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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

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 2 November 2024 and was last updated on 25 February 2025.

INTRODUCTION

Review question / Objective The aim of this meta-analysis of randomized controlled trials is to evaluate the effect of exercise intervention on anxiety among college students and to propose an exercise program for anxiety intervention.
What is the total effect size of exercise training intervention on the anxiety of college students? What are the optimal intervention content, cycle, frequency and single duration?

Rationale Anxiety is not a simple psychological problem, especially it can lead to disorders of the autonomic nervous system (ANS), usually involving the exhaustion of the sympathetic nervous system and the parasympathetic nervous system. Long-term anxiety may also affect the body's immune system, increasing the risk of illness. Medication and cognitive behavioral therapy are effective ways

to improve anxiety, but medications usually have obvious side effects and are prone to excessive mental dependence. Cognitive behavioral therapy can help individuals identify and change negative thinking patterns and behavioral habits, and improve their ability to cope with anxiety. By adjusting irrational cognition, changing the view and attitude towards events, anxiety can be reduced. However, cognitive intervention usually requires well-trained experts to complete. In contrast, exercise, as a safe and low-cost intervention, can also improve anxiety and bring more health benefits, such as improving cardiopulmonary endurance and muscle strength.

Condition being studied The researchers searched Chinese and English databases on September 23, 2024. The Chinese databases included China National Knowledge Infrastructure (CNKI), Wanfang, and VIP, and the English databases included Web of Science, Pubmed,

Medline, Embase, Scopus, etc. The search range was from database establishment to the search date. The first group of keywords in the Chinese search formula included: exercise, Tai Chi, yoga, Qigong, resistance, physical activity, exercise, Ba Duan Jin, Pilates, aerobic exercise; the second group of keywords included: anxiety, mental health. OR was used within the two groups of search keywords, and AND was used between the two groups of keywords, and Boolean operators were used for calculations. The first group of English search keywords include: exercises, physical exercise, physical activity, aerobic exercise, isometric exercise, acute exercise, exercise training; the second group of keywords include: anxiety, angst, nervousness, hypervigilance, social anxiety, anxiety social, social anxieties, anxiousness.

METHODS

Participant or population College students with anxiety.

Intervention 1) The intervention measures are exercise for no less than 30 minutes each time, such as Pilates, Tai Chi, yoga, Ba Duan Jin and other mind-body exercises; 2) The study is a multi-stage exercise (not a single exercise).

Comparator The control group was non-exercise or maintained their previous lifestyle.

Study designs to be included Combined effect size and subgroup analysis to determine the best intervention plan for exercise intervention in anxiety of college students.

Eligibility criteria A subjective scale was used to assess anxiety and provide sample size, mean value, and standard deviation for the experimental and control groups. Excluding the subjects who engaged in regular exercise for more than 3 months, the control group adopted cognitive therapy for anxiety and the data were incomplete, only partial data before or after intervention could be provided.

Information sources CNKI、Web of Science、Pubmed、Medline、Embase and Scopus.

Main outcome(s) 1) Exercise intervention can significantly improve the anxiety of college students; 2) The effect of Taijiquan is the most outstanding, which can obviously improve the anxiety of college students; 3) The exercise program that exercises 3 times a week for about 50 minutes and lasts for 8 weeks has the most

significant effect on improving the anxiety of college students.

Quality assessment / Risk of bias analysis The Physiotherapy Evidence Database (PEDro) scale was used to evaluate the quality of the included literature. PEDro consists of 11 questions, in addition to the first question does not count in the total score, each of the remaining questions are scored 1 point, meet the corresponding criteria get 1 point, do not meet 0 points. Literature with scores ≥ 6 points can be considered to be of high quality. Two researchers independently scored 10 articles according to the evaluation criteria. After the first round of evaluation, the items with score differences were consulted by the third researcher or finalized through group discussion. Use Review Manager 5.3 to draw a funnel plot to observe article bias.

Strategy of data synthesis This study used the random effects model of Revman 5.3 software to analyze the anxiety scale total score outcome indicators of the included literature. Since the outcome indicators of the included literature are continuous variables with the same test units, the standard mean difference (SMD) was selected as the effect size indicator. The mean and standard deviation of anxiety levels in the experimental and control groups after the included literature trials were extracted and imported into Review Manager 5.3, and then a forest plot was drawn to combine the effect sizes. Subgroup analysis was completed by classifying according to the frequency and period of the intervention program.

Subgroup analysis According to the heterogeneity of the overall effect size test, further subgroup analysis of the moderating variables is needed to explore the source of heterogeneity. This study set up subgroups for testing the four elements of the exercise program, namely, intervention content, weekly intervention frequency, single intervention duration, and intervention period. The results showed that the intervention content ($I^2 = 0\%$) had low heterogeneity, and the single intervention duration ($I^2 = 75\%$), intervention frequency ($I^2 = 75\%$), and intervention period ($I^2 = 72\%$) had high heterogeneity.

Sensitivity analysis Sensitivity analysis is a method used to evaluate whether the results of meta-analysis or systematic review are stable and reliable. Sensitivity analysis was performed on the 10 included articles, mainly by excluding articles one by one, changing the analysis model, and recalculating the effect size on this basis. The test found that the results did not change significantly,

indicating that the meta-analysis results of this study are more credible.

Language restriction Chinese and English literature.

Country(ies) involved Malaysia and China.

Keywords physical exercise; anxiety; college students; mental health; effect size; meta-analysis.

Contributions of each author

Author 1 - Peng Chen - Search various databases and include literature that meets the requirements, drafted the manuscript, sextracted data, and completed the entire article writing.

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Author 2 - Yusha Gu - Assist in searching for eligible literature, extracting data and drawing funnel and forest plots.

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