is a particularly important and consistent factor for maintaining and improving the physical health of adolescents.

2.2. Effects of physical activity on mental well-being

Research has shown that physical activity has multiple and beneficial effects on the mental health of adolescents. Aerobic exercise, for example, has been positively associated with improved cognition and mood [29], and different types of training have contributed to increased self-efficacy and reduced depressive symptoms. Participation in physical activity encourages social interaction, while practices like yoga have demonstrated effectiveness in reducing stress and enhancing emotional regulation. [34,37].

Other interventions, such as sports mentoring programs, have shown positive effects not only on mental well-being, but also on psychological resources, physical fitness, and general activity levels [29]. Several studies have also reported that physical activity can induce positive changes in affective states, increasing positive emotions such as enthusiasm and calmness and reducing negative states, including fatigue and anxiety [34]. Regular practice of specific yoga techniques has shown preventive benefits, effectively reducing the risk of physical and mental disorders from early developmental stages. [37]. Also, significant relationships have been identified between the level of physical activity, self-determination, interpersonal adaptability and mood, which are essential dimensions of emotional intelligence [34]. The findings suggest that physical activity has a protective role and promotes mental well-being, with positive influences on both cognitive and emotional psychological processes, as well as on the social relationships of adolescents.

Although the included studies consistently reported beneficial effects of physical activity on both physical (e.g., cardiorespiratory fitness, body composition) and mental health outcomes (e.g., depression, anxiety, self-esteem), key synthesis indicators such as effect sizes, confidence intervals, or standardized mean differences were not uniformly reported. The high heterogeneity in study design and outcome measures precluded the conduct of a formal meta-analysis.

3. Discussion

The interpretation of the results is based only on the data presented previously, without adding new information or unfounded conclusions. For clarity, the Results section includes only the description of the results, and this section is concerned with discussing their theoretical and practical implications.

Adolescence is a developmental stage marked by major physical, emotional, and social changes. During this period, adopting healthy behaviors, including regular physical activity, has important implications for present and future well-being [40,41]. The findings of this review confirm that physical activity positively influences both physical and mental health, although the magnitude and consistency of these effects vary across studies.

On the physical component, several studies have shown that cardiorespiratory fitness acts as an important mediator between muscular fitness and health-related quality of life [26,27,37]. High-intensity exercise has been shown to have a significant impact on both physical health and overall well-being, as measured by improvements in cardiorespiratory fitness and body mass index [38]. This aspect is also confirmed by other illustrative studies in this regard [42,43]. In addition, weight management programs with a level of complexity have been shown to be effective in several areas, such as increasing physical activity levels, fitness, and positive self-perceptions of physical abilities in overweight or obese adolescents [31,39]. Long-term studies show that consistent physical activity helps maintain good cardiorespiratory fitness [23]. Overall, these results indicate that regular physical activity is a particularly important and consistent factor for maintaining and improving the physical health of adolescents.

On the psychological side, evidence shows that aerobic exercise has contributed to improving higher mental processing, as well as achieving a better mood [29] and different types of training have contributed to increasing self-efficacy and reducing depressive symptoms [32]. Participation in sports games has been correlated with the development of social interaction skills [34] and mind–body activities, such as yoga, have proven useful

in reducing stress and regulating emotions [30,36,37]. In addition, sports mentoring programs have generated integrated benefits – on mental well-being, psychological resources and physical condition [29]. Other research has shown that physical activity can have an immediate impact on the emotional state of adolescents. Feelings of excitement, calmness, and a general sense of well-being were reported by participants even after a single exercise session. At the same time, significant reductions in negative emotions such as fatigue, tension, and anxiety were observed. These rapid changes suggest that movement not only influences physical health, but can act as a catalyst for emotional balance and psychological well-being [28,34]. However, the evidence is mixed. While some cross-sectional studies confirm significant relationships between levels of physical activity, self-determination, interpersonal adaptability, and mood [34], others indicate modest or inconsistent effects, particularly with regard to cognition and anxiety reduction [44,45]. This suggests that the impact of physical activity on mental health is influenced by contextual factors such as duration, type of activity, social support, and gender differences [33].

Overall, this study highlights consistent associations suggesting that physical activity represents an accessible and inclusive means of supporting adolescents' physical and psychological health. Further longitudinal and randomized controlled studies are needed to confirm potential causal pathways and better understand mechanisms underlying these relationships.

3.1. Practical implications

The results of this review highlight the need to systematically integrate regular physical activity into school and community settings as a preventive and promotional strategy for adolescent health. Multicomponent programs that combine aerobic exercise with mind-body activities (such as yoga or mindfulness) and structured mentoring appear to be particularly promising. Interventions need to be tailored to individual characteristics, baseline physical fitness, and motivational profiles to maximize adherence and long-term benefits. Ensuring that these programs are accessible and integrated into adolescents' daily routines can improve both physical and psychological outcomes.

3.2. Theoretical Implications

Our findings align with and extend several theoretical frameworks. For instance, self-determination theory is supported by the role of PA in fostering autonomy, competence, and relatedness, which in turn enhance mental well-being Regular practice of specific yoga techniques has shown preventive benefits, effectively reducing the risk of physical and mental disorders from early developmental stages. [37]. Similarly, the biopsychosocial model is echoed in the interconnected improvements in physical fitness, emotional regulation, and social functioning. The positive effects on mental health can be explained by mechanisms such as increasing neurotransmitters involved in mood regulation and stress reduction, as well as by satisfying the psychological needs for autonomy, competence, and relatedness, according to self-determination theory. This review underscores the value of integrating multiple theoretical perspectives to fully understand PA's holistic impact on adolescent health.

3.3. Limitations of the scoping review

Some of the studies reviewed were cross-sectional, with small samples and no randomization, which limits the validity of the results. Also, most of the research focuses on specific regions (Europe, Asia), which reduces the generalizability of the results to other cultural contexts [46-48].

The lack of prospective registration of the research protocol is also an important limitation, as it can affect the transparency of the analytical process and the reproducibility of the results. In the absence of clear and prior documentation of the methodological steps, there may be a risk that some decisions will be influenced by the data obtained, which may introduce bias or unjustified variations in interpretation. Thus, without a registered protocol, it may be difficult to compare similar studies and reduce confidence in the validity of the conclusions drawn.

Another shortcoming of this study is that most of the evidence focused on physical fitness, self-esteem, and symptoms of depression and anxiety, with fewer analyses addressing hormonal changes and social relationships, which prevented us from reaching firm conclusions in subgroup analyses for these outcomes.

The lack of standardized effect sizes and confidence intervals across the included studies limited the strength of our conclusions. This aspect should prompt future research to ensure consistent reporting of comparable statistical indicators to allow for a more robust quantitative synthesis.

A further limitation relates to the geographic distribution of the evidence. Most included studies were conducted in Europe and Asia, whereas research from Latin American and African contexts remains scarce. This underrepresentation limits the cultural generalizability of the findings and highlights the need for future investigations in more diverse socio-cultural settings.

The risk of publication bias is another important aspect, as studies with positive results are more likely to be published, which can influence the overall direction of the evidence.

4. Materials and Methods

4.1. Study design

This study was conducted as a scoping review, following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines [18-20]. The review aimed to identify, synthesize, and map the existing literature on health-related quality of life (HRQoL) in adolescents in educational settings

4.2. Eligibility Criteria

The inclusion criteria focused on studies examining the effects of physical activity on adolescents, with particular emphasis on both physical and mental health outcomes. We used two major criteria, as follows:

4.2.1. Inclusion Criteria

Studies were included if they met the following conditions:

- participants were adolescents aged 10 to 19 years;
- assessed the effects of physical activity on physical or mental health;
- included interventions or measures related to physical exercise, organized sports, aerobic activities, yoga, or multicomponent programs;
- used an experimental, quasi-experimental, observational, or mixed research design.

The PICO framework applied in this review is summarized in Table 1.

Table 1. Search strategy framework based on the PICO model

P (Population):	I (Intervention):	C (Comparison):	O (Outcome):
Adolescents aged 10–19 years, healthy or at risk of mental health problems	Physical activity interventions (aerobic exercise, organized sports, yoga, multicomponent programs)	Low levels or absence of physical activity, sedentary behaviors, or standard conditions (control)	Physical outcomes (cardiorespiratory fitness, body composition, BMI) and mental outcomes (depression, anxiety, self-esteem, emotional regulation, social functioning)

4.3. Selection and search strategy

In our approach, the studies that were the subject of the analysis were identified and selected based on the adequacy and relevance of the topic proposed for research. The bibliographic search was performed in the Medline (National Library of Medicine's), Scopus,

Scientific Electronic Library Online, and ScienceDirect databases. In the mentioned databases, we used several variants, combining various terms: "PE/PA with mental well-being" or/and "PE/ PA with physic well-being", and “the effects of PA or/and PE”, “PE in adolescence”. We also searched under the variant "importance of PE" or/and "PA in adolescents".

To ensure transparency and reproducibility, the full electronic search strategy for Medline (via PubMed) was as follows: ("physical activity" OR "exercise" OR "sports") AND ("adolescent" OR "teen" OR "youth") AND ("mental health" OR "well-being" OR "psychological health" OR "depression" OR "anxiety") AND ("physical fitness" OR "cardiorespiratory fitness" OR "body composition"). Similar strategies were adapted for the other databases using relevant controlled vocabulary and keywords.

The literature search was conducted across multiple international databases using targeted keywords, restricted to publications between June 2015 and December 2024. The screening and selection process was carried out independently by two reviewers, with any discrepancies resolved through consensus. The search was limited to peer-reviewed articles published in English, in order to ensure access to full-text and standardized reporting.

The flowchart with the articles that were included in this review is shown in Figure 1. Initially, we obtained a total of 1440 articles in four databases (PubMed/Medline: 976; Scopus: 230; Science Direct: 234). After excluding duplicates (n = 615), 38 studies were considered eligible from the 825 records screened and were further analyzed. Twenty-four studies were excluded for not fully meeting the eligibility criteria. At the end of the process, 14 articles were included, all articles were published between 2015 and 2024. The majority of studies addressed either physical or mental well-being.

Due to the high heterogeneity in study designs, interventions, and outcome measures, quantitative synthesis (e.g., meta-analysis) was not feasible. Therefore, we present a qualitative summary of the findings without effect sizes or comparative metrics, focusing on thematic trends and consistent associations.

Data extraction was performed independently by two authors using a standardized charting form. Inconsistencies were checked and resolved by consensus to ensure accuracy and transparency of the process.

4.4. *Quality Assessment*

The methodological quality of the included studies was assessed using the Mixed Methods Appraisal Tool (MMAT), version 2018 [21,22], allowing for consistent evaluation across diverse study designs. (see Table 2). MMAT quality assessment was used for descriptive purposes to highlight the methodological robustness of the included studies. MMAT results were not used to exclude studies, but were included to assess the consistency and credibility of the evidence

Table 2. Methodological quality assessment using MMAT (2018) for included studies

No.	Study	Design Type	MMAT Category	Overall Quality	Observations
23	Aira et al., 2021	Longitudinal cohort	Category 2	High	Sophisticated analysis of long-term PA trajectories
24	Dewi et al., 2021	Cross-sectional	Category 3	Low	Simple design, local data, no variable control
25	Costigan et al., 2019	Cross-sectional	Category 3	Moderate	Large sample; valid measures but lacks confounder control
26	Evaristo et al., 2019	Cross-sectional	Category 3	High	Fitness–HRQoL association; rigorous analysis
27	Eddolls et al., 2018	Cross-sectional	Category 3	High	Objective measures (BMI, fitness); strong statistical analysis
28	Fromel et al., 2017	Cross-sectional	Category 3	Moderate	Limited validity of outdoor PA; self-reporting
29	Ho et al., 2017	Randomized Controlled Trial (RCT)	Category 1	High	Randomization, clear intervention, validated measures

No.	Study	Design Type	MMAT Category	Overall Quality	Observations
30	Jurado-Castro & Lucena-Romero, 2022	Exploratory qualitative study	Category 1	Moderate	Missing instrument validation and coding details
31	Morano et al., 2020	Pilot study	Category 3	Low	Small sample; potential bias; mixed intervention
32	Li et al., 2024	Cross-sectional + mediation analysis	Category 3	High	Solid SEM model, large sample, rigorous validation
33	Hermassi et al., 2023	Cross-sectional	Category 3	Moderate	Gender differentiation, but missing sampling details
34	Vaquero-Solís et al., 2020	Cross-sectional	Category 3	Moderate	Good statistical analysis, but missing sampling data
35	Mavilidi et al., 2020	Cross-sectional	Category 3	Moderate	Short intervention but significant; small sample
36	Choukse et al., 2018	Cohort	Category 2	Moderate	No randomization, but clear structure and direct measurements

The main reasons for exclusion at the full-text stage were: population outside the 10–19 age range (n = X), lack of a physical activity intervention (n = X), lack of mental or physical health data (n = X), ineligible design (n = X), and insufficient reporting of outcomes (n = X).

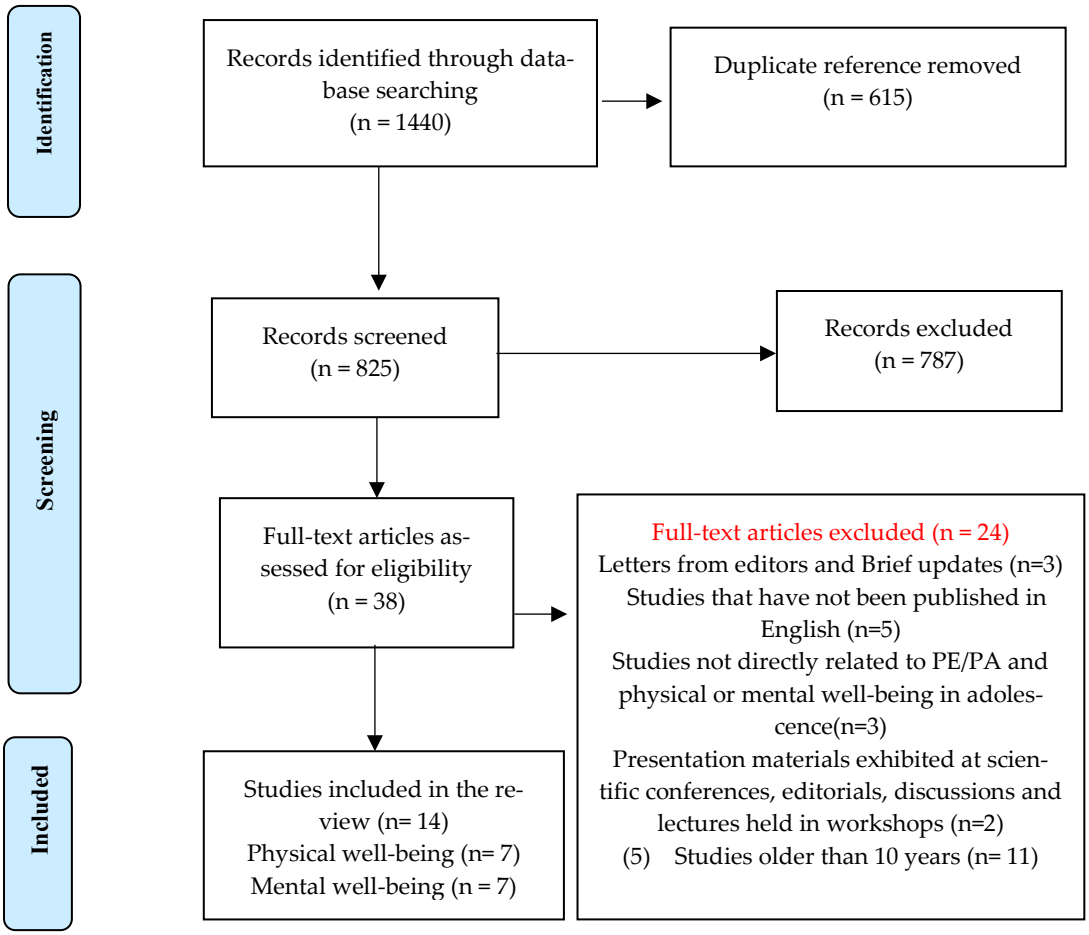

Figure 1. PRISMA flow diagram of studies in the scoping review

4.5. Registration and Protocol

This review was not registered in PROSPERO or any other platform due to its scoping nature and exploratory objectives. A protocol was not prepared.

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Table 3. Characteristics of the studies included in the scoping review

Author/year	Country No. of subjects/papers Age of participants	Research Design	HRQoL	Physical well-being						Mental well-being				Conclusions/ Further development
				PAI	CF	MF	BMI	OPA/Y	D	A	SE	CF	TB	
Aira et al., 2021 [23]	Finland 254 subjects 15–19 years	LCS		x	x									PA patterns diverge across adolescence; SC and AC dropout linked to reduced PA. Personalized, context-sensitive interventions are needed to sustain long-term PA..
Dewi et al., 2021 [24]	Indonesia 70 subjects 14–15 years	CSS		x		x	x							High fat mass % linked to low physical fitness; BMI less predictive than FM%. Promote PA to reduce obesity and improve fitness
Costigan et al, 2019 [25]	Australia 1223 subjects 11-17 years	CSS		x										It is recommended that adolescents perform vigorous PA to improve positives affects. PA intensity is positively associated with adolescent well-being, underscoring the need for school-based vigorous activity interventions.
Evaristo et al, 2019 [26]	Portugal 567 subjects Aged 12-18 years	CSS	x		x	x								Cardiorespiratory fitness acted as a full mediator variable on the relationship between muscular fitness and HRQoL in adolescents. Further data are needed to replicate findings using longitudinal designs.
Eddolls et al, 2018 [27]	UK 576 subjects 12 – 14 years	CSS	x	x	x		x		x					Rigorous PA, BMI and cardiorespiratory fitness determine mental well-being and quality of life in adolescents. Vigorous physical activity and cardiorespiratory fitness are linked to adolescents' mental well-being and quality of life, highlighting the need for multifactorial health interventions.
Formel et al, 2017 [28]	Czech Polish 248 schools 16-18 years	CSS						OPA					x	PA based on favorite outdoor activities are effective ways to promote an active lifestyle (physical and mental). The research did not evaluate the particular type of the natural environment and its influence on well-being.
Ho et al, 2017 [29]	China 664 subjects 12-13 years	CSS		x	x	x	x						x	A sports mentorship intervention improved healthy adolescents' mental well-being, psychological assets, physical fitness, and physical activity levels.

												Sport-based development programs can enhance both mental health and fitness in adolescents, highlighting their role in promoting overall well-being.
Jurado-Castro &Lucena-Romero, 2022 [30]	Spain 269 subjects 13-17 years	DS					Y					Despite the lack of knowledge of adolescent students about yoga in general, there was a position in favor of this activity in the education improvement Incorporating yoga techniques into physical education can improve the well-being of adolescents and diversify pedagogical approaches in schools.
Morano et al, 2020 [31]	Italy 18 subjects 11-12 years	PS			x	x	x			x		x	PA combined with nutrition education provides important benefits, especially in children with a tendency to obesity. Multidimensional school programs combining physical activity with psychosocial support can foster healthy, active behaviors in children.
Li et al., 2024 [32]	China 1,732 subjects 16–20 years	CSS+SEM	x							x	x		PA improves resilience via self-efficacy and psychological needs. Design school-based interventions to enhance resilience.
Hermassi et al, 2023 [33]	Quatar 52 subjects 11-12 years	CSS		x	x		x					x	Subjects in middle school are sensitive to gender, but not necessarily influence by PA at this age. Gender variations in physical activity and sedentary behavior affect academic performance, supporting gender-specific interventions.
Vaquero-Solis et al, 2020 [34]	Spain 231 subjects 12 – 16 years	CSS		x	x	x						x	Significant relationships between physical activity, selfdetermination, interpersonal adaptability and mood state dimension from the emotional intelligence. Emotional intelligence helps drive adolescent motivation for physical activity, highlighting the link between psychology and physical education.
Mavilidi et al, 2020 [35]	Australia 68 subjects 11-12 years	CSS		x	x				x		x	x	Short physical activity breaks can be used before examinations without impeding academic performance. Short activity breaks before tests have minimal impact on anxiety but can be used in schools without affecting academic outcomes.
Choukse et al, 2018 [36]	India 510 subjects 13-15 years	CSS		x			Y					x	Yoga improves the psychological fitness among adolescents. Residential yoga camps can enhance adolescents' psychological fitness, indicating their potential in mental health education programs.

Abbreviations and Variables:
Research Design: LCS: Longitudinal Cohort Study; CSS: Cross-Sectional Study; PS: Pilot Study; DS: Descriptive Study; CSS+SEM: Cross-Sectional Study with Structural Equation Modeling.
Physical Well-being Indicators: PAI: Physical Activity Intensity; CF: Cardiorespiratory Fitness; MF: Muscular Fitness; BMI: Body Mass Index; OPA/Y: Outdoor Physical Activities / Yoga.
Mental Well-being Indicators: D: Depression; A: Anxiety; SE: Self-Esteem; CF: Cognitive Functions; TB: Total Behavior (encompassing confidence, self-efficacy, resilience, emotional intelligence). HRQoL: Health-Related Quality of Life. An "x" in a cell indicates that the study measured or focused on that specific variable.

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Table 4. Summary of Physical Activity Type, Measurement Instruments, and Psychometric Properties Based on CERT Guidelines

Author (Year)	Type of Exercise	Duration / Frequency	Physical Health Instruments	Mental Health Instruments
Aira et al., 2021 [23]	General physical activity	Not specified	CRF test, BMI	–
Dewi et al., 2021 [24]	School-based physical activity	3×/week, 45 min	BMI, body composition	–
Costigan et al, 2019 [25]	Vigorous activity	Not specified	IPAQ-A	PANAS
Evaristo et al, 2019 [26]	Fitness exercises	2 months, 2×/week	MF test, CRF	–
Eddolls et al, 2018 [27]	Structured fitness program	Weekly sessions	BMI, CRF	GHQ, HRQoL scale
Formel et al, 2017 [28]	Outdoor physical activities	Variable, self-reported	Self-report PA	–
Ho et al, 2017 [29]	Sports mentorship program	12 weeks, 3×/week	Standard physical tests	GHQ-12, SEQ
Jurado-Castro & Lucena-Romero, 2022 [30]	Yoga	8 weeks, 2×/week	–	Attitude questionnaire + focus group
Morano et al, 2020 [31]	Physical activity + nutrition	6 weeks, 3×/week	BMI, MF	STAI-C
Li et al., 2024 [32]	General activity	Not specified	–	SEM: self-efficacy, resilience
Hermassi et al, 2023 [33]	Mixed school-based PA	Weekly sessions	BMI, CRF	Mood scale
Vaquero-Solis et al, 2020 [34]	School-based physical activity	Not specified	–	TMMS-24, adaptability questionnaire
Mavilidi et al, 2020 [35]	Active breaks	10 min before exams	–	STAI, anxiety questionnaire
Choukse et al, 2018 [36]	Residential yoga camp	2 weeks, daily	–	Custom psychological questionnaire

Note: Validation and reliability information for all instruments is provided in the original studies

Table 4 provides a structured overview of the physical activity types, measurement instruments, and their psychometric properties, following the CERT (Consensus on Exercise Reporting Template) recommendations.

5. Conclusions

This review provides an overview of the existing evidence on the associations between physical activity and physical and mental well-being in adolescents. The results indicate that regular participation in physical activity is consistently associated

with better cardiorespiratory fitness, better overall physical fitness, and improved psychological outcomes, such as reduced symptoms of depression and anxiety, increased self-esteem, and better emotional regulation. These findings should be understood as associations rather than causal relationships, due to the predominance of cross-sectional and non-randomized studies. We found evidence that regular physical activity is a cornerstone in promoting overall health during this critical period of development.

Studies show that PA significantly improves physical health indices, including cardiorespiratory fitness, body composition, and muscle strength. In addition, PA plays an important role in preventing and improving mental well-being by using various forms of physical activity - from aerobic exercise and sports to the appropriate use of yoga techniques.

Different forms of PA are associated with increased self-esteem, improved emotional regulation, and improved social interaction skills.

Adopting multicomponent interventions tailored to individual preferences and characteristics may represent key directions for maximizing these benefits. For such interventions to be effective, they should be engaging, accessible, and integrated into adolescents' everyday environments, particularly in school and community settings.

Beyond synthesizing empirical associations, this scientific approach offers a theoretical contribution by integrating the findings into two major frameworks: self-determination theory and the biopsychosocial model. Evidence supports the idea that physical activity enhances autonomy, competence, and relatedness, simultaneously influencing emotional regulation and social functioning. Through this comprehensive approach, we gain a clearer understanding of how physical activity supports adolescent well-being across all aspects of their lives, while also providing a solid starting point for the development of future theoretically grounded interventions.

The results suggest the need to integrate physical activity programs into school and community settings, focusing on interventions tailored to adolescents' preferences and accessibility. Educational policies should include mandatory components of daily movement to support physical and mental health.

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