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Effect of exercise intervention on depression among college students: a meta-analysis

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ADMINISTRATIVE INFORMATION

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Review Stage at time of this submission - The review has not yet started.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 23 July 2025 and was last updated on 23 July 2025.

INTRODUCTION

Review question / Objective Review Question: What is the effect of structured exercise interventions on depressive symptoms among college and university students? Objectives: This systematic review and meta-analysis aims to assess the overall effectiveness of exercise interventions in reducing depressive symptoms among college and university students. It also seeks to explore whether different types, durations, and frequencies of exercise moderate the effect size. Subgroup and sensitivity analyses will be conducted to identify potential sources of heterogeneity.

Condition being studied Depression is a common mental health condition characterized by persistent sadness, loss of interest, fatigue, and impaired daily functioning. Among college students, depression is highly prevalent and has been associated with poor academic performance,

substance use, and increased suicide risk. This review focuses on depressive symptoms in college and university students, typically measured using standardized tools such as the PHQ-9, BDI, CES-D, or SDS.

METHODS

Participant or population This review will include studies involving college or university students aged 18 to 30 years who experience symptoms of depression. Participants may be formally diagnosed with depression or identified as having elevated depressive symptoms based on validated screening tools such as the PHQ-9, BDI, SDS, or CES-D. Both clinical and subclinical levels of depression will be considered. There will be no restrictions on gender, academic major, or geographic location.

Intervention The intervention of interest includes structured exercise interventions designed to

improve physical activity levels among college or university students. These may include, but are not limited to, aerobic training (e.g., jogging, cycling), resistance training (e.g., weightlifting, bodyweight exercises), mind-body practices (e.g., yoga, tai chi), team sports, or multicomponent exercise programs. Interventions must have a defined frequency, intensity, duration, and mode of delivery, and be delivered in either individual or group-based formats. Studies with combined interventions (e.g., exercise plus counseling) will be included only if the exercise component can be clearly isolated and analyzed.

Comparator The comparator group will consist of participants who receive no intervention, waitlist control, usual care, or non-exercise interventions such as educational seminars, psychological counseling, or social activities. The comparator condition must not include structured physical activity. Studies comparing different types or intensities of exercise without a non-exercise control group will be excluded.

Study designs to be included This review will include randomized controlled trials (RCTs) and quasi-experimental studies that examine the effects of exercise interventions on depressive symptoms in college or university students. Eligible study designs include parallel-group RCTs, cluster RCTs, and controlled before-and-after studies. Observational studies, cross-sectional studies, case reports, case series, qualitative studies, conference abstracts, and reviews will be excluded.

Eligibility criteria Additional eligibility criteria include the following: (1) Only peer-reviewed journal articles with full-text availability will be included; (2) Studies must provide sufficient statistical data for effect size calculation (e.g., means, standard deviations, sample sizes, or reported effect sizes); (3) Only studies published in English or Chinese will be considered; (4) Studies published from January 2010 onward will be included; (5) Studies must involve interventions primarily based on physical exercise rather than multi-component interventions unless the effect of exercise can be isolated.

The following exclusion criteria will also apply: (1) Conference abstracts, dissertations, editorials, commentaries, and reviews will be excluded; (2) Studies involving participants with other diagnosed psychiatric disorders (e.g., bipolar disorder, schizophrenia) in addition to depression will be excluded; (3) Studies in which the target

population cannot be identified as college or university students will be excluded.

Information sources The following electronic databases will be systematically searched: PubMed, Web of Science, MEDLINE, Embase, Scopus and CNKI (China National Knowledge Infrastructure). The search will cover literature published from January 2010 to the date of final search execution, and both English- and Chinese-language publications will be considered. No restrictions will be applied to country or publication type, as long as the study meets inclusion criteria.

Main outcome(s) The primary outcome of this review is the change in depressive symptoms following exercise interventions, as measured by validated self-report or clinician-administered instruments. Eligible outcome measures include, but are not limited to, the Beck Depression Inventory (BDI), Patient Health Questionnaire-9 (PHQ-9), Center for Epidemiological Studies Depression Scale (CES-D), and Self-Rating Depression Scale (SDS).

The timing of outcome assessment must be clearly reported and should correspond to post-intervention measurements. Where available, follow-up measurements will also be extracted and analyzed separately. Effect sizes will be calculated using standardized mean differences (SMD) with 95% confidence intervals. Studies that do not report quantitative data for depressive symptoms at post-intervention will be excluded from the meta-analysis.

Quality assessment / Risk of bias analysis The methodological quality and risk of bias of the included studies will be independently assessed by two reviewers. For randomized controlled trials (RCTs), the Cochrane Risk of Bias 2.0 (RoB 2) tool will be used to evaluate five domains: randomization process, deviations from intended interventions, missing outcome data, measurement of the outcome, and selection of the reported result.

For non-randomized or quasi-experimental studies, the ROBINS-I (Risk Of Bias In Non-randomized Studies - of Interventions) tool will be used. Discrepancies between reviewers will be resolved through discussion or by consulting a third reviewer. The results of the quality assessments will be presented in tabular and graphical formats, and sensitivity analyses will be conducted by excluding studies with high risk of bias.

Strategy of data synthesis Data will be synthesized using meta-analysis if at least two studies report comparable outcome measures. Standardized mean differences (SMD) with 95% confidence intervals will be calculated to quantify the effect size of exercise interventions on depressive symptoms. A random-effects model will be applied to account for heterogeneity across studies.

Statistical heterogeneity will be assessed using the I^2 statistic and Chi-squared test. Subgroup analyses will be conducted based on intervention type (e.g., aerobic, resistance, mind-body), duration, and population characteristics, depending on data availability. Sensitivity analyses will be performed by excluding studies at high risk of bias.

Publication bias will be examined using funnel plots and Egger's regression test if more than 10 studies are included in the meta-analysis. All analyses will be conducted using Review Manager (RevMan) and/or Stata software.

Subgroup analysis If sufficient data are available, subgroup analyses will be conducted to explore potential sources of heterogeneity. The following subgroups are planned:

1. Type of exercise intervention (e.g., aerobic training, resistance training, yoga, tai chi)
2. Duration of intervention (e.g., ≤ 8 weeks vs. > 8 weeks)
3. Format of intervention (e.g., individual-based vs. group-based)

The aim of subgroup analysis is to identify whether certain types or conditions of exercise intervention produce stronger effects on depressive symptoms among college students.

Sensitivity analysis Sensitivity analyses will be performed to test the robustness of the meta-analysis results. The following approaches will be used:

1. Excluding studies assessed as having high risk of bias;
2. Excluding studies with small sample sizes (e.g., $n < 10$ per group);
3. Excluding quasi-experimental studies to assess the impact of study design;

These analyses will help determine whether the overall findings are stable and not overly influenced by specific studies or methodological characteristics.

Country(ies) involved Malaysia; China.

Keywords College students; Exercise intervention; Depression; Meta-analysis.

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