REVIEW

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Effect of Physical Activity on Health-Related Quality of Life among Cancer Patients and Survivors: A Systematic Review and Meta-Analysis

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Abstract

Objectives: To manage chronic illnesses and enhance health-related quality of life (HRQOL), exercise is essential. This research attempts to determine how different forms of exercise affect cancer patients' and survivors' HRQOL and its physical, mental, emotional and social components separately. **Methodology:** This study was prepared following PRISMA guidelines for systematic review and meta-analysis. Databases like PubMed, Scopus, Embase, and Google Scholar were searched. Only randomized control trials in the English language were included in the review. The authors obtained the standardized mean difference (SMD) and 95% confidence interval (CI) of the aggregated intervention effect estimate by pooling every study for a random-effects meta-analysis. Risk of Bias was assessed using Cochrane's Risk of Bias tool 2.0 for randomized control trials. Publication bias was expressed using funnel plots. **Results and Conclusion:** The pooled standardized mean difference of physical, mental, emotional and social components of the health-related quality of life index, as determined by the meta-analysis, was 0.61 [0.13;1.09] ($p<0.01$), 0.27 [-0.17; 0.7] ($p<0.01$), 0.54 [-0.30;1.38] ($p<0.01$) and, 0.38 [-0.27; 1.02] ($p<0.01$) respectively. There was an overall low risk of bias in the included RCTs. The publication bias showed overall symmetry in funnel plots. The review's conclusions show that exercise therapies improve HRQOL significantly overall as well as a few specific HRQOL dimensions, such as social, mental, emotional, and physical functioning. However, not all types of cancers have been included in the study therefore more research can be done for all other cancer types separately.

Keywords: HRQOL- Neoplasm- Neoplasm therapy- Exercise- Walking- Yoga- Resistance training- Breathing exercises

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Introduction

To manage chronic illnesses and enhance health-related quality of life (HRQOL), exercise is essential [1]. It is widely advised that cancer patients avoid physical inactivity and routinely participate in resistance and aerobic exercise [2]. Exercise is essential to avoid physical deterioration and decrease in muscle mass after cancer treatment, in addition to its overall health advantages [2].

Numerous exercise interventions, such as yoga, strength training, and aerobics, as well as a range of cancer types, diagnosis dates, and treatment regimens, have all been the subject of research on the effects of exercise on the quality of life of cancer survivors [3]. Furthermore, there has been significant variation in the particular quality of life objectives addressed, with some concentrating on overall HRQOL, broad domains of functioning (like physical or emotional), or particular consequences (like pain or exhaustion) [3].

Health-related quality of life (HRQOL) measures are becoming increasingly important for clinicians and policymakers to know how to manage patients and make informed decisions. Questionnaires that patients self-administer or that interviewers administer can be used to measure longitudinal shifts in HRQL within patients over time (evaluative instruments) or cross-sectional variations in quality of life amongst patients at a moment in time (discriminative instruments) [20]. Exercise interventions before and after cancer treatment have been shown to enhance cancer survivors' HRQOL, psychological health, and fatigue. Nevertheless, there are surprisingly few meta-analyses and systematic reviews discussing the impact of physical activity on cancer patients' health-related quality of life during and after the treatment [15-19]. This research attempts to close this gap by determining how different forms of exercise affect cancer patients' overall HRQOL.

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Materials and Methods

This study was registered by the International Prospective Register of Systematic Reviews PROSPERO (CRD42024521768). This study was prepared following PRISMA guidelines for systematic review and meta-analysis.

Eligibility criteria

The trials that satisfied the following criteria were included by the authors: (a) they had to be RCTs or controlled clinical studies; (b) they had to involve only adult cancer survivors; (c) they had to compare exercise interventions started after cancer treatment ended with regular treatment or a non-exercise contrast intervention; and (d) they had to measure broadly HRQOL or an HRQOL realm as an outcome. Studies that concentrated on patients with terminal illnesses, hospice patients, or studies in which the bulk of participants were getting therapy were disqualified.

Information sources

Various databases like PubMed, Scopus, Embase, and Google Scholar were searched on 1 April 2024.

Search strategy

The search terms used were "exercise", "health-related quality of life" and "cancer".

Selection process

Every author (Gupta B, Goel R) assessed each study's eligibility separately starting in April 2024 once it was found in the databases. If there were any differences among these writers, they discussed them in detail to find a solution.

Data collection process

The titles and abstracts of each study were used to determine eligibility. Subsequently, the authors examined full-text forms of trials that were considered eligible or potentially eligible to verify eligibility (refer to Figure 1). Each trial's eligibility was assessed by paired reviewers, who also extracted information about the trial's features and the intervention's impact on results. Reviewers' disagreements were settled by agreement or by involving a third reviewer. To get any missing information or clarification, the writers made contact with the original trial author.

Data items

The first researcher's name, publication year, research nation, size of the sample, population under study (age range and multiple cases), type of cancer, and key findings were extracted from the retrieved publications using a standardized form (Table 1).

Study risk of bias assessment

The Risk of Bias tool 2.0 developed by Cochrane was used to evaluate the quality of randomized control trials. Five domains are used to evaluate the quality: (1) Randomization Process Risk of Bias; (2) Deviations from Intentioned Interventions Risk of Bias; (3) Missing Outcome Data Risk of Bias; (4) Measurement Process Risk of Bias; and (5) Reporting Process Risk of Bias.

Effect measures

Any athletic endeavour that increased energy expenditure and required a deliberate, structured, and methodical movement of the body was considered exercise. Patient-reported outcomes included overall health-related quality of life (HRQOL) and HRQOL dimensions, such as functioning (physical, psychological, social, and role), spiritual well-being, pain, vitality, overall perceptions of health, positive qualities, and symptoms associated with illness and treatment. Heterogeneity was assessed using I^2 values.

Synthesis methods

When suitable, trial data (i.e., data demonstrating no substantial clinical heterogeneity) were merged in a meta-analysis. The standardized mean difference (SMD) and 95% confidence interval (CI) of the aggregated intervention effect estimate were obtained by the authors by pooling every study for a random-effects meta-analysis using R software version 4.3.0. For both kinds of measurements and every follow-up period, a meta-analysis was carried out since trial findings were presented as an alteration in score from baseline through follow-up or follow-up values.

Reporting bias assessment

Funnel plots were made to express publication bias.

Results

Study selection

Following the application of the keywords, 1255 items in total were found; of these, 156 articles were eliminated on the grounds of duplication. Because 230 of the articles were not in English, they were deleted. Of the 447 publications that did not match the inclusion criteria, 368 were old enough to be accepted into the study. Nine articles were determined by the authors to be suitable for the meta-analysis following extensive deliberation and examination. The PRISMA flow diagram, as seen in Figure 1, is used to depict the detailed selection process.

Study characteristics

A total of 808 people with cancer were assessed across the nine randomised control studies that were included in the meta-analyses. Of them, some were conducted in Spain, Denmark, China, India, Germany, Brazil, and Korea, while two were conducted in the United States. Breast cancer and colon cancer made up the bulk of the cancer types examined in the study. Pancreatic cancer and head and neck cancer were among the others. Table 1 lists the specifics of the listed studies.

Risk of bias in studies

Every trial had a moderate to high risk of bias. The exercise program's design placed all trials at a high risk of performance bias, a condition in which knowledge of

Table 1. Characteristics of the Studies Included

Author, and Year of Publication	Country and sample size	Type of Cancer	Major Findings
Soriano-Maldonado A et al, [4]	Spain, 60	Breast Cancer	Adding two weekly bouts of watched resistance workouts to a prescription of home-based exercise for 12 weeks resulted in significant improvements in upper-, lower-, and full-body strength in the muscles in female breast cancer individuals who survived who had finished their core therapies within the previous ten years. However, other aspects of fitness and patient-reported outcomes remained unchanged.
Mikkelsen MK et al, [5]	Denmark, 84	Pancreatic, biliary tract, and non-small cell lung cancer	During oncological treatment, older patients with cancer who were advanced showed improvement in their physical performance after a 12-week multimodal program of exercise with tailored assistance.
Ho M et al, [6]	China, 223	Colorectal Cancer	After six months, the SF-6D utility score and physical performance of participants in the physical activity intervention showed a significant improvement.
Samuel et al, [7]	India, 148	Head and Neck Cancer	The findings demonstrate that an 11-week planned exercise programme can enhance the functional ability as well as the quality of life of HNC patients undergoing CRT. Additionally, it keeps the exercise group's levels of weariness from declining.
Brown et al, [8]	USA, 39	Colon Cancer	Increased aerobic exercise dosages of up to 300 minutes per week increase the number of HRQoL outcomes in colon cancer survivors in stages I–III. These results show that aerobic activity may assist colon cancer survivors in several ways.
Steindorf K et al, [9]	Germany, 47	Pancreatic Cancer	After three months, but not after six, this first randomized resistance training experiment in patients with pancreatic cancer showed clinically significant increases in quality of life.
Paulo et al, [10]	Brazil, 36	Breast Cancer	In elderly breast cancer survivors receiving aromatase inhibitor medication, this study showed the potential advantages and high therapeutic relevance of exercise programs to enhance quality of life.
Dieli-Conwright et al, [11]	USA, 100	Breast Cancer	The quality of life and physical fitness of ethnically varied overweight or obese breast cancer survivors were found to be considerably enhanced by a 16-week mixed aerobic and resistance training program aimed at addressing metabolic syndrome.
Kim JY et al, [12]	Korea, 71	Colorectal cancer	A home-based fitness regimen may enhance colorectal cancer survivors' quality of life and mental well-being.

the treatment assigned to a research participant causes systematic discrepancies in outcome measures. As indicated by Figures 2 and 3, the vast majority of studies were at an elevated risk for detecting and attrition bias and at low risk for bias in selection due to appropriate randomization sequence generation and reporting bias.

Results of syntheses and individual studies

Physical Function

Nine papers that were included in the current study reported on the physical component of the health-related quality of life index for people who had undergone different training intensities. P<0.01) and I^2=84% were discovered, per the heterogeneity test. After that, analysis was done using the REM. The pooled standardized mean difference, as determined by the meta-analysis, was 0.61, 95% confidence interval (CI): 0.13 to 1.09, P<0.01. The physical component of the health-related quality of life score showed a significant (P<0.01) difference between the two patient groups after training at different intensities. Figure 4 shows the forest plot.

Mental Function

Nine papers included in the current analysis reported on the mental component of the health-related quality of life index for persons after varied training intensities. The heterogeneity test revealed that P<0.01) and I^2=83% were present. The REM was then used for analysis. The pooled standardized mean difference, according to the meta-analysis results, was 0.27, 95% confidence interval (CI): -0.17 to 0.70, P<0.01. The mental component of the health-related quality of life score showed a significant (P<0.01) difference between the two patient groups after training at different intensities. The forest plot is seen in Figure 5.

Emotional Function

Five papers that were a part of the current analysis reported on the emotional component of the health-related quality of life index for persons after varied training intensities. The heterogeneity test revealed that P<0.01) and I^2=90% were present. The REM was then used for analysis. The pooled standardised mean difference, according to the meta-analysis results, was 0.54 (95% CI: -0.30 to 1.38, P<0.01). As a result, after training at different intensities, the two patient groups' emotional scores on the health-related quality of life index differed significantly (P<0.01). The forest plot is seen in Figure 6.

Social Function

The present study included five articles that reported on the social component of the health-related quality

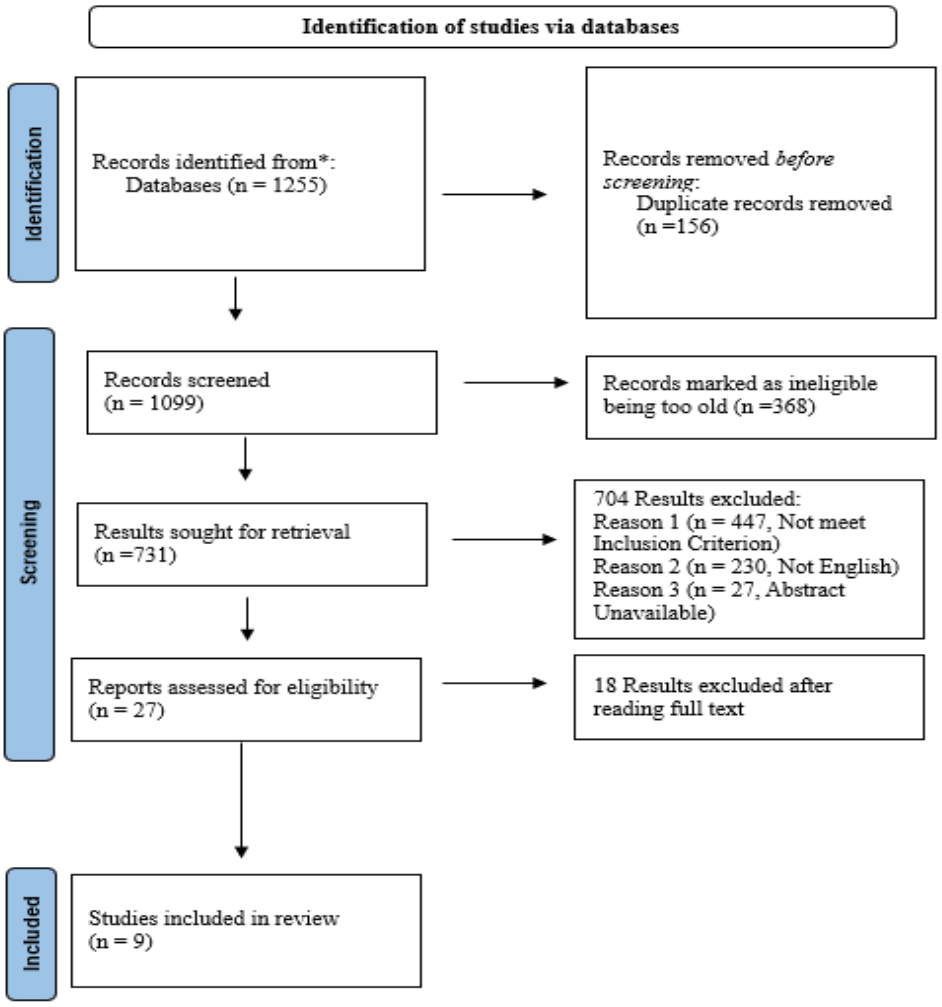

Figure 1. PRISMA Flow Diagram

of life index for individuals who had undergone varied intensities of training. The heterogeneity test revealed that P<0.01) and I^2=77% were present. The REM was then used for analysis. According to the meta-analysis results, the pooled standardised mean difference was 0.38, 95% confidence interval (CI): -0.27 to 1.02, P<0.01. As a result,

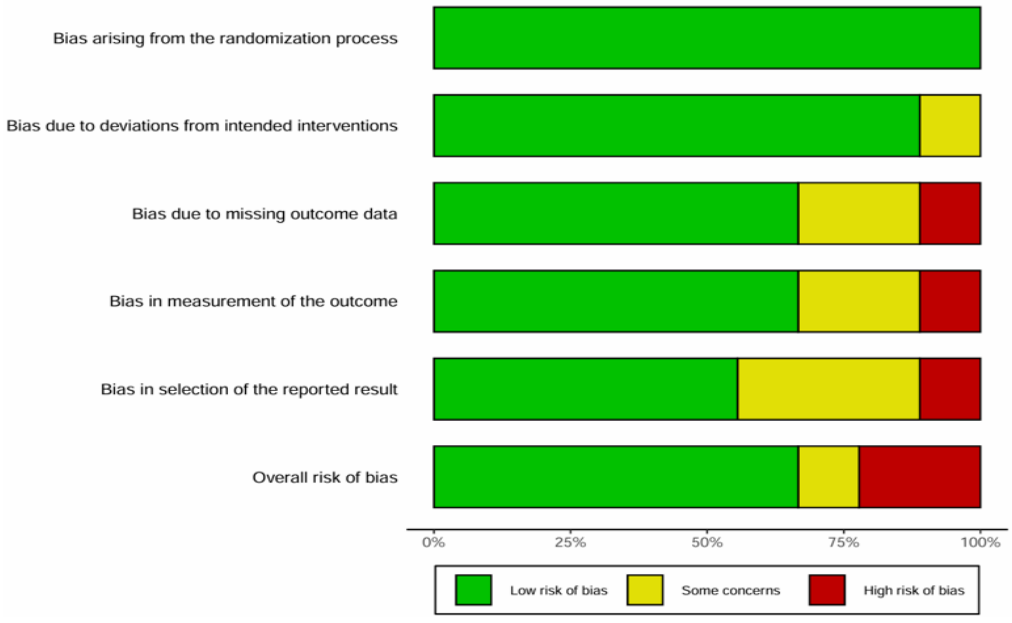

Figure 2. Risk of Bias in Included Studies

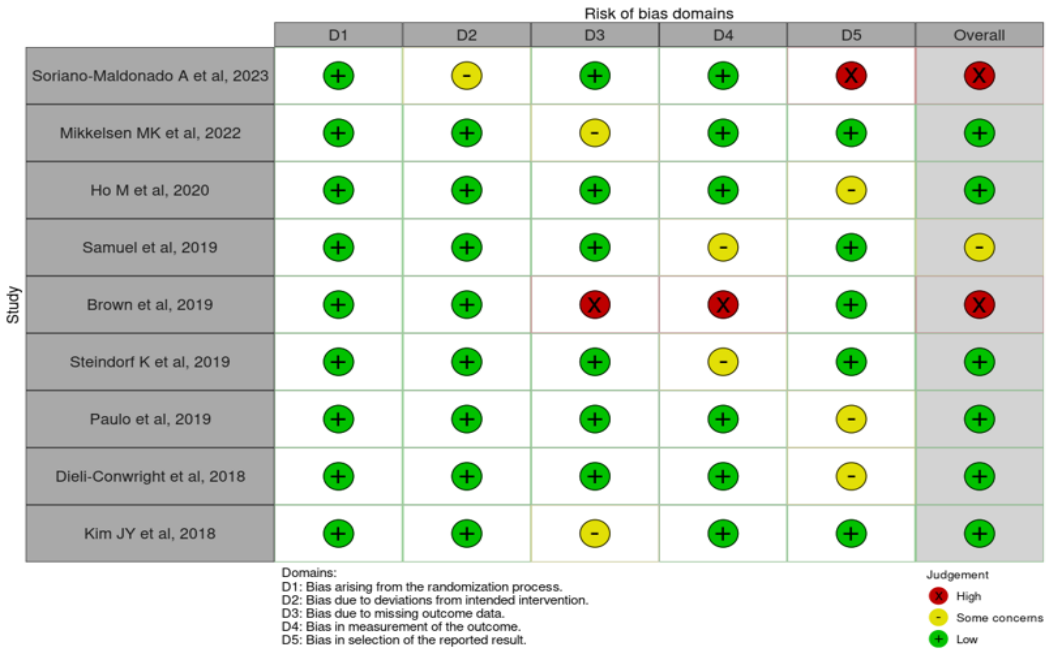

Figure 3. Traffic Plot Showing the Risk of Bias in Included Studies

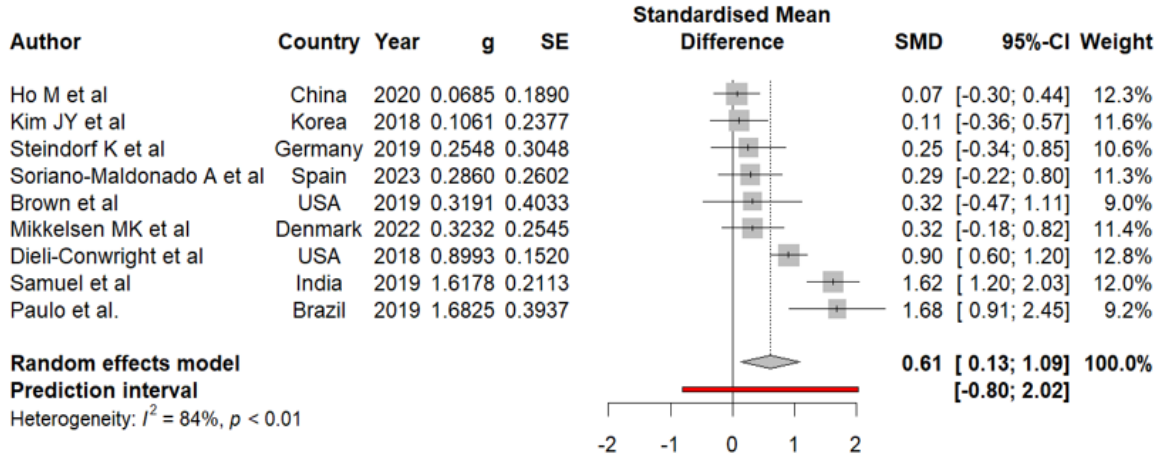

Figure 4. Forest Plot of the Physical Component of HRQOL for the Two Groups of Patients. CI, confidence interval; SE, standard error.

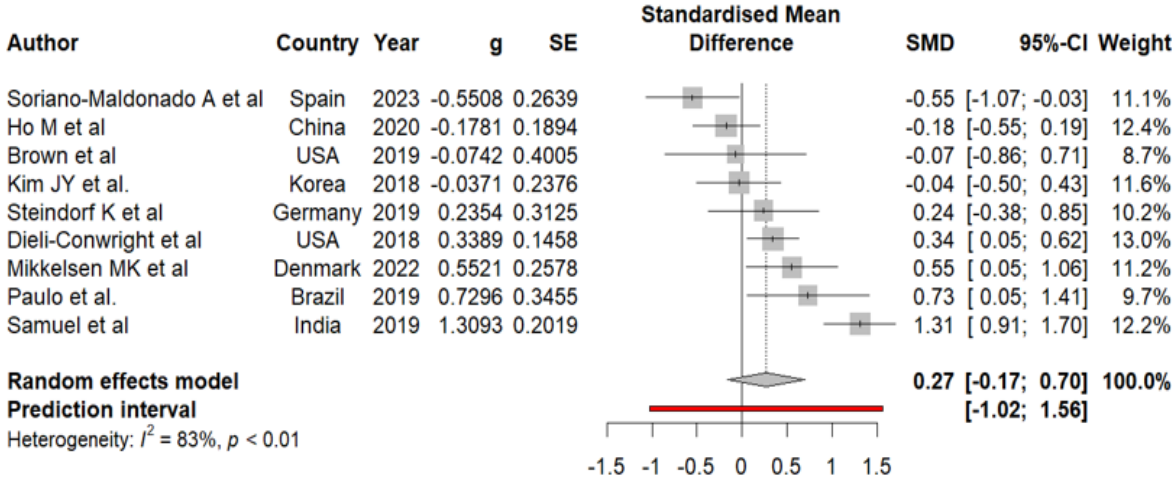

Figure 5. Forest Plot of the Mental Component of HRQOL for the Two Groups of Patients. CI, confidence interval; SE, standard error.

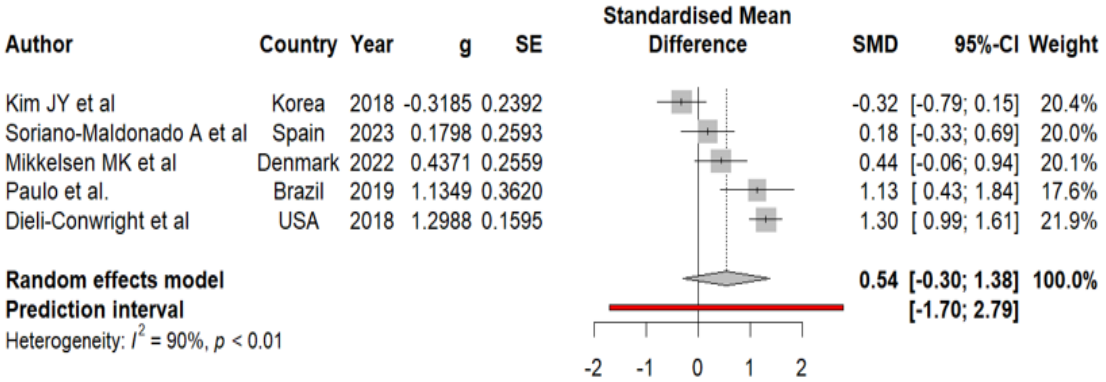

Figure 6. Forest Plot of the Emotional Component of HRQOL for the Two Groups of Patients. CI, confidence interval; SE, standard error.

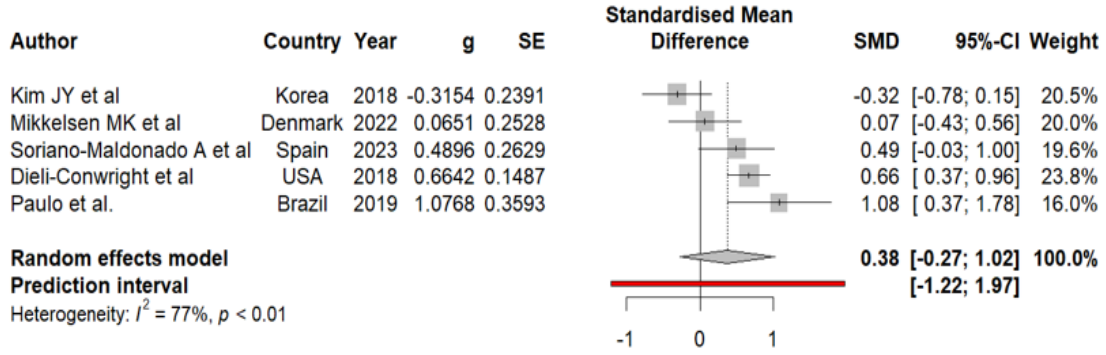

Figure 7. Forest Plot of the Social Component of HRQOL for the Two Groups of Patients. CI, confidence interval; SE, standard error.

after training at different intensities, the social component of the health-related quality of life measure showed a significant difference (P<0.01) between the two patient groups. The forest plot is shown in Figure 7.

Reporting biases

Physical Function

The publishing bias was successful in guaranteeing that all the components of the health-related quality of life index of patients at different training intensities had

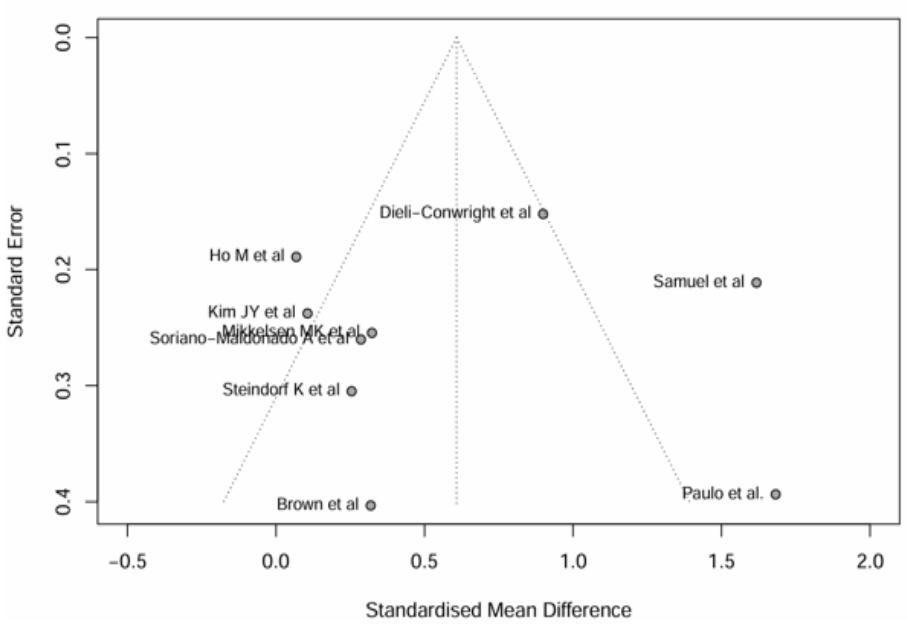

Figure 8. Funnel Chart of the Physical Component of the HRQOL Index of the Two Groups of Patients. MD, mean different; SE, standard error.

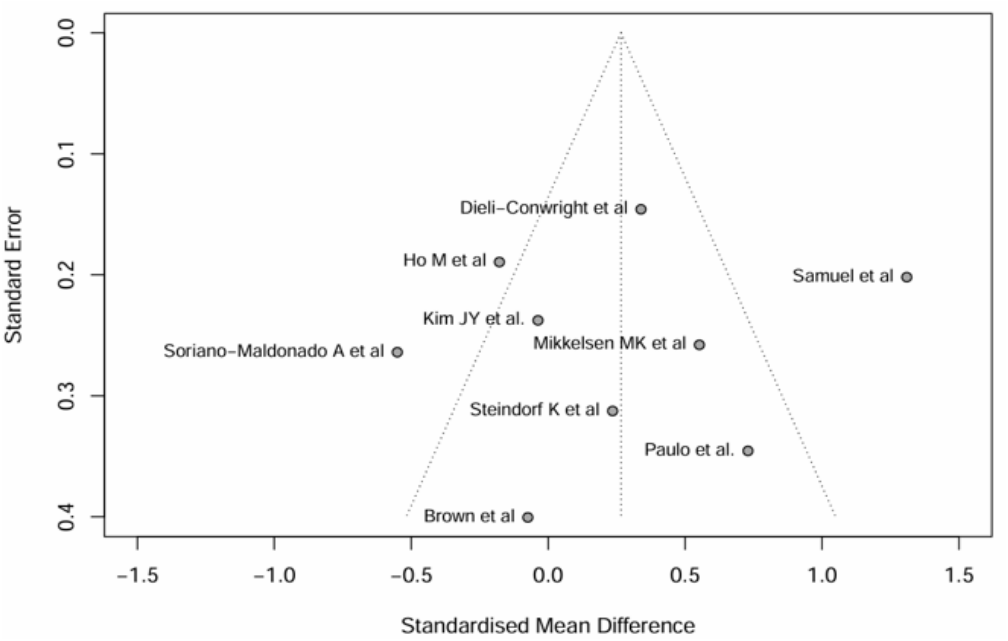

Figure 9. Funnel Chart of the Mental Component of the HRQOL Index of the Two Groups of Patients. MD, mean different; SE, standard error.

results above 5k +10=95, as shown by the symmetrical funnel chart in Figures 8, 9, 10, and 11. Furthermore, most of the data points corresponded to values inside the 95% confidence interval.

Certainty of evidence

The sensitivity analysis examined the potential impact of a single study on the combined results, which may have implications for conducting in-depth research in the following two scenarios. First, removing a study will significantly change the outcome. When studies are eliminated from the analysis without appreciably changing the final results, the combined outcomes may be unstable and sensitive. Second, the results show sensitivity and stability, and the inference is true.

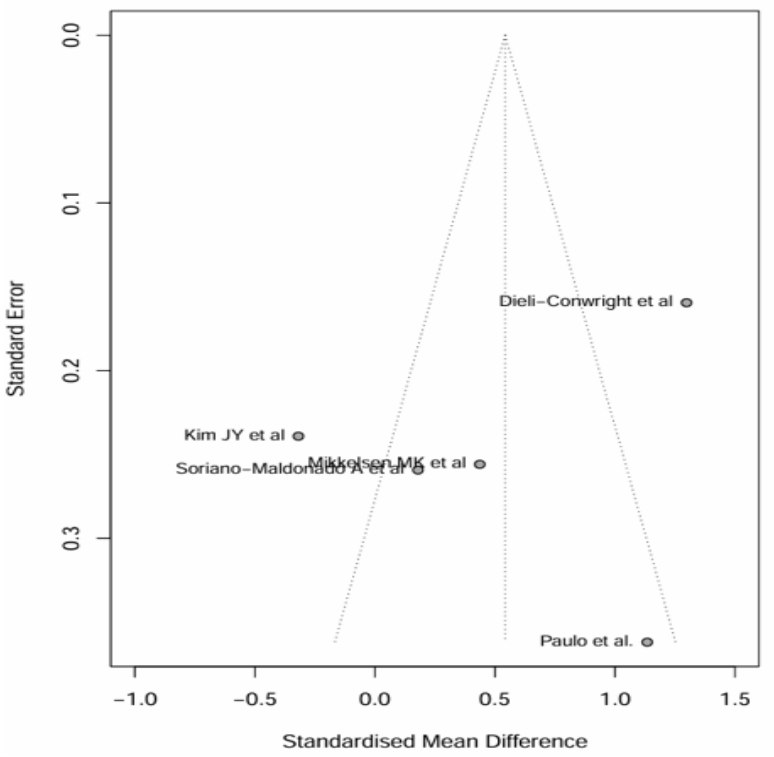

Figure 10. Funnel Chart of the Emotional Component of the HRQOL Index of the Two Groups of Patients. MD, mean different; SE, standard error.

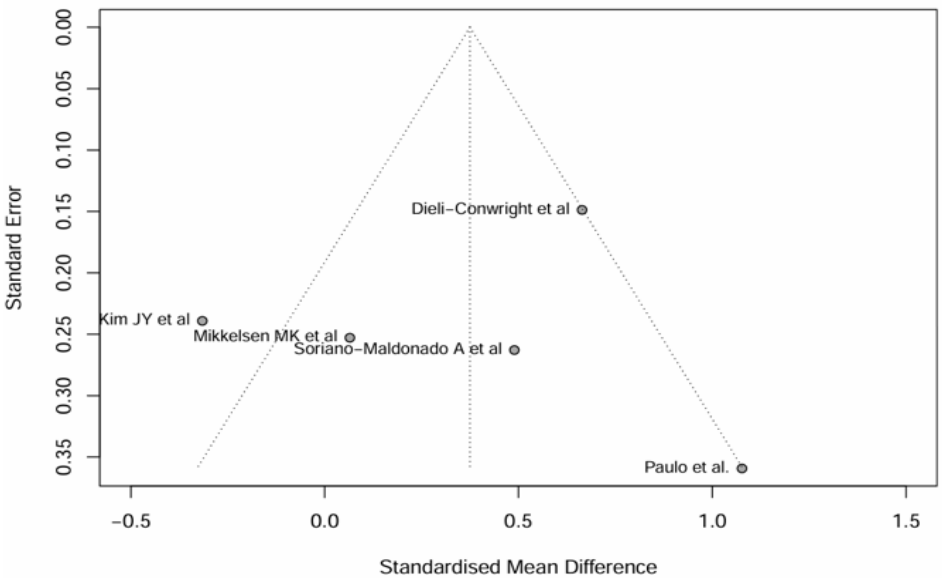

Figure 11. Funnel Chart of the Social Component of the HRQOL Index of the Two Groups of Patients. MD, mean different; SE, standard error.

Discussion

The review's conclusions show that exercise therapies improve HRQOL overall as well as a few specific HRQOL dimensions, such as social, mental, emotional, and physical functioning. Early data from a related trial by Capozzi LC et al. [13] suggests that physical exercise therapies can help those suffering from cancer of the head and neck both during and after treatment [13]. In another study, over half of cancer of the head and neck survivors are fully sedentary, and very few engage in any kind of moderate-to-intense exercise (Rogers LQ et al., 2006). There were shown to be significant and potentially positive relationships between QoL, tiredness, and total exercise minutes [14]. Exercise programmes had a positive impact on HRQOL and many of its aspects, according to a study by Mishra SI et al. They can be included in management strategies for those with cancer who have finished their treatment [3]. When quantified by shifts in baseline or follow-up scores, or both, the favourable benefits held across time or when observed. There were several restrictions, such as the fact that it only addressed the impact of exercise on specific cancer types. On the other hand, it has created a road for similar studies on all other cancer kinds in cancer patients and survivors.

Author Contribution Statement

BG, RG, and AG: conception and design and typographical logic of the article. BG, AM, and AG: literature selection and acquisition of data. BG, RG, and AM: analysis and interpretation of data and editing the article. BG, RG, and AG: study supervision and revising the article. All authors contributed to the article and approved the submitted version.

Acknowledgements

Ethical permission

Since it is a meta-analysis and systematic review, therefore no ethical permission was required for the study.

Registering Authority

This study was registered by the International Prospective Register of Systematic Reviews PROSPERO (CRD42024521768).

Conflicts of interest

There were no conflicts of interest.

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