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Analysis of physical activity on anxiety and stress in education: a systematic review

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Keywords

Emotional well-being
Coping strategies
Educational intervention
Mental health

Abstract

Regular physical activity has been shown to generate benefits for mental health and emotional well-being. Anxiety and stress are common problems in education, and physical activity has been shown to mitigate these problems. This study aims to deepen our understanding of the effects of physical activity on stress and anxiety in primary, secondary, and higher education settings through a systematic review based on research published between 2017 and May 2023. A search for literary and scientific papers was conducted in Web of Sciences, SCOPUS, and PubMed databases. The final study sample consisted of 12 scientific studies. The results indicate that encouraging coping strategies, such as physical activity, peer selection, and modification of expectations, is crucial to manage academic workload and act positively on the mental health of students, thus promoting healthy habits that reduce anxiety and improve their well-being in various environments. As a conclusion, it is highlighted that participation in sports activities improves stress and anxiety management, in addition to strengthening academic engagement. The intensity and regularity of exercise influence these benefits, underscoring the need for personalized interventions. These findings support the integration of physical activity into the educational curriculum and the creation of accessible environments, also suggesting the exploration of innovative approaches that combine exercise, technology and psychological support to optimize student well-being.

Análisis de la actividad física sobre la ansiedad y estrés en educación: una revisión sistemática

Palabras clave

Bienestar emocional
Estrategias de afrontamiento
Intervención educativa
Salud mental

Resumen

Se ha demostrado que la actividad física regular genera beneficios para la salud mental y el bienestar emocional. La ansiedad y el estrés son problemas comunes en la educación, demostrándose que la actividad física puede mitigar estos problemas. Este estudio tiene como objetivo profundizar en el conocimiento de los efectos de la actividad física en el estrés y la ansiedad en entornos de educación primaria, secundaria y superior, mediante una revisión sistemática basada en investigaciones publicadas entre 2017 y 2023. Se llevó a cabo una búsqueda sistemática en tres bases de datos: Web of Sciences, SCOPUS y PubMed. La muestra final del estudio quedó formada por 12 estudios científicos. Los resultados señalan que fomentar estrategias de afrontamiento, como la actividad física, la selección de compañeros y compañeras, junto con la modificación de expectativas, es crucial para manejar la carga de trabajo académico y actuar positivamente sobre la salud mental del alumnado, promoviendo así hábitos saludables que reduzcan la ansiedad y mejoren su bienestar en diversos entornos. Como conclusión, se destaca que la participación en actividades deportivas mejora el manejo del estrés y la ansiedad, además de fortalecer el compromiso académico. La intensidad y regularidad del ejercicio influyen en estos beneficios, lo que subraya la necesidad de intervenciones personalizadas. Estos hallazgos respaldan la integración de la actividad física en el currículo educativo y la creación de entornos accesibles, sugiriendo también explorar enfoques innovadores que combinen ejercicio, tecnología y apoyo psicológico para optimizar el bienestar estudiantil.

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Currently, lifestyle is responsible for nearly two-thirds of all cases of disease worldwide (Weinert and Gubin 2022). Research focused on the impact of physical activity on mental health in children and adolescents has been less explored compared to studies conducted in adults (Bailey et al., 2018; Jiang et al., 2021). It is indisputable that regular physical exercise has benefits for mental health, emotional well-being, and quality of life (Ahn y Fedewa, 2011; Bernstein y McNally, 2018; De la Cruz-Sánchez et al., 2011; Deslandes et al., 2009; Korge y Nunan, 2018; Ogawa et al., 2019). There is growing concern about the decline in physical activity (Williams et al., 2022) hence the need to analyze where people spend their leisure time. So far, there is no strong evidence indicating a decline in physical activity levels in recent decades (Guinhouya et al., 2013; Toussaint et al., 2021; Wold et al., 2016).

Leading a sedentary lifestyle has been found to have negative effects on psychological well-being, related to increased levels of depression and anxiety (Blough and Loprinzi, 2018). The subject of Physical Education plays a potentially significant role in improving public health by influencing attitudes towards exercise and promoting health-focused physical conditioning programs (Ntoumanis, 2001). This discipline facilitates the development of personality, the promotion of values, and the acquisition of a great diversity of skills and movements by students, integrating them into a life approach (Prado and Albarrán, 2023).

Anxiety is one of the most researched topics in the field of sport psychology. It is characterized by the manifestation of negative emotions such as worry and nervousness, affecting both cognitive and somatic aspects (Pineda-Espejel et al., 2021). Mascret et al. (2021) assert that continued exposure to elevated levels of anxiety can distort self-concept and worsen individuals' mental self-image. Physical Education brings several benefits to the physical and emotional health of students, as Posso-Pacheco et al. (2020) point out, among these benefits include the reduction of anxiety. This is supported by the study of Bonet et al. (2017), who indicate that physical activity promotes the release of hormones, such as endorphin and serotonin, which act as painkillers, generating feelings of well-being and happiness.

A fundamental element that is related to anxiety is stress (Fernández-García et al., 2024). It has been shown that people with high levels of stress are more likely to show increased levels of anxiety (Melguizo-Ibáñez et al., 2023). Specifically in the student population, the stress originated in the academic environment increases anxiety, generating a worsening in the quality of life of students in the different educational stages (Ahmad et al., 2019; Baqutayan, 2011; Bonilla and Padilla, 2015; García-Ros et al., 2012; Manrique-Millones et al., 2019). Previous studies suggest that more than 70% of students experience high levels of academic stress (García-Ros et al., 2012; Joseph et al., 2021). Due to the above and based on the benefits that are provided from the physical education classroom, proposals based on physical activity should be designed to learn strategies for the successful management of stress and anxiety (Chust-Hernández et al., 2023).

Although there is a general consensus on the benefits of physical activity on mental health, most previous reviews have focused on adult populations or in clinical settings. This has obviated its specific application within the school setting (De Souza-Lima et al., 2024; Remes et al., 2016). Some recent studies have begun to explore this area, however, they focus on describing the benefits in a general way. This highlights the relevance of a systematic analysis of physical-educational interventions applied at different educational stages (Kinder et al., 2023). This limitation evidences an important gap in the literature, especially considering the increased levels of emotional distress and anxiety-related disorders among the student population following the pandemic (Loades et al., 2020; Orgilés et al., 2020). In addition, academic stress, particularly in secondary and higher education, has been consolidated as one of the main risk factors for the deterioration of psychological well-being (Silva-Ramos et al., 2020).

Physical activity can improve coping with anxiety and stress, but more research is needed to understand its effectiveness in different educational contexts. Based on this, this study aims to analyze the findings of the school physical-educational proposals on anxiety and stress published during the period 2017-2023.

Method

The guidelines established in the PRISMA statement (Page et al., 2021) were followed to select the articles to be reviewed and the PICO search strategy (da Costa et al., 2007) was applied (Table 1).

Search procedure and strategy

The Web of Science (WoS), SCOPUS, and PubMed databases were searched. The search was carried out during the months of May and June 2023, establishing a time period to include articles published from 2017 to May 2023. Prior to defining the time range, an evolution of the scientific production of the subject was carried out. More than 70% of the studies on this subject were published from 2017 onwards. This justifies the choice of 2017 as the reference point for collecting scientific research. Specific search terms such as "physical activity", "stress", "anxiety" and "education*" were used, combined with the Boolean operator "AND". Finally, 12 scientific papers were selected for qualitative synthesis in this study.

Results

Study selection

A total of 840 scientific papers were obtained from the initial search. Filters were then applied to select only articles in appropriate format, discarding systematic reviews, which reduced the number to 716 articles. The search was then refined by specifying that the studies to be included should belong to the fields of *Education & Educational Research*, *Sport Sciences*,

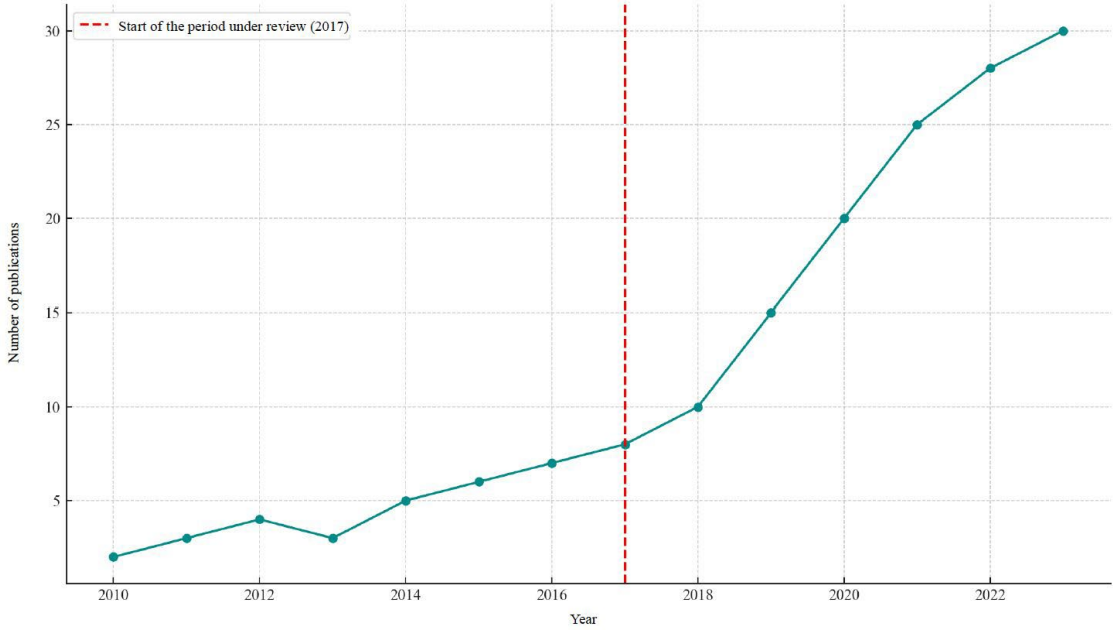
Table 1

Eligibility criteria

Criteria	Description of the inclusion criteria
Population	Primary, secondary, and higher education students.
Intervention	Scientific publications that use a cross-sectional and/or longitudinal design methodology.
Comparison	Scientific studies including physical activity programs with an impact on anxiety and stress in primary education, secondary education, and higher education.
Results	Researches with significant results and conclusions that empower the analysis of the study variables.
Time	Research published between 2017 and 2023.
Language	Writing in Spanish or English.
Study characteristics	Use of research instruments to analyze study participants.

Figure 1

Evolution of publications on physical activity, anxiety and stress in education (2010-2023)



Applied Psychology, *Psychology*, and *Social Sciences*. For their selection, the studies had to be written in Spanish or English. This resulted in the incorporation of 15 articles from the Web of Science database, 60 articles from SCOPUS, and 16 articles from PubMed. This added up to a total of 91 papers.

Then, the bibliographic management program Mendeley Reference Manager was used to discard duplicate studies that were present in more than one database. This resulted in the elimination of 85 articles. These articles were evaluated by reading the titles and abstracts, selecting only those that met the established criteria (Figure 2).

Data extraction and description of the sample of selected ítems

Once the articles had been selected, an analysis of their quality was carried out using the Standard Quality Assessment Criteria for Evaluating Primary Research Papers from a Variety of Fields (Kmet et al., 2004). Each study was examined using 14 criteria covering aspects such as research design, sample characteristics, methodology used, data analysis, and presentation of results and conclusions.

Each of these criteria was rated according to the degree of compliance within the study, following a rating scale: 2 points if satisfactory, 1 point if partially complied with, and 0 points if unsatisfactory, plus the not applicable option. The overall score was calculated by applying the following formula: [("satisfactory numbers" x 2) + ("partially satisfactory numbers" x 1) / 28 - ("not applicable numbers" x 2)]. The results were expressed as a percentage, with a range from 0 to 100%. This process was carried out independently by two researchers.

The information extracted from the different investigations was: 1) author/s, 2) year of publication, 3) country, 4) study participants, 5) methodological design/characteristics, 6) objective, 7) variables, 8) outcome measures, 9) results (Table 2 and Table 4).

Figure 2

Study flowchart

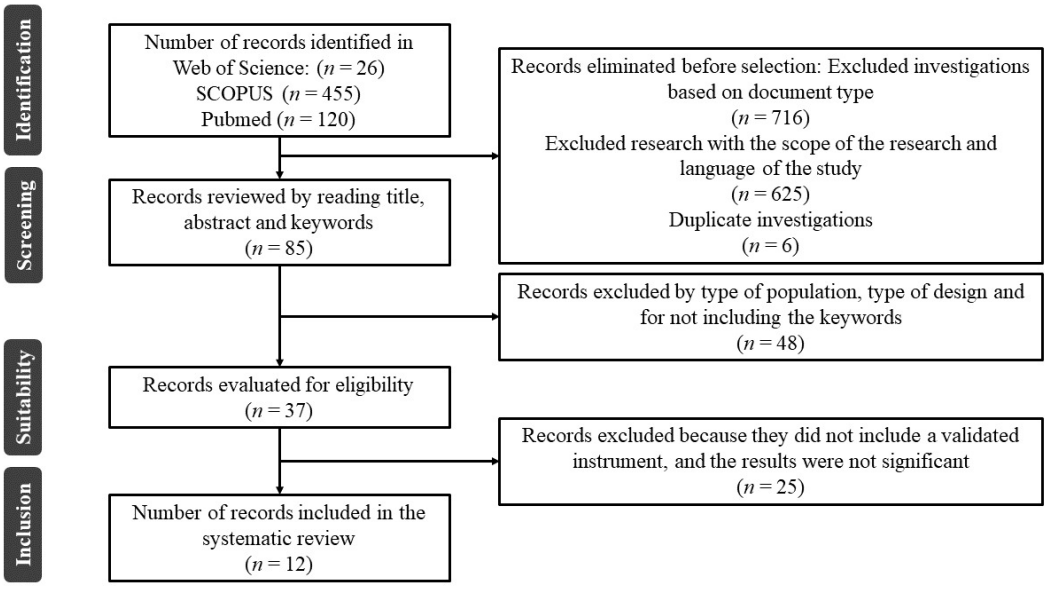


Table 2

Main characteristics of the study sample

Authors	Year	Country	Participants	Design
Carratalá-Bellod et al.	2022	Spain	11 participants, ranging in age from 11 to 19 years old	Selective research method, with an ex-post-facto retrospective design
Chacón-Cuberos et al.	2019	Spain	225 participants, mean 21.65 (± 2.59) years of age	Descriptive cross-sectional study
Deng et al.	2020	China	1607 participants, aged 18 to 22 years old	Descriptive cross-sectional study
Jiang et al.	2022	China	3662 participants, average age 19.2 years old	Descriptive longitudinal study
Kayani, Kiyani, et al.	2021	China	305 participants, between 18 and 36 years of age	Descriptive cross-sectional study
Kayani, Wang et al.	2021	Canada	442 participants, aged between 18 and 36 years old	Structural equation modeling for developing multiple mediation models
Mendoza-Castejón and Clemente-Suárez	2020	Spain	181 participants, with a mean age of 7.91 (± 2.29) years.	Descriptive cross-sectional study
Naderi et al.	2019	Iran	22 participants, between 8 and 11 years of age	Quasi-experimental pretest-posttest class research with control group
Nopembri y Sugiyama	2022	Indonesia	556 participants, aged between 10 and 12 years old	Cross-sectional correlational study
Stolarska et al.	2019	Poland	240 participants, between 19 and 27 years of age	Randomized controlled trial, experimental and control groups
Webber et al.	2020	Canada	98 participants, mean 23.75 (± 2.5) years old	Sequential mixed methods, including questionnaires and inductive analysis of focus groups
Zhang et al.	2021	Canda	70 participants, between 18 and 30 years of age	Randomized controlled trial, experimental and control groups

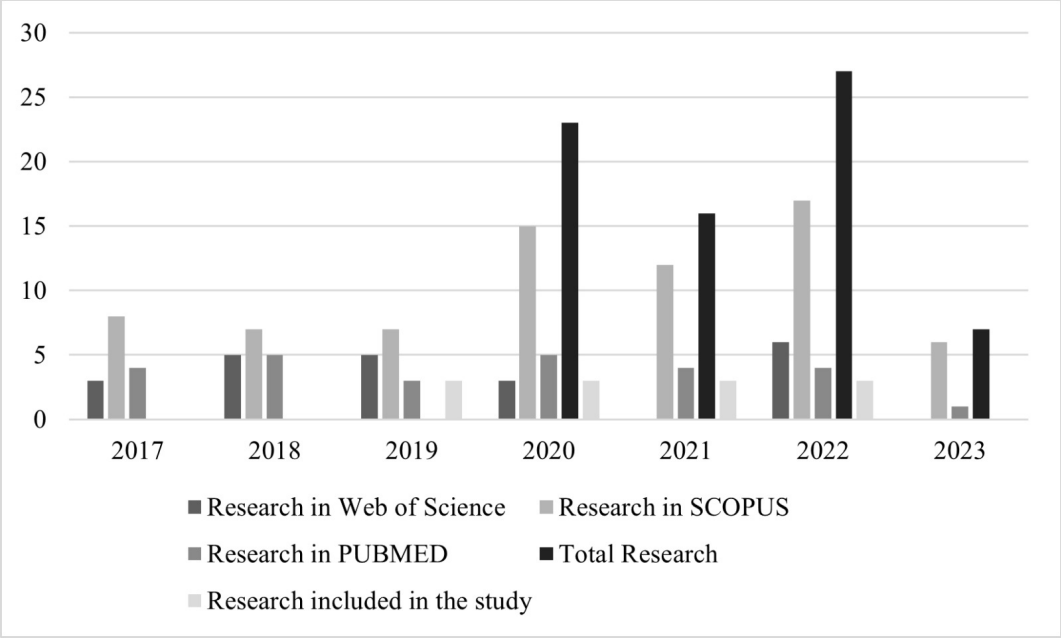
Table 3

Evaluation of the quality of the studies

Studies	Observer 1	Observer 2
Carratalá-Bellod et al. (2022)	0.81	0.82
Chacón-Cuberos et al. (2019)	0.62	0.58
Deng et al. (2020)	0.85	0.85
Jiang et al. (2022)	0.77	0.71
Kayani. Kiyani. et al. (2021)	0.7	0.75
Kayani, Wang, et al. (2021)	0.68	0.61
Mendoza-Castejón and Clemente-Suárez (2020)	0.8	0.6
Naderi et al. (2019)	0.61	0.61
Nopembri y Sugiyama (2022)	0.78	0.75
Stolarska et al. (2019)	0.7	0.7
Webber et al. (2020)	0.64	0.68
Zhang et al. (2021)	0.64	0.68

Figure 3

Evolution of scientific productivity and selected articles since 2017



Quality of studies

The scores are expressed in percentages, varying between 0 % and 100 % (Table 3). To assess the degree of agreement between the evaluators, the intraclass correlation coefficient was used, obtaining a value of 0.83 ($p < .001$), indicating a good level of agreement (Koo and Li, 2016). After establishing the level of inter-rater agreement, a conservative criterion was agreed upon for the selection of studies, including only those with scores equal to or higher than 55 %. Overall, scores ranged from 0.61 to 0.85 for the first rater and from 0.58 to 0.85 for the second rater.

Figure 3 shows the evolution of scientific production and selected articles for this research work. The trend of the graph manifests linearity in terms of the number of studies carried out in the years 2017, 2018, 2019, and 2021. The production is higher in the years 2020 and 2022, as for the year 2023 the volume of articles is lower.

Table 4 presents the study objectives, variables and measures, as well as the results of these studies. A relationship between stress and engagement was verified (Carratalá-Bellod et al., 2022), which suggests that sports practice can improve coping strategies for stress and academic engagement (Carratalá-Bellod et al., 2022). A significant correlation was established between mental state and regular exercise, as well as adequate

Table 4

Treatment variables and main physical activity outcomes and relationships

Study	Objective	Variables	Measures	Results
Carratalá-Bellod et al. (2022)	To know the relationship of predictor variables of stress and commitment in the sport and academic context of young judokas, according to personal characteristics such as sex and sport level.	Stress Resilience Sport Coping	EACD (Molinero et al., 2010). CSQ (Sandín and Chorot, 2003). RS-14 (Wagnild & Young), validated by Sánchez-Teruel and Robles-Bello (2015). CD-RISC validated by Serrano-Parra et al. (2012). EDQ (Pedrosa et al., 2012). PSS-14 (Cohen et al.), version validated by Remor and Carrobles (2001). ECD (Orlick), validated by Belando et al. (2012). UWES-S (Schaufeli & Bakker), validated by Parra and Pérez (2010).	Stress, academic engagement and sports practice are related. Physical activity improves stress coping strategies. Sport increases students' commitment to their studies.
Chacón-Cuberos et al. (2019)	To relate the levels of motivation and learning strategies with academic performance and the practice of physical activity in university students.	Academic performance Physical activity Anxiety Motivation Habits	MLSQ-SF (Pintrich et al., 1993), adapted to Spanish by Sabogal et al. (2011). *Ad-hoc* questionnaire	Academic grades were negatively related to task worthiness and positively related to organization, study habits, and effort regulation. Intrinsic motivation was positively associated with effort regulation, organization, and strategy use. Physical activity reduced anxiety, but decreased strategy use and effort regulation.
Deng et al. (2020)	Using data from an Internet-based survey to assess the relationship between the mental health status of university students and their sport-related lifestyles.	Anxiety Stress Depression Physical activity	DASS-21	Mental state improves with regular exercise and adequate duration. College students need professional physical guidance. Online Physical Education presents problems of personalization, technical, and limited interaction.
Jiang et al. (2022)	To investigate the mediating role of adult attachment between childhood maltreatment and depressive symptoms among college students and to explore the moderating effect of physical activity on the mediating pathway.	Depression Child abuse Adult attachment Physical activity	SDS (Zung, 1965). CTQ-SF (Zhao et al., 2005). ECR-R: (Fraley et al., 2000). PARS-3 (Liang, 1994).	Childhood maltreatment and adult attachment were associated with depressive symptoms, with attachment being the mediator between the two. Physical activity moderated the relationship between attachment anxiety and depressive symptoms.
Kayani, Kiyani, et al. (2021)	Examining the role of self-improvement and self-criticism in the analogy between physical activity and anxiety.	Physical Activity Personal improvement Self-criticism Anxiety	PAQ SFSESS (Hepper et al., 2013). LOSC STAI Y-6	Interventions to reduce student anxiety include promoting physical activity and improving the student's.

Table 4 (continued))

Study	Objective	Variables	Measures	Results
Kayani et al. (2021)	To test the association given between physical activity and academic anxiety in Canadian university students and to examine whether the mediation of self-improvement and self-criticism explains this relationship.	Physical activity Self-improvement Self-criticism Anxiety	Cho-PAQ (Cho, 2016). SFSESS-CN (Hepper et al., 2013). LOSC (Thompson and Zuroff, 2004). STAI-SF (Marteau & Bekker, 1992).	Physical activity influences academic anxiety indirectly, through self-improvement and self-criticism.
Mendoza-Castejón and Clemente-Suárez (2020)	To analyze differences in psychophysiological markers of stress, behavior, and academic performance of rural and urban students.	Anxiety Physical activity Academic performance Heart rate Nutrition	Polar V800 PAQ-C / PAQ-A CHN: Nutritional Habits Questionnaire (developed *ad hoc*). STAIC	School location affects stress, anxiety, nutritional habits, and physical activities, but not academic performance. Body mass index, food intake, and stress markers can influence academic performance.
Naderi et al. (2019)	Investigating the impact of physical exercise on anxiety among victims of child abuse.	Anxiety Physical activity Child abuse	STAI CTQ	The effect of physical exercise on the decrease of anxiety among children who were victims of child maltreatment is confirmed.
Nopembri and Sugiyama (2022)	To examine the correlation between physical, psychosocial and spiritual aspects of children in Physical Education class at school.	Depression Anxiety Stress Physical activity	ESPS SSCE RaSSY (Hernández, 2019). DASS-42	Increasing the psychosocial aspect favors the spiritual, while decreasing the psychological aspect improves the spiritual. Physical Education and sport are expected to develop the psychosocial and reduce the negative psychological aspects.
Stolarska et al. (2019)	To test the impact on mood of a 45-minute aerobic training session conducted in a natural environment.	State of mind Physical activity	UMAC (Matthews et al., 1990), provided by Goryńska (2005).	Physical activity improved mood in all three dimensions, especially in energy arousal. Improvements in energy and tension were greater in individuals with low initial hedonic tone.
Webber et al. (2020)	To measure and compare the distress of initial master's students in physical therapy and physical therapy. To assess levels of distress in relation to existing data. To explore stressors, effects of stress, and coping strategies.	Anxiety Stress Depression Coping	*Ad-hoc* questionnaire DASS-21 OTSSS SOC-13 Discussion group.	Students reported more stress, anxiety, and depression than in the following course, compared to university students and the general population. Academic workload negatively affected mental health. Coping strategies included physical activity, peer selection, and modification of expectations.
Zhang et al. (2021)	To evaluate the efficacy of an online high-intensity interval training (HIIT) and health education intervention on behaviors, mental health, and cognitive function in sedentary young women.	Cognitive abilities Stress Physical activity Sedentary lifestyle	PAQ STAI PSS	Both online body weight HIIT intervention with health education and education alone improve health-related behaviors, although their effects vary depending on the approach. The "HIIT plus education" modality could be effective in mitigating negative emotions and improving cognitive function.

exercise duration. This implies that adequate exercise can have a positive impact on the mental well-being of students (Deng et al., 2020; Webber et al., 2020; Zhang et al. 2021). In addition, it was found that physical activity can function as a moderator between attachment anxiety and depressive symptoms, highlighting that PE and sport can have a positive impact on psychosocial health and reduce psychological problems (Jiang et al., 2022; Nopembri & Sugiyama, 2022).

To reduce anxiety in students, it is recommended to implement interventions that promote physical activity and improve the support system (Kayani, Kiyani, et al., 2021). In some studies, it was found that physical activity does not directly affect academic anxiety, but has an indirect influence through self-improvement and self-criticism (Kayani, Kiyani et al., 2021). Combining intense, high-intensity interval exercise with health education is highlighted as a modality, which can help mitigate negative emotions and improve cognitive function (Zhang et al., 2021). On the other hand, other research indicates that school location can affect students' stress, anxiety, nutritional habits, and physical activities (Mendoza-Castejón y Clemente-Suárez, 2022). It has been found that students attending schools located in neighborhoods with a medium-high socioeconomic level show lower levels of anxiety and stress than young people attending schools located in areas with low purchasing power (Mendoza-Castejón & Clemente-Suárez, 2022).

It is important to have professional physical guidance for students, as this can be beneficial for both their physical and mental development. In this area, Physical Education via the Internet presents challenges, such as exercises that are not adapted to the students' preferences, frequent technical problems and lack of interaction. These issues need to be addressed in the future in order to improve the online Physical Education experience (Deng et al., 2020).

Coping strategies, including physical activity, strategic peer selection, and modification of expectations, are important in coping with academic workload and affect students' mental health. In general, encouraging healthy habits, such as physical activity, can help to reduce anxiety and improve students' well-being in different contexts.

Discussion

The findings of this study have important implications for youth and educators, highlighting the critical role of physical activity in promoting mental well-being and academic performance. Evidence suggests that regular exercise not only improves psychosocial health and reduces stress, anxiety, and depression, but also acts as an effective coping strategy in the face of academic demands.

The results of the present study coincide with those of San Román-Mata et al. (2020), since they show that regular physical exercise has a positive impact on various psychological aspects. In order to show the impact of physical activity practice on anxiety and stress in students, different data have been extracted that verify a positive link when facing these mental health problems. These aspects coincide with those described by Sánchez-Núñez et al. (2023), who highlight the adaptive emotional regulation strategies and their importance as mediators to enhance the effect of physical activity on mental health.

In turn, Melguizo-Ibáñez, Zurita-Ortega et al. (2023), in the conclusions of their work, state that sports practice plays a key role in the channelling of anxiety. In this sense, the degree of physical activity practice is significantly connected with the degree of stress, depression, and anxiety. Biernat et al. (2022) suggest implementing programs to improve leisure time physical activity and to support the leadership of the school administration and the higher education system in this regard. Since, as stated in the results of this systematic review, practicing physical activity periodically will have a positive impact on the psychological well-being of students (Melguizo-Ibáñez, Zurita-Ortega et al., 2023).

Currently, children and adolescents who comply with the recommended daily movement patterns have a better quality of life in relation to their mental health (López-Gil et al., 2022). This is related to the present study, which suggests that carrying out physical activity in an appropriate manner can have beneficial effects on the psychological well-being of students.

According to González-Valero et al. (2022), physical activity is directly related to well-being. This coincides with the results presented in the exposition of results where it has been shown that physical activity can play a mediating role between attachment anxiety and depressive symptoms.

Adherence to healthy lifestyles can contribute to lower anxiety levels and promote the overall well-being of students in various situations. This is consistent with the results presented by Olanescu et al. (2022), as they have shown that a significant increase in sedentary lifestyles among students and a reduction in physical activity negatively affect stress and anxiety.

About anxiety, it is important to refer to what was studied by Pérez and Gétrudix-Barrio (2021). Their qualitative analysis revealed several positive factors that could promote the reduction of anxiety, such as: overcoming challenges, collaboration among peers, enjoyment of playful elements, personal growth, learning and improvement in aspects of the curriculum. In this line, the present systematic review suggests carrying out interventions that encourage contribution in physical activities and strengthen the available support system, to face anxiety situations in students.

In terms of stress, the findings supported the assumptions made by López-Walle et al. (2020). It is highlighted that students who reported greater participation in physical activities also manifested a greater sense of control and a lower perception of being overwhelmed by stressful situations. In this sense, a connection was found between stress and physical activity, indicating that participation in sports activities may improve stress coping skills and promote greater academic engagement.

Despite the important findings on the relationship between physical activity, stress, anxiety, and academic performance, this study had several limitations, such as the lack of longitudinal data to establish clear causal relationships. Another relevant limitation lies in the heterogeneity of the measurement instruments used in the studies analyzed, which makes it difficult to

directly compare the results and consolidate more solid conclusions. Likewise, the diversity of cultural and educational contexts in which the research was carried out may influence the applicability of the findings to different academic systems and educational levels. It is also important to note that most of the studies were based on self-report methods, which could generate biases in the participants' perception of their level of physical activity and emotional well-being. Other external variables, such as socioeconomic factors or access to adequate spaces for sports practice, which could influence the relationship between physical activity and mental health in students, were not considered. In addition, most of the studies relied on specific samples and may not be generalizable to other student populations.

For future research, longitudinal studies exploring the long-term effects of physical activity on students' mental health are suggested. In addition, practical applications could be explored, such as the integration of physical activity programs into the school curriculum and the development of more effective online physical education platforms. In short, although physical activity favors decreased anxiety and improved well-being in students, more research is needed to fully understand its impact and to develop effective intervention strategies.

Conclusions

The findings of this review reinforce the growing evidence on the influence of physical activity on students' mental well-being and academic performance. In line with previous studies, it confirms that sports practice not only contributes to reducing stress and anxiety but may also play a key role in developing coping strategies and promoting stronger academic engagement. Furthermore, it has been identified that factors such as the intensity and regularity of exercise can increase the beneficial effects on mental health, suggesting the need to design physical intervention programs tailored to the individual needs of students.

These results should also be interpreted in the context of current challenges in health education and promotion. Despite the documented benefits of physical activity, the adoption of healthy habits continues to be influenced by variables such as socioeconomic environment, access to sports spaces, and educational modality. Online Physical Education represents a developing area that requires adjustments to ensure its effectiveness and improve the student experience.

From an applied perspective, the results support the implementation of multidimensional strategies that integrate physical activity, health education, and psychosocial support as a means to strengthen student well-being. Future research could focus on exploring innovative approaches, such as the use of technology to personalize exercise programs or the integration of movement-based psychological interventions, in order to optimize their impact on mental health and academic performance.

Author contributions

Conceptualization: R.F.C.-C., J.L.U.-J.
Methodology: R.F.C.-C., E.M.-I.
Validation: J.L.U.-J., J.M.A.-V.
Formal analysis: R.F.C.-C., E.M.-I.
Investigation: R.F.C.-C., J.L.U.-J.
Data curation: J.L.U.-J., E.M.-I.
Supervision: R.F.C.-C., J.L.U.-J.
Project administration: R.F.C.-C., E.M.-I.
Writing – Original draft: R.F.C.-C., J.M.A.-V.
Writing – Review & Editing: J.L.U.-J., J.M.A.-V.

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Conflict of interest

The authors declare that there is no conflict of interest.

Data availability statement

Data supporting the results and conclusions of this study are available upon request from the corresponding author.

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Note: asterisks indicate studies included in the meta-analysis.

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