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None declared.

The effectiveness of different exercise modalities on sleep quality: a systematic review and network meta-analysis

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Review question / Objective: **The effectiveness of different exercise modalities on sleep quality.**
Condition being studied: **Sleep occupies a substantial proportion of life. People with good sleep quality tend to have good health and wellbeing while those with sleep disturbance may suffer from the increased risk of cardiovascular disease, dementia, depression and immune disorders. Recently, the effect of exercise on sleep quality has been paid increasing attention by researchers. A number of systematic reviews and direct meta-analyses have explored the effectiveness of exercise on sleep quality. However, which type of exercise is optimal for sleep quality cannot be concluded from direct meta-analysis. Superior to direct meta-analysis, network meta-analysis can compare and analyze multiple exercise styles' effects on sleep quality simultaneously. A recent network meta-analysis was published to evaluate the effects of different meditation exercises on sleep quality in older people. In this review, it only focused on older people and involved meditation exercises without consideration of any other kinds of exercise as well as specific dimensions of sleep quality. Therefore, a network meta-analysis needs to be conducted to systematically assess the effects of different exercises (e.g., aerobic exercise, resistance exercise and mind-body exercise) on sleep quality and identify the most effective exercise for improving sleep quality.**

INPLASY registration number: This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 26 May 2020 and was last updated on 26 May 2020 (registration number INPLASY202050096).

INTRODUCTION

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METHODS

Participant or population: All people with or without sleep problems.

Intervention: Exercises including aerobic exercise, anaerobic exercise, resistance exercise, combined exercise, mind-body exercise and flexibility exercise.

Comparator: Control group including any other forms other than the same exercise as the intervention group, such as other forms of exercise, health education, usual care and social activity.

Study designs to be included: Randomized controlled trials.

Eligibility criteria: (1) Study design: Randomized controlled trials in English were included. Studies without full-text articles were excluded. (2) Population: All people with or without sleep problems. (3) Intervention: The studies involved any form of exercises including aerobic exercise, anaerobic exercise, resistance exercise, combined exercise, mind-body exercise and flexibility exercise. (4) Comparator: Control group included any other forms other than the same exercise as the intervention group, such as other forms of exercise, health education, usual care and social activity. (5) Outcomes: Sleep quality was the only outcome. Pittsburgh sleep quality index (PSQI) was used as measuring tool.

Information sources: The databases searched included PubMed, Web of Science, EMBASE, CENTRAL, PsycINFO and SPORTDiscus. Studies published in English and from the dates of database inception to 10th October 2019 were included. The specific search strategies for each database are shown in the attached document. To ensure that all relevant literatures are included, we also checked the reference lists of systematic reviews published in recent years.

Main outcome(s): Total Pittsburgh sleep quality index score and each dimension score.

Quality assessment / Risk of bias analysis: Two researchers (Cai & Zhang) will assess the risk of bias independently based on the modified Cochrane Risk of Bias Tool, including random sequence generation, allocation concealment, blinding of participants and researchers, blinding of outcome evaluator, incomplete outcome data addressed, selective reporting of results, and other risk bias. Finally, all eligible studies will be identified as "high risk of bias", "unclear risk of bias" and "low risk of bias" according to the results of each item evaluation. If there is any disagreement, the two researchers will discuss or a third researcher (Cao) will appear to resolve the disagreements. Finally, Review Manager 5.3 software will be used to present the risk of bias graph.

Strategy of data synthesis: Literature data such as publication year, authors, and sample size of groups will be input into STATA 14.0 software for network and direct meta-analysis. A p-value (two-tailed) less than 0.05 will be considered statistically significant. SMDs with 95% CIs will be calculated as the scores of PSQI is continuous data. For the direct meta-analysis, the random effect model will be used if there is a significant difference between study heterogeneity; otherwise, the fixed effect model will be used. Statistical heterogeneity will be considered significant for I2 >50% and p value of Cochran's Q statistic < 0.10. Network meta-analysis will be played using the function of 'networkplot' in STATA 14.0 software. It divides into 5 steps. The first step is to draw a network plot to understand which interventions are compared directly, how comparations flow indirectly and the contribution of various interventions. The second step generates a contribution plot. The third step is to investigate the two parts of inconsistency. One is global inconsistency that is assessed by comparison of the fit and parsimony of the inconsistency and consistency models via the Wald test. The other is local inconsistency that is assessed by calculation of the differences between direct and indirect estimates in every closed loop within the network. The fourth step creates the network forest plot to compare the summary size of effectiveness among different interventions. The last step is to determine relative rankings of interventions. To evaluate publication bias in the network meta-analysis, a 'comparison-adjusted' funnel plot will be plotted. If the funnel plot is symmetrical near the zero line, it indicates that there is no publication bias.

Subgroup analysis: Subgroup analyses will also be planned to find the discrepancy for specific populations and intervention dimensions (including time, frequency and duration). The subgroup factors will be as follows: age (using age 60 years as a cut-off point according to World Health Organization), intervention time (using 60 minutes as a cut-off point), intervention frequency (using 3 times a week as a cut-off point), intervention duration (using 6 months as a cut-off point).

Sensibility analysis: None.

Country(ies) involved: China.

Keywords: effectiveness; exercise; sleep quality; systematic review; network meta-analysis.

Contributions of each author:
Author 1 - Ying Cai - Study selection, data extraction, quality assessment, manuscript drafting.
Author 2 - Peiye Cao - Study selection, data extraction, quality assessment, statistic analysis, manuscript drafting.
Author 3 - Shifang Zhang - Study selection, data extraction, quality assessment.
Author 4 - Qiaoqin Wan - Study design, manuscript drafting.