Performance in sport

Sport as a pedagogical tool in higher education: effects on depression, anxiety, stress and well-being in university students. A systematic review

El deporte como herramienta pedagógica en educación superior: efectos sobre depresión, ansiedad, estrés y bienestar en universitarios. Una revisión sistemática

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ABSTRACT

Objective: To synthesise the evidence on interventions based on sport, physical activity or exercise with a structured educational component in university students, compared with controls, usual practice, active comparators or uncontrolled pre–post designs, regarding depression, anxiety, stress and well-being as measured using validated instruments. Methods: A systematic review was conducted in accordance with PRISMA 2020. The search was completed on 6 May 2026 in Scopus, ScienceDirect, Web of Science and SPORTDiscus. A total of 920 records were identified; after removing duplicates, screening and full-text assessment, 13 studies were included. Results: The studies included randomised trials and non-randomised intervention designs, with high heterogeneity in duration, modality, educational component and instruments. The interventions were associated with improvements in depression, anxiety, stress and/or well-being, although the certainty of the evidence was low to very low due to risk of bias and methodological variability. Conclusion: The evidence suggests favourable associations, but does not allow for firm causal inferences. Practical implications: Integrate structured physical activity programmes with a pedagogical focus and follow-up into university well-being strategies.

Keywords: physical activity, higher education, mental health, educational intervention.

RESUMEN

Objetivo: Sintetizar la evidencia sobre intervenciones basadas en deporte, actividad física o ejercicio con componente pedagógico estructurado en estudiantes universitarios, comparadas con controles, práctica habitual, comparadores activos o diseños pre–post sin control, sobre depresión, ansiedad, estrés y bienestar medidos con instrumentos validados. Métodos: Se realizó una revisión sistemática siguiendo PRISMA 2020. La búsqueda se cerró el 6 de mayo de 2026 en Scopus, ScienceDirect, Web of Science y SPORTDiscus. Se identificaron 920 registros; tras eliminar duplicados, cribados y evaluación a texto completo, se incluyeron 13 estudios. Resultados: Los estudios incluyeron ensayos aleatorizados y diseños no aleatorizados con intervención, con alta heterogeneidad en duración, modalidad, componente pedagógico e instrumentos. Las intervenciones se asociaron con mejoras en depresión, ansiedad, estrés y/o bienestar, aunque la certeza de la evidencia fue baja a muy baja por riesgo de sesgo y variabilidad metodológica. Conclusión: La evidencia sugiere asociaciones favorables, pero no permite inferencias causales firmes. Aplicación práctica: integrar programas estructurados de actividad física con intencionalidad pedagógica y seguimiento en estrategias de bienestar universitario.

Palabras Clave: actividad física, educación superior, salud mental, intervención pedagógica.

INTRODUCTION

Mental health in the university setting has become a critical public health challenge globally. During the transition to higher education, students face a convergence of academic, social and personal pressures that significantly increase the prevalence of mood disorders (Fuller et al., 2025; Sun et al., 2026). Recent research highlights that depression and anxiety not only affect academic performance but also impair this population's quality of life and social functioning (Huo & Yang, 2023; Jing et al., 2026). This phenomenon intensified during the pandemic due to restrictions and isolation, but persists as a structural challenge in higher education, linked to academic workloads, life changes and sedentary habits (Sanchis-Soler et al., 2022).

Despite the scientific consensus on the benefits of exercise, an alarming proportion of university students maintain sedentary lifestyles (Bulguroglu et al., 2023). Physical inactivity is consistently associated with an increased risk of depressive symptoms and reduced psychological resilience (Ammar et al., 2020; Biernat et al., 2022). However, the literature suggests that regular physical activity acts as a robust protective factor, positively mediating emotional regulation through neurobiological and psychosocial mechanisms (Lin et al., 2026; Zhang et al., 2025).

In this review, sport/physical activity is understood as a 'pedagogical tool' only when the intervention incorporates an explicit and verifiable educational intent, expressed through at least one of the following elements: formal curricular or extracurricular integration, stated learning objectives, educational contents associated with physical activity, teaching or professional guidance for educational purposes, micro-lessons, educational materials, learning-oriented feedback, or assessment/monitoring of the learning process. Consequently, mere technical supervision, attendance recording, monitoring via or messaging apps, or correction of technique were not considered sufficient if these elements were not explicitly linked to an educational or pedagogical purpose.

In the university context, it is necessary to move beyond the view of sport as a purely recreational activity and position it as an intentional pedagogical strategy (Worobetz et al., 2020). Although there is a wealth of literature on physical activity and mental health, a significant proportion consists of

cross-sectional or observational designs that limit causal inference and, furthermore, do not always describe an explicit pedagogical component (Evans et al., 2021; Luo et al., 2024). Therefore, the aim of this systematic review was to synthesise the available evidence on the effect of interventions based on sport, physical activity or exercise with a structured pedagogical component, targeting university or higher education students, compared with control conditions, usual care, active comparators or pre–post designs without a control group where no comparator was available, on mental health outcomes such as depression, anxiety, stress and psychological well-being, as measured using validated instruments.

METHOD

Design and reporting guidelines

A systematic review was conducted on interventions based on sport, physical activity or exercise with an educational component and their relationship to mental health as measured in university students. The review was conducted and reported in accordance with the PRISMA 2020 guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), including the flow diagram and the corresponding checklist.

Information sources and search strategy

The search was conducted in four bibliographic databases, with a cut-off date of Wednesday 6 May 2026: Scopus (n=128), ScienceDirect (n=110), Web of Science (n=657) and SPORTDiscus (n=25), yielding a total of 920 records.

No initial restrictions were applied regarding year of publication, country or language. The search was conducted primarily in English, given that the databases consulted mainly index titles, abstracts and keywords in this language; however, records were not excluded on the basis of language during the initial identification phase. The inclusion of specific instrument names was intended to increase sensitivity towards studies with explicit mental health measurements; however, records reporting equivalent validated scales or instruments were also accepted when such measurements were identifiable in the title, abstract or full text. The ScienceDirect search strategy was more restrictive due to the retrieval and specificity limitations of that database; consequently, its results were supplemented with broader searches in Scopus, Web of Science and SPORTDiscus.

The strategy was structured around four conceptual blocks, adapted to the syntax of each database: (1) population (university students/higher education), (2) intervention/exposure (sport/physical activity/exercise), (3) pedagogical/educational approach (curriculum, year, pedagogy/educational intervention) and (4) measured mental health (mental health terms + validated instruments). To ensure reproducibility, the full search equations were formulated in accordance with the PRISMA guidelines for reporting search components and flowcharts, which were as follows: 1) Scopus: (((sport OR "physical activity" OR exercise OR athletics OR "sport-based") AND (pedagogy OR curriculum OR course OR instruction OR didactic OR "sport pedagogy" OR “pedagogical model” OR “sport education model” OR “educational intervention” OR programme OR intervention)) AND (“higher education” OR university OR “university student” OR “college student” OR undergraduate OR campus) AND (“mental health” OR wellbeing OR well-being OR “psychological well-being” OR depression OR anxiety OR stress OR distress OR burnout OR resilience OR “emotion regulation”)

AND (DASS OR "DASS-21" OR PHQ OR "PHQ-9" OR GAD OR "GAD-7" OR PSS OR "WHO-5" OR WEMWBS OR GHQ OR K10 OR K6 OR BDI OR STAI OR CES-D OR "CD-RISC" OR "Rosenberg")); 2) ScienceDirect: "curriculum" AND "higher education" AND "mental health" AND ("physical activity" OR sport) AND (DASS OR PHQ OR GAD); 3) Web of Science: (((sport OR "physical activity" OR exercise OR athletics OR "sport-based") AND (pedagogy OR curriculum OR course OR instruction OR didactic OR "sport pedagogy" OR "pedagogical model" OR "sport education model" OR "educational intervention" OR programme OR intervention)) AND ("higher education" OR university OR "university student" OR "college student" OR undergraduate OR campus) AND ("mental health" OR wellbeing OR well-being OR "psychological well-being" OR depression OR anxiety OR stress OR distress OR burnout OR resilience OR "emotion regulation") AND (DASS OR "DASS-21" OR PHQ OR "PHQ-9" OR GAD OR "GAD-7" OR PSS OR "Perceived Stress Scale" OR "WHO-5" OR WEMWBS OR GHQ OR K10 OR K6 OR BDI OR "Beck Depression Inventory" OR STAI OR "State-Trait Anxiety Inventory" OR CES-D OR "Connor-Davidson" OR CD-RISC OR "Rosenberg" OR "self-esteem scale")); and 4) SPORTDiscus: TI(("sport pedagogy" OR "sport education model" OR curriculum OR course OR "educational intervention" OR pedagogy)) AND AB(("university student*" OR "college student*" OR undergraduate* OR university OR "higher education")) AND AB(((sport* OR "physical activit*" OR exercise) N3 (intervention* OR programme* OR curriculum OR course OR pedagog*))) AND AB(("mental health" OR wellbeing OR well-being OR depression OR anxiety OR stress OR distress OR burnout OR resilience OR "emotion* regulation")) AND AB((DASS* OR PHQ* OR GAD* OR PSS OR GHQ OR "WHO-5" OR WEMWBS OR K10 OR K6 OR CES-D OR STAI OR BDI)).

Reference management, duplicate removal and corpus preparation

The retrieved records were exported and managed in Mendeley. Duplicates were identified and removed prior to screening, using matches by DOI (where available) and by metadata (title, authors, year and source). Of the total of 920 records, 93 duplicates were removed, leaving 827 unique records for screening by title and abstract.

Eligibility criteria

The following criteria were defined a priori:

Inclusion

- Population: university students (undergraduate/postgraduate) or an explicit higher education context.
- Intervention/exposure: participation in sport, physical activity or exercise in a university setting.
- Pedagogical approach: explicit evidence of an educational/pedagogical component, defined as the presence of learning objectives, formal curricular or extracurricular integration, educational contents associated with physical activity, teaching or professional guidance for educational purposes, micro-lessons, learning materials, learning-oriented feedback, or Assessment/monitoring of the learning process. Simple technical supervision, monitoring of attendance or follow-up via messaging were not considered sufficient if these elements were not linked to an explicit educational purpose.
- Outcomes: mental health measured using validated instruments/scales (e.g. DASS-21, PHQ-9, GAD-7, PSS, GHQ, WHO-5, WEMWBS, BDI-II, amongst others).

- Study type: primary studies with original data.

Exclusion
- Systematic reviews, scoping reviews, meta-analyses, protocols and bibliometric studies.
- Ineligible literature (e.g., conference abstracts, posters, indexes, 'full issue PDFs', book chapters).
- Non-university population or context not attributable to higher education.
- Absence of an intervention/exposure based on sport/physical activity/exercise or absence of mental health outcomes.
- Absence of explicit measurement of mental health using an instrument or scale (or not reported in the title or abstract, according to the operational screening criteria).
- Withdrawn records.

Study selection process

Two authors carried out the selection process independently. Discrepancies were resolved by consensus. The process was carried out in stages: 1) Screening by title and abstract: 827 unique records were screened. 709 records were excluded for predefined reasons (e.g., non-university population, absence of sport/physical activity, absence of measured mental health, ineligible publication type). Following this initial screening, 118 records were considered potentially relevant. 2) Advanced screening by abstract (thematic refinement): this stage was applied to the 118 potentially relevant records with the aim of verifying, prior to retrieving the full text, the explicit presence of three operational criteria: (a) a verifiable pedagogical/curricular component, (b) a structured intervention based on sport, physical activity or exercise, and (c) explicit measurement of mental health using a validated instrument or scale. The advanced screening was carried out independently by two reviewers. Discrepancies were resolved by consensus and, where necessary, through a joint review of the title, abstract and keywords. To minimise the risk of double-counting or arbitrary exclusion, each record was classified with a single primary reason for exclusion, applying a predefined hierarchical rule: population/context, intervention, design, pedagogical component and measurement instrument. At this stage, 78 records were excluded and 40 were prioritised for retrieval and full-text assessment. 3) Full text: attempts were made to retrieve the full text of the 40 prioritised reports; 39 were retrieved and 1 could not be retrieved due to access/availability limitations. The 39 full texts were assessed for final eligibility, with 26 excluded for documented reasons; ultimately, 13 studies were included.

Reasons for exclusion were categorised with one primary reason per record to avoid double counting. In the advanced screening of abstracts, a hierarchical exclusion rule was applied (population/context, intervention, design, pedagogical component and explicit instrument), ensuring mutually exclusive categories.

Data extraction

The authors independently extracted the following: author/year, country, design, sample size, characteristics of the intervention (type, duration, frequency, intensity and pedagogical context), mental health instruments, primary outcomes and reported statistical data. A standardised data extraction matrix (piloted on a subset of articles) was used, which included: FITT characteristics, pedagogical context (curricular/extracurricular; on-campus/online; with feedback/follow-up), instruments and outcomes. Data extraction was carried out independently by two authors, and any discrepancies were resolved by consensus.

Assessment of risk of bias and certainty of evidence

General approach

The risk of bias assessment was conducted at the level of the primary mental health outcome in each study. RoB 2 was applied to randomised trials and ROBINS-I to non-randomised intervention studies. Disagreements between assessors were resolved by consensus, and the reasons for judgement were documented by domain.

Randomised trials (RoB 2)

In the randomised trials, details of which are presented in Appendix 1 (Table A1), the overall assessment ranged from 'high risk' to 'some concerns'. The domains with the highest frequency of limitations were: (D4) outcome measurement, where the outcome was self-reported and there was a likelihood of bias due to expectations or lack of blinding; and (D1–D2) due to uncertainty in the randomisation process or unavoidable deviations from the intervention in behavioural studies. Domain (D3) raised fewer concerns when adequate retention and explicit handling of missing data were reported.

Non-randomised intervention studies (ROBINS-I)

In the non-randomised studies, the details of which are presented in Appendix 2 (Table A2), an overall 'critical' grade predominated, explained mainly by (D1) confounding. This grade was consistent with pre–post designs without a comparator, where threats to internal validity (history, maturation, regression to the mean and simultaneity of changes) may explain part of the pre–post differences. 'Serious' judgements were also observed regarding (D2) participant selection (convenience samples or self-selection) and (D6) outcome measurement (self-report without blinding). One study received a 'serious' overall judgement, consistent with the presence of comparisons between interventions but without randomisation and with potential residual confounding.

Certainty of the evidence (GRADE)

Overall certainty by outcome was assessed using the GRADE approach. Given the clinical and methodological heterogeneity and the absence of meta-analyses, certainty was assessed qualitatively, taking into account risk of bias, inconsistency, indirectness and imprecision. Overall, certainty was low to very low for most outcomes, particularly where uncontrolled designs or those with a high risk of bias predominated. The assessments are presented in Table 4.

Synthesis of the evidence

Due to clinical and methodological heterogeneity (differences in study designs, duration and intensity of interventions, and scales used to assess mental health), a structured narrative synthesis was carried out by type of intervention and outcome (depression, anxiety, stress and well-being). No meta-analysis was performed.

RESULTS

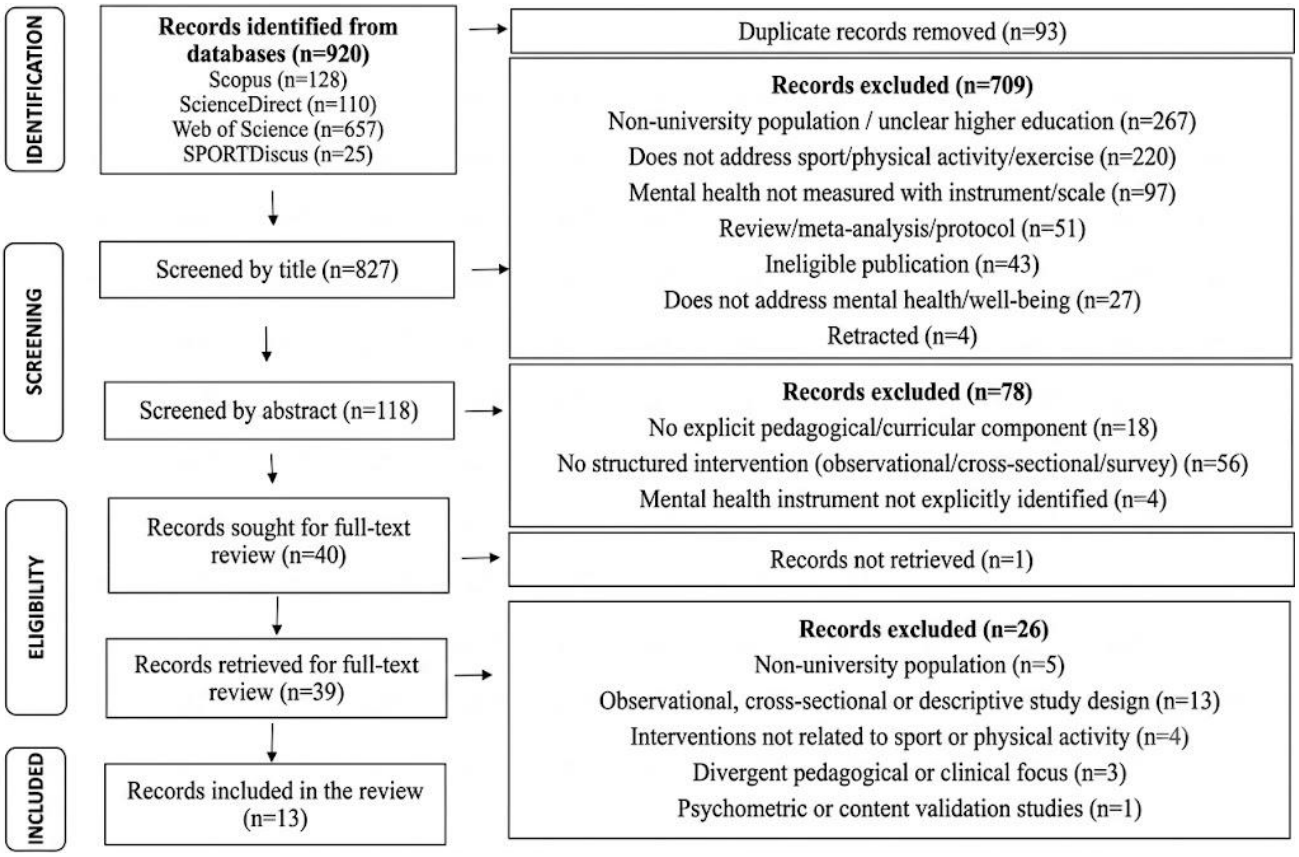
Study selection

A total of 920 records were identified across four databases (Scopus, n=128; ScienceDirect, n=110; Web of Science, n=657; SPORTDiscus, n=25). After removing duplicates (n=93), 827 records were screened by title and abstract. At this stage, 709 records were excluded, mainly due to a non-university population (n=267), absence of sport/physical activity/exercise (n=220), absence of mental health measured using an instrument (n=97), non-primary study type (review/meta-analysis/protocol; n=51), ineligible publications (n=43), absence of mental health/well-being (n=27) or retraction (n=4). In total, 118 records were considered potentially relevant.

Subsequently, an advanced abstract screening was carried out to ensure alignment with the 'educational tool' and 'structured intervention' approach and the explicit mention of the mental health instrument. Seventy-eight records were excluded: the main reason was the absence of a structured intervention (observational/cross-curricular/survey; n=56), followed by the absence of an explicit educational/curricular component (n=18) and an instrument not explicitly identified (n=4). Forty reports were prioritised for full-text retrieval.

Of the 40 reports, 39 full-text articles were retrieved; one could not be retrieved due to access restrictions. Following the full-text eligibility assessment (n=39), 26 reports were excluded: non-university population (n=5), observational/cross-sectional/descriptive design (n=13), interventions unrelated to sport or physical activity (n=4), divergent pedagogical or clinical approach (n=3), and psychometric or content validation studies (n=1). Finally, 13 studies were included in the synthesis. The process is summarised in Figure 1.

Figure 1:
PRISMA flow chart of the record selection process



Characteristics of the included studies

The 13 included studies spanned different geographical contexts (primarily Europe, the Americas and Asia) and methodological designs. Both randomised controlled trials (RCTs) and non-randomised intervention studies (pre–post, pilot and feasibility studies) were included. Interventions ranged from structured programmes lasting several weeks (e.g. 6–8 weeks) to brief interventions (e.g. a single session). The educational component was evidenced by curricular courses, training micro-lessons, supervision using teaching materials (videos, LMS platforms), and/or follow-up and feedback strategies (e.g. digital monitoring). Mental health scales included validated instruments such as the DASS-21, BDI/BDI-II, HAMD, SDS, PSS and WHO-5, amongst others. Detailed characteristics are presented in Table 1.

Analytical synthesis according to intervention characteristics

When comparing the included studies by duration, multi-week interventions (5 to 8 weeks or one academic term) tended to report more consistent changes in depression, stress or well-being than single-session interventions. Longer-duration programmes more frequently incorporated follow-up, progression, educational materials or supervision, which could promote adherence and the consolidation of habits. In contrast, brief or acute interventions allowed immediate changes to be identified, but offer less evidence regarding the sustainability of effects.

By delivery mode, on-campus interventions facilitated direct supervision and group interaction, whilst online, hybrid or technology-mediated modes increased accessibility and follow-up. However, the evidence does not allow us to conclude that one mode is superior to another, due to the heterogeneity of study designs, assessment tools and sample sizes. Interventions using immersive technologies or telerehabilitation show promising results, but require comparative studies with greater methodological rigour.

With regard to the pedagogical component, studies involving curriculum integration, micro-lessons, educational materials or formative feedback provided a more robust justification for sport/physical activity as a pedagogical tool. In contrast, interventions focused solely on technical supervision or behavioural monitoring provide less clarity regarding the pedagogical mechanism, although they may contribute to adherence and the structuring of practice.

When considering study design, randomised trials allow for a more robust interpretation than uncontrolled pre–post designs; however, even in the trials, limitations were identified due to self-reporting and the absence of blinding. Non-randomised studies suggest favourable associations, but their interpretation must be cautious due to the risk of confounding, maturation, history and regression to the mean.

Table 1.
Characteristics of the included studies on sport/physical activity-based interventions (with an educational/structured component) and mental health measured in university students.

Study	Country / Context	Design and sample	Intervention (FITT + educational component)	Mental health (measurement tools)	Key findings (reported)
Gallego et al., 2014	Spain (University of Almería)	Trial with 3 groups (mindfulness vs physical education vs control); n=125	8 sessions/1 hour/week. 'Physical Education' group: stretching + adapted sports games + breathing/posture.	DASS-21 (depression, anxiety, stress)	Between-group effect on total score ($F=5.91$; $p=.004$; $\eta^2=.106$). Reduction in stress also observed in the physical education group (paired t-test reported).
Hoyos-Cifuentes & Bernal-Torres, 2021	Colombia (private university)	Pre–post (non-controlled); n=30 completed	2 months; 2–3 times/week; ~40 mins; moderate intensity (60–70% MHR). Aerobics, strength training, yoga/tai chi, etc.	BDI-II	Significant reduction in depressive symptoms (Wilcoxon) post-intervention.
Worobetz et al., 2020	Ireland (Graduate Entry Medical School, University of Limerick)	Pre–post feasibility study; 74/286 participated; 69 followed up	6 weeks; 1 session per week lasting 60 minutes: 15-minute interactive 'micro-lesson' (exercise-as-medicine) + 45 minutes of varied physical activity; materials on the LMS.	WHO-5 (well-being); scales for sleep, loneliness and social support; EQ-VAS	Significant improvement in WHO-5 ($p=.015$), sleep ($p<.001$), loneliness ($p=.003$) and weekly PA ($p=.021$).
Marenus et al., 2021	USA (University of Michigan)	Random allocation to 2 active interventions; n=77 (WeActive n=43; WeMindful n=28)	8 weeks; 2 sessions per week; 30 mins via Zoom. WeActive (aerobic exercise + strength training) vs WeMindful (yoga + mindful exercise) + fortnightly 'peer coaching'.	WHO-5; Subjective Vitality Scale; (PA: IPAQ-SF)	Time effect on PA; time×group interaction for PWB (WeMindful ↑; WeActive ↓); greater vitality in the WeMindful group.

Özer et al., 2023	Turkey	RCT; n=63 (exercise group 32; control group 31)	6 weeks; hybrid telerehabilitation. 2 initial synchronous sessions (education + technical correction) + asynchronous programme 3 days a week (indoor walking + strength/flexibility).	BDI; (SF-12 mental health; PSQI)	Intergroup differences in favour of the exercise group: BDI (p=.037), SF-12 mental health (p=.007), PSQI (p=.026), physical inactivity (p=.003).
Ruiz et al., 2024	Colombia (public university)	Pre–post + predictive model; n=680 with pre/post	Technology-mediated year/'Formative Sport' (curricular context); 1 session per week (2 hours) during the semester; attendance as a measure of adherence.	BDI-II	Significant pre–post changes (Wilcoxon) and a classification tree with a sensitivity of 0.83 and specificity of 0.72.
Sanchis-Soler et al., 2022	Spain (University of Alicante)	Longitudinal repeated measures (pre, post, 2 weeks post); n=14	5 weeks + 2 weeks' follow-up. Progressive home-based training + aerobic exercise (steps). Supervision via Telegram with videos and daily monitoring.	DASS-21	Significant improvements in physical fitness, mental health and sleep (p<.05); depression and anxiety decreased during follow-up.
Lu et al., 2025	USA (Hispanic university students, UTRGV)	Pre–post pilot study; preference-based allocation to MIPE vs yoga; n=18	6 weeks; 2 sessions per week. MIPE (moderate walking/jogging) vs yoga (beginners). University leisure centre.	PSS-10 (stress); cortisol + TSST	Perceived stress did not decrease significantly; acute cortisol response to the TSST improved following yoga.
Lin et al., 2026	China (Jimei University)	Single-blind RCT; n=34 completed (17 exercise; 17 control)	8 weeks; aerobic exercise 3 times a week; 60 mins per session; heart rate progression; with technical instruction and monitoring.	BDI-II; HAMD	Significant reductions in BDI-II (Δ≈−11.65) and HAMD (Δ≈−10.76); HRV and EEG also improved.
Jing et al., 2026	China (university campus)	Pre–post, 1 group; n=47	"21-Day Exercise Check-In": 30 minutes daily for 3 weeks; aerobic activities (running, skipping, tai chi) with evidence/logs and follow-up.	PCL-5 (PTSD); SAS (anxiety); SDS (depression); CD-RISC (resilience)	Significant pre–post improvements in PTSD, anxiety, depression and resilience; 57.45% below the post-intervention cut-off point.

Sun et al., 2026	China (public physical education years)	Randomised (VR boxing vs control); n=56 women (28/28)	Single 30-minute session of immersive VR boxing (moderate intensity) vs non-exercise VR control.	SDS (depression)	Reduction in SDS scores in the VR boxing group (57.79→52.61); no significant improvement in the control group; additionally, frontal EEG.
Wang, 2024	China	Pre–post 'long-term experiment'; n=28	Multimodal intervention: biomechanical/ergonomic adjustments + physical activity programme + postural correction using mindfulness (in phases).	PSS; NASA-TLX; (well-being: WHO-5)	PSS decreased (24.66→18.10; p=.0001) and NASA-TLX cognitive load decreased (65.38→54.23; p=.00005).
Xia, 2024	China (3 universities)	Pre–post; n=126	6 weeks: postural correction exercises (3×/week, 30 mins) + dynamic movement training (2×/week, 45 mins); initial supervision followed by home-based training.	PSS; GAD-7; PANAS	Total PSS decreased (23.6±5.8→16.3±4.7); GAD-7 decreased (11.7±3.4→7.2±2.8); PANAS improved.

Narrative summary of findings by outcome

Depression

Eleven studies assessed depression using validated instruments (BDI/BDI-II, HAMD, SDS or DASS-21 subscales). Favourable results were observed mainly in multi-week interventions, structured aerobic programmes, curricular interventions and modalities involving supervision or follow-up. Trials with a comparison group provided stronger evidence, although with limitations due to self-reporting and blinding. Uncontrolled pre–post studies also reported reductions in depressive symptoms, but these findings should be interpreted as associations rather than direct causal evidence.

Anxiety

Five studies reported anxiety using the GAD-7, SAS or DASS-21. Improvements were observed mainly in structured interventions with follow-up and in multi-component programmes. However, comparability between studies was limited by differences in scales, duration, modality and design. In particular, studies without a control group prevent the exclusion of alternative explanations such as maturation, contextual changes or regression to the mean.

Stress

Six studies assessed stress using the PSS and/or DASS-21. Interventions incorporating components of self-awareness, yoga, moderate exercise, postural correction or digital monitoring reported favourable associations with stress reduction. However, the heterogeneity of modalities and the absence of comparators in several studies limit the ability to identify which type of intervention is most beneficial.

Psychological well-being / positive mental health

Three studies reported on psychological well-being, vitality or positive mental health using instruments such as the WHO-5 or vitality scales. Favourable changes were observed particularly in interventions that combined physical activity with educational components, peer support or micro-classes. Nevertheless, the reliance on self-reporting and the variability in study designs limit the generalisability of these results.

Assessment of risk of bias and certainty of evidence

Generally speaking, the included randomised trials received overall assessments ranging from ‘some concerns’ to ‘high risk’, mainly due to limitations in the self-reported measurement of outcomes and difficulties with blinding inherent in behavioural interventions. The detailed assessment using RoB 2 is presented in Table 2.

Table 2.

Risk of bias (RoB 2) in included randomised trials

Study	D1. Randomisation process	D2. Deviations from the intended intervention	D3. Missing outcome data	D4. Measurement of the outcome	D5. Selection of reported outcome	Overall assessment
Gallego et al., 2014	Some concerns	Some concerns	Some concerns	High risk	Some concerns	High risk
Marenus et al., 2021	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns
Özer et al., 2023	Some concerns	Some concerns	Low risk	High risk	Some concerns	High risk
Lin et al., 2026	Some concerns	Some concerns	Some concerns	High risk	Some concerns	High risk
Sun et al., 2026	Some concerns	Some concerns	Low risk	High risk	Some concerns	High risk

Note: The risk of bias was assessed using RoB 2 for the primary mental health outcome measured in each study.

In the non-randomised studies, the risk of serious or critical bias predominated, particularly due to confounding, participant selection, lack of comparators and self-reported outcome measurement. The detailed assessment using ROBINS-I is presented in Table 3.

Table 3.

Risk of bias (ROBINS-I) in included non-randomised studies

Study	D1. Confusion	D2. Participant selection	D3. Intervention classification	D4. Deviations from the intended interventio	D5. Missing data	D6. Measurement of the outcome	D7. Selection of the reported outcome	Overall assessment
Hoyos-Cifuentes & Bernal-Torres, 2021	Critical	Serious	Low	Moderate	Serious	Serious	Moderate	Critical
Worobetz et al., 2020	Critical	Serious	Low	Moderate	Moderate	Serious	Moderate	Critical
Ruiz et al., 2024	Critical	Moderate	Low	Moderate	Moderate	Serious	Moderate	Critical
Sanchis-Soler et al., 2022	Critical	Serious	Low	Moderate	Moderate	Serious	Moderate	Critical
Jing et al., 2026	Critical	Serious	Low	Moderate	Serious	Serious	Moderate	Critical
Wang, 2024	Critical	Serious	Moderate	Serious	Moderate	Serious	Serious	Critical
Xia, 2024	Critical	Moderate	Low	Moderate	Moderate	Serious	Moderate	Critical
Lu et al., 2025	Serious	Moderate	Low	Moderate	Low	Serious	Moderate	Serious

Note: The assessment of risk of bias in non-randomised studies was carried out using ROBINS-I for the primary mental health outcome.

Consequently, the certainty of the evidence for each outcome was rated as low to very low, mainly due to the risk of bias, heterogeneity of interventions and assessment tools, and imprecision in some studies. Details of the GRADE assessment are presented in Table 4.

Table 4.
Certainty of the evidence (GRADE) by key outcome

Outcome	N (studies)	Predominant study designs	Main reasons for reduced certainty	Final GRADE certainty
Depression (BDI/DASS/SDS/HAMD)	11	RCTs + non-randomised studies	High risk of bias (several studies with unfavourable findings); inconsistency (heterogeneous interventions and scales); imprecision (small sample sizes in several studies).	Low to Very low
Anxiety (GAD-7/SAS/DASS)	5	Predominantly non-randomised	Risk of bias (non-controlled designs); inconsistency; imprecision.	Very low
Stress (PSS/DASS)	6	Non-randomised	Risk of bias (uncontrolled); indirect evidence (diverse settings and interventions); imprecision.	Very low
Well-being / positive mental health (WHO-5/SVS)	3	RCTs + non-randomised studies	Risk of bias; inconsistency; imprecision.	Low

Note: The certainty of the evidence was assessed using the GRADE approach for each outcome. As no meta-analysis was performed, inconsistency and imprecision were assessed qualitatively.

DISCUSSION

This systematic review synthesised the available evidence on interventions based on sport, physical activity or exercise with a pedagogical/educational component and mental health measured using validated instruments in university students. Overall, the findings suggest that structured interventions may be associated with improvements in indicators of depression, anxiety, stress and/or psychological well-being, particularly when they incorporate explicit pedagogical intent (e.g. curricular courses, training micro-lessons, teaching supervision, feedback, digital monitoring and/or support) (Gallego et al., 2014; Worobetz et al., 2020; Ruiz et al., 2024; Marenus et al., 2021). However, these findings should be interpreted with caution, given the risk of bias identified in several studies (RoB 2 and ROBINS-I) and the overall certainty of evidence, which is predominantly low to very low (GRADE).

Interpretation from an educational perspective

A key finding of this review is that the potential effect of sport/physical activity on university students' mental health appears to depend not only on the physiological 'dose' of exercise, but also on its integration into a deliberate educational framework. Interventions with an explicit instructional design (structured sessions, teaching resources, support, coaching or feedback) could facilitate

psychoeducational processes relevant to university students' wellbeing: (i) self-regulation (planning and adherence), (ii) self-efficacy and perceived control, (iii) a sense of belonging and social support (particularly in group or coaching-based interventions), and (iv) the consolidation of sustained healthy habits. This rationale is consistent with programmes that incorporate educational components (e.g., micro-lessons focused on 'exercise as medicine' combined with practical application) (Worobetz et al., 2020), peer-coaching interventions and materials on educational platforms (Marenus et al., 2021), and university curricular contexts such as 'Educational Sport' courses (Ruiz et al., 2024). Therefore, the pedagogical approach should not be viewed as a mere 'add-on', but rather as a potential implementation mechanism that promotes adherence, continuity and transfer to everyday university life.

Delivery method, 'dose' and heterogeneity of interventions

The included studies covered on-campus delivery, online, hybrid and immersive technology-based modalities, with durations ranging from a single session to multi-week programmes. For example, favourable effects on depression have been reported with 8-week progressive aerobic programmes (Lin et al., 2026), with 6-week hybrid telerehabilitation for inactive students (Özer et al., 2023), with multi-component online programmes with follow-up (Marenus et al., 2021), and acute interventions such as immersive VR boxing (Sun et al., 2026). In uncontrolled pre–post designs, significant reductions in depressive symptoms or improvements in stress and well-being have been observed following structured programmes (Hoyos-Cifuentes & Bernal-Torres, 2021; Sanchis-Soler et al., 2022; Jing et al., 2026; Xia, 2024). Although these findings are promising, variability in 'dose' (frequency, intensity, duration, type), in the level of supervision and in the instruments used limits direct comparison between studies and justifies the choice of a narrative synthesis rather than a meta-analysis.

Effects by outcome: depression, anxiety, stress and well-being

In the case of depression, various studies report reductions, as measured by validated instruments, in both randomised trials and pre–post designs (Gallego et al., 2014; Lin et al., 2026; Sun et al., 2026; Hoyos-Cifuentes & Bernal-Torres, 2021; Ruiz et al., 2024). For anxiety and stress, improvements have been reported in structured programmes, particularly where follow-up or support is provided (Sanchis-Soler et al., 2022; Jing et al., 2026; Özer et al., 2023; Lu et al., 2025). With regard to psychological well-being, favourable changes are evident in interventions with an educational focus and/or support components (Marenus et al., 2021; Worobetz et al., 2020; Wang, 2024). However, the consistency of results varies, and it should be borne in mind that some studies are pilot studies with small sample sizes (e.g., Lu et al., 2025; Sanchis-Soler et al., 2022) or high dropout rates, which increases uncertainty and limits generalisability.

Risk of bias and certainty of the evidence

The findings should be interpreted in light of the risk of bias. In randomised trials, it is common for participants in behavioural interventions to be unable to be blinded and for the results to rely on self-reporting, which may increase bias in the measurement of the outcome and result in a 'high risk' or 'some concerns' rating according to RoB 2 (Gallego et al., 2014; Özer et al., 2023; Lin et al., 2026; Sun et al., 2026; Marenus et al., 2021). In non-randomised studies, the absence of a control group and self-selection increase the risk of confounding (e.g., history, maturation, regression to the mean), which usually results in 'serious' or 'critical' judgements in ROBINS-I (Hoyos-Cifuentes & Bernal-Torres,

2021; Ruiz et al., 2024; Sanchis-Soler et al., 2022; Jing et al., 2026; Xia, 2024; Wang, 2024; Worobetz et al., 2020; Lu et al., 2025). Consequently, the overall certainty by outcome (GRADE) was predominantly rated as low to very low. This does not invalidate the observed potential benefit, but it does require that strong causal claims be avoided and that interpretations such as 'suggests', 'indicates a trend' or 'is associated with' be prioritised.

Implications for higher education

Despite the limitations, the results offer useful implications for universities and wellbeing programmes. Firstly, physical activity interventions with an educational purpose (whether curricular or part of a university wellbeing programme) could prioritise: (1) explicit learning objectives (self-regulation, healthy habits, stress management), (2) a clear FITT framework and progression, (3) professional/academic support, (4) monitoring with feedback (on-campus or digital) and (5) systematic measurement of mental health using validated pre–post instruments (Worobetz et al., 2020; Özer et al., 2023; Marenus et al., 2021; Sanchis-Soler et al., 2022). Secondly, technology could facilitate reach and adherence (e.g. telerehabilitation, platforms, VR, daily logs), but it should be integrated with pedagogical strategies and not used as a substitute for supervision or instructional design (Özer et al., 2023; Jing et al., 2026; Sun et al., 2026).

LIMITATIONS

This review has the following limitations: (1) heterogeneity of interventions (duration, intensity, delivery mode) and measurement scales; (2) a predominance of self-reported outcomes; (3) the presence of uncontrolled designs with a high risk of confounding; (4) small sample sizes or short follow-up periods in some studies; and (5) a prioritised report for which the full text was not retrieved. These limitations restrict comparability between studies and the robustness of causal inferences.

Furthermore, the search strategy may have been limited by its partial reliance on the names of specific instruments and by the predominant use of English terms, which may have reduced the retrieval of studies using other instruments or terminology in Spanish, Portuguese or other languages. It should also be noted that the advanced abstract screening, although carried out using predefined criteria and with consensus among reviewers, may have excluded records where the educational component was described only in the full text. Therefore, the results should be interpreted as a specific synthesis of studies with an explicit educational component and an identifiable measure of mental health.

PRACTICAL APPLICATIONS

Given the low to very low certainty of the evidence, the following applications should be understood as preliminary guidelines for the design of university programmes, rather than definitive recommendations regarding effectiveness.

• Integrate physical activity programmes with an educational focus (courses, short training sessions and follow-up) into institutional strategies for student wellbeing.

• Prioritise supervised interventions with a clear FITT framework (frequency, intensity, time and type) and pre–post measurement using validated instruments (e.g., DASS-21, BDI/BDI-II, PSS, WHO-5).

• Use digital resources (LMS, messaging, telerehabilitation) to support adherence and provide feedback, whilst ensuring they do not replace supervision and instructional design.

CONCLUSIONS

The available evidence suggests that sport/physical activity-based interventions with a structured pedagogical component may be associated with improvements in mental health indicators (depression, anxiety, stress and/or well-being) among university students. However, methodological heterogeneity, the predominance of some uncontrolled designs and the risk of bias limit the certainty of the evidence and prevent the establishment of robust causal inferences. Controlled studies are required, with better standardisation of interventions, an explicit description of the educational component and comparable outcomes, to strengthen the evidence and guide its implementation in higher education.

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