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Lifestyle interventions improving health-related quality of life: A systematic review and meta-analysis of randomized control trials

Sohrab Amiri, Nailah Mahmood[1], Sameeha Junaidi[2], Moien AB Khan[3]

Quran and Hadith Research Center, Baqiyatallah University of Medical Sciences, Tehran, Iran, [1]Department of Clinical Psychology, Snö Healthcare, Abu Dhabi, United Arab Emirates, [2]Department of Public Health, RAK Medical and Health Sciences, United Arab Emirates University, Ras Al Khaimah, United Arab Emirates, [3]Department of Family Medicine, College of Medicine and Health Sciences, United Arab Emirates University, Al-Ain, United Arab Emirates

Address for correspondence:
Dr. Moien AB Khan, Health and Wellness Research Group, Department of Family Medicine, College of Medicine and Health Sciences, United Arab Emirates University, Al-Ain, United Arab Emirates.
E-mail: moien.khan@uaeu.ac.ae

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Abstract:

Lifestyle interventions have garnered significant research interest for their potential to enhance health-related quality of life (HRQoL). Understanding the impact of these interventions on various dimensions of HRQoL is crucial for effective healthcare strategies. This study aims to systematically review and meta-analyze the effects of lifestyle interventions on HRQoL in randomized control trials. A systematic search was conducted across five scientific databases, including PubMed, Web of Science, Scopus, the Cochrane Library, and gray literature, with a filter applied to include only English language publications. Study selection was carried out by two independent reviewers in several steps, including duplicate removal and eligibility evaluation for meta-analysis. Information extracted from the studies included authors, countries, study designs, target populations, ages, genders, number of participants, interventions, outcomes, and results. A total of 61 randomized control trials were included in this meta-analysis. The meta-analysis revealed that lifestyle interventions significantly improved healthrelated quality of life compared to control groups, with Hedges' g of 0.38 (95% CI 0.25–0.50, Z = 5.94; $P < 0.001$; I2 = 84.59%). This positive effect was consistently observed in patients with heart-related diseases and metabolic disorders. Meta-regression analysis indicated that lifestyle interventions had the most substantial impact on health-related quality of life in the 1-month follow-up period. Considering the cost-effectiveness of lifestyle interventions compared to other intervention types, they can benefit various patient groups. This systematic review contributes to health policy goals by advocating focused preventive strategies in alignment with the observed benefits of lifestyle interventions.

Keywords:

Health lifestyle behaviors, health-related quality of life, lifestyle, lifestyle modification, lifestyle training

Introduction

The burden of physical and mental diseases on the healthcare system is significant, resulting in health issues and social problems. Among the top global causes of death, noncommunicable diseases (NCDs) include diabetes, hypertension, and cardiovascular disease.[1,2] Furthermore, NCDs like cancer, obesity, and mental disorders contribute significantly to the burden of disease.[3] In the last three decades, NCD-adjusted life years (DALYs) have increased from 43.2% to 63.8%.[4] The prevalence of NCDs among adolescents is also high.[5]

A number of lifestyle factors contribute to the development of NCDs, including smoking, diet, physical activity, obesity, and alcohol consumption.[3,6,7] It is common

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for these behaviors to develop early in life and to persist throughout one's life.[6] More than 200 million deaths have been caused by smoking alone in the past three decades, resulting in a US$ 1 trillion economic burden every year.[8,9] It is estimated that overweight and obesity have an economic impact of 2.19% to 3.3% of the Gross Domestic Product.[10] Health systems around the world were estimated to spend $53.8 billion on physical inactivity in 2013, causing 13.4 billion disability-adjusted life years.[11] In 2017, dietary risk factors were attributed to 11 million deaths and 255 million disabilities related to NCDs.[12-14] Various aspects of lifestyle affect different dimensions of health,[15] such as cardiometabolic health,[16,17] weight,[18] hypertension,[19] obstructive sleep apnea,[20] and mental health and well-being.[21-23]

Health-related quality of life (HRQoL) is a crucial aspect in assessing the impact of lifestyle interventions. It encompasses how well individuals can function in various aspects of their lives and their perceived well-being across the physical, mental, and social domains of health. In simpler terms, it focuses on evaluating how individuals are doing in their daily lives and how they perceive their overall well-being in relation to their physical, mental, and social health.[24] Another definition refers to 'those aspects of self-perceived well-being that are related to or affected by the presence of disease or treatment.[25] Multiple factors affect the HRQoL, such as socio-economic status,[26] age,[27] unemployment,[28] and social support.[29] The impact of lifestyle interventions on HRQoL has been examined in previous review studies. In these studies, improvements in HRQoL were consistently demonstrated in individuals with chronic diseases such as metabolic disorders[30,31] and cancer.[32-34]

There are, however, several issues that remain unresolved in the existing literature. A first limitation of previous meta-analyses is that they have focused solely on metabolic diseases and cancer, ignoring other common conditions. Furthermore, lifestyle interventions have not been studied comprehensively in diabetes, overweight/obesity, and mental disorders, despite their potential insights. In addition, there is uncertainty about the impact of intervention duration on quality of life. Furthermore, no consideration has been given to the sex differences between men and women. Finally, various tools used to measure HRQoL need to be examined. This systematic review and meta-analysis aim to address these gaps by evaluating the effects of lifestyle interventions on health-related quality of life through randomized controlled trials. Unique to this study, separate meta-analyses will consider specific physical and mental illnesses, gender disparities, follow-up durations, and the health-related quality of life assessment tools employed, adding novel insights to the field.

Materials and Methods

The methodology of this manuscript follows the guidelines and adheres to the reporting standards set by the Preferred Reporting Items for Systematic Reviews and Meta-analyses.[35] The review protocol has been registered in the PROSPERO International Register of Systematic Reviews under the registration number CRD42023397903.

Since the data for this systematic review and meta-analysis were obtained from publicly available databases and internet searches, ethical committee approval and informed consent from study populations were not required.

Inclusion and exclusion criteria

1) Randomized control trial studies were eligible to be selected for this research, while non-randomized control trials, quasi-experimental, pre-post studies, and cluster randomized control trials were excluded from the study because the number of clusters and the degree of intra-class correlation was not reported in cluster randomized control trials, and it was not possible to estimate the effect size correctly.[36,37] 2) Lifestyle intervention should include at least two components of lifestyle, and studies that included only one dimension such as nutrition and physical activity were excluded from the study. 3) Studies must have a control group or a waiting list group, and studies that did not have this group were excluded from the study. 4) Studies that did not report the necessary data to calculate the effect size were not eligible for this study. Some studies also did not provide this information after contacting the authors. 5) Studies that had several published reports from the same trial, only one of them was included in this meta-analysis.

Information sources

Five scientific databases were used to search for articles, including PubMed, Web of Science, Scopus, the Cochrane Library, and Google Scholar. The syntax of keywords used in this research is list. To find articles from all the manuscripts available in these scientific sources until December 2022, they were searched systematically and manually. This search is limited to articles published in English. One of the authors also screened all references of previous review studies that were related to the current study to find eligible articles.

Search strategy

A systematic review was conducted using comprehensive keyword searches across multiple databases until December 2022. The primary focus was on lifestyle interventions, including terms such as "Lifestyle intervention," "Lifestyle modification, " "Lifestyle

training," "Life Style," "Healthy Lifestyle," "Lifestyle change," "lifestyle behaviors," and "Healthy Lifestyle Behaviors." Additionally, the review encompassed the domain of Quality of Life, employing terms such as "Quality of Life," "Health-Related Quality of Life," "36-Item Short Form Survey," and "WHOQOL." The databases searched included PubMed, Scopus, Web of Science, Cochrane Library, and Google Scholar. The syntax of keywords used in this research is list.

Selection process

The process of selecting studies was carried out in several steps. First, the citations obtained from the scientific information sources were extracted into the Endnote software. In the next step, duplicate studies were identified and removed, and after this step, the studies were screened and those with possible eligibility were evaluated and selected for meta-analysis.

Data collection process

The information extracted from the studies included the following variables: authors, country, design, target population, age of the study population, sex of participants based on percentage, number of participants in each study, intervention variable, outcome variable, and results of each study.

Data items

The intervention variable in this study was the lifestyle. Based on this, each of the studies had a protocol for lifestyle-based intervention, and those studies that included at least two aspects of lifestyle (such as diet and exercise) in the intervention protocol were defined as "lifestyle intervention."

The outcome variable that was considered as the outcome was the HRQoL. Various tools have been used to measure this outcome, which was eligible for the present research, including the Short Form Health Survey, World Health Organization quality of life assessment (WHOQOL), European Quality of Life questionnaire, Impact of Weight on Quality of Life, Functional Assessment of Cancer Therapy (FACT), Pediatric Quality of Life Inventory, European Organization of Research and Treatment for Cancer, Icelandic HRQoL scale, Child Health Questionnaire- PF50, Weight-specific Quality of Life, Diabetes Quality of Life questionnaire, and self-administered Asthma Quality of Life Questionnaire.

Study risk of bias assessment

The quality of the studies in the randomized clinical trial was measured using the Cochrane Collaboration[38] tool which includes five dimensions of quality assessment selection bias, performance bias, detection bias, attrition bias, and reporting bias (Table 1).

Effect measures

In this research, the effect size used was Hedges's g effect size and 95% confidence interval (CI). The necessary data to calculate Hedges's g were the mean, standard deviation, and sample size in the intervention group and the control group in post-intervention.

Meta-analysis

After the intervention in the two lifestyle groups and the control group, the effect size was calculated using the Cochrane Handbook procedure.[39] In some studies, instead of the standard deviation, the standard error or the 95% CI was reported. For these studies, existing procedures were used to extract the standard deviation.[39] Existing processes were used to combine dependent outcomes,[40] which were implemented in comprehensive meta-analysis-3 software.[41] Then Hedges's g effect size was calculated, which can be explained in three levels including 0.20 (low), 0.50 (medium), and 0.80 (large).[42] For each of the analyses, Hedges's g was reported with a 95% CI based on the random-effects method. In this study, Hedges's g test was used for these reasons, which is sensitive to the sample size and gives a more accurate estimate of the effect size and the studies used different sample sizes.[43] Also, a sub-group meta-analysis based on types of physical and mental illness, sex, follow-up duration, and HRQoL scale was done. The heterogeneity tests were the Q test and I^2;[44,45] I^2 has different interpretations, including low, medium, and high heterogeneity.[46] Publication bias evaluation was done with funnel plots,[47,48] Egger's test,[49,50] and the Trim and fill.[51] Comprehensive meta-analysis-3 software was used for analysis.[41]

Result

Screened studies

The studies included in this meta-analysis were screened step by step according to Figure 1. The screening was done based on the title, abstract, and full texts, and the study was selected based on the inclusion and exclusion criteria. Finally, 62 randomized control trial studies were included in this research.[52-112] The included studies were from these countries: Australia, Brazil, the UK, the USA, Spain, Taiwan, Iran, China, Iceland, Sweden, Germany, South Korea, the Netherlands, India, Italy, and Turkey.

Quality assessment of studies

Five areas of quality assessment were performed for each of the studies included in the meta-analysis, and the quality assessment of each study is listed in Table 1.

Lifestyle intervention and health-related quality of life

Figure 2 shows that the lifestyle intervention resulted in an increase in HRQoL compared to those who

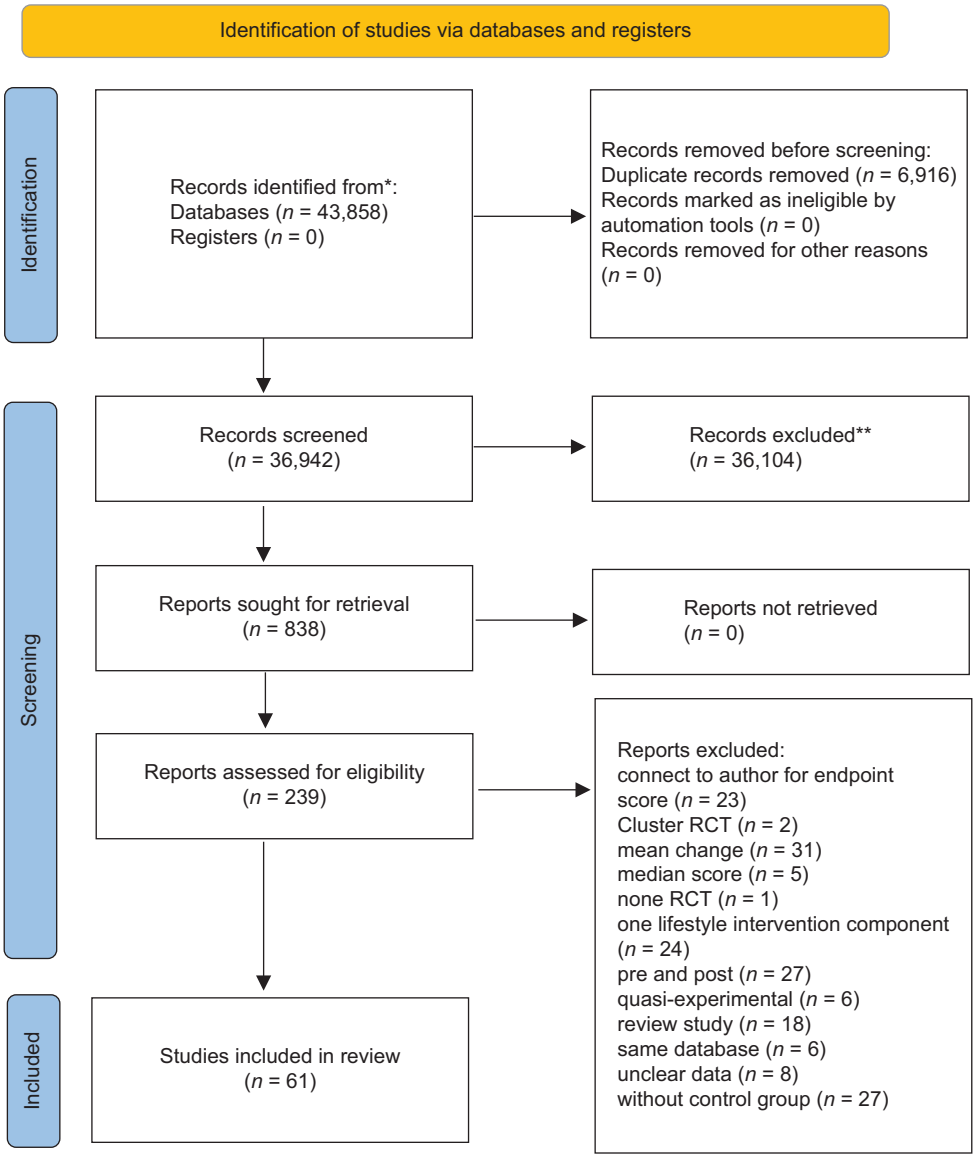

Figure 1: Flowchart diagram of screening studies included in this meta-analysis

did not receive the lifestyle intervention. Hedges' g was 0.38 with 95% CI 0.25–0.50 (Z = 5.94; $P < 0.001$; $I^2 = 84.59\%$).

Sub-group analysis

Figure 3 shows that the lifestyle intervention resulted in an increase in HRQoL compared to those who did not receive the lifestyle intervention based on different diseases. Hedges' g was nonsignificant for the cancer, mental disorders, diabetic, and overweight/obesity groups. Hedges' g was 0.39 with 95% CI 0.18–0.59 (Z = 3.69; $P < 0.001$; $I^2 = 16.63\%$) for heart-related diseases. Hedges' g was 0.49 with 95% CI 0.08–0.91 (Z = 2.36; $P = 0.018$; $I^2 = 83.75\%$) for metabolic disorders.

Figure 4 shows that the lifestyle intervention resulted in an increase in HRQoL compared to those who did not receive the lifestyle intervention based on sex. Hedges' g was 0.59 with 95% CI 0.29–0.90 (Z = 3.81; $P < 0.001$; $I^2 = 92.56\%$) for women. Hedges g was nonsignificant for men.

Figure 5 shows that the lifestyle intervention resulted in an increase in HRQoL compared to those who did not receive the lifestyle intervention-based HRQoL scale. Hedges' g was 0.27 with 95% CI 0.10–0.45 (Z = 3.05; $P = 0.002$; $I^2 = 58.38\%$) for the European Quality of Life questionnaire. Hedges' g was 0.31 with 95% CI 0.17–0.44 (Z = 4.50; $P < 0.001$; $I^2 = 79.66\%$) for Short Form Health Survey. Hedges' g was not significant for other scales.

Additional analysis

Figure 6 shows that the lifestyle intervention effects on quality of life. Hedges' g was 0.38 with 95% CI -0.04–0.80 (Z = 1.77; $P = 0.076$; $I^2 = 89.94\%$) was nonsignificant.

Table 1: Characteristics and the quality assessment of the included studies

Author and Year	Country	Design	Follow-up	Population	Age	Sex % women	Sample size	Lifestyle intervention definition	Health-related quality of life
Anderson 2015	Australia	Randomized controlled pilot trial	12 weeks	Breast cancer	45–60	Women	51	Pink Women's Wellness Program	High scores=higher quality of life
Attux 2013	Brazil	Multi-centric randomized clinical trial	3-months	Schizophrenia	18–65	40% women	126	Lifestyle Wellness Program	High scores=higher quality of life
Austin 2005	UK	Randomized controlled trial	24-week	Heart failure	≥60	57% women	179	Cardiac rehabilitation	High scores=higher quality of life
Basen-Engquist 2006	USA	Randomized pilot	6-month	Breast cancer	For intervention 55.7 (11.1) For control 54.4 (11.7)	Women	51	Lifestyle physical activity (Project Active)	High scores=higher quality of life
Bonham 2017	Australia	Multisite parallel-group randomized controlled trial	12-week	Obesity	13–17	74.3% women	74	Lifestyle behavioral program	Lower scores=higher quality of life
Bourke 2011 (1)	UK	Randomized controlled trial	12-week 6-month	Prostate cancer	60–87	Men	50	Lifestyle intervention	High scores=higher quality of life
Bourke 2011 (2)	UK	Randomized, controlled pilot trial	12-week	Colon cancer	52–80	33.3% women	18	Pragmatic lifestyle intervention	High scores=higher quality of life
Casañas 2012	Spain	Randomized controlled trial	3-month 6-month 9-month	Major depression	≥20	89.2% women	231	Psycho-educational	High scores=higher quality of life
Chiang 2019	Taiwan	Randomized controlled trial	12-week	Metabolic syndrome	≥40	Women	68	Lifestyle modification combined with motivational counseling	High scores=higher quality of life
Clark 2012	USA	Randomized controlled trial	6-month	Older people	60–95	65.9% women	360	Lifestyle intervention (Well Elderly Lifestyle)	High scores=higher quality of life
Croker 2012	UK	Randomized controlled trial	6-month	Obese	10.3±1.6	69.4% women	63	Family-based behavioral treatment	High scores=higher quality of life
Daubenmier 2006	USA	Randomized controlled trial	12-month	Prostate cancer	64.8 (7.1) for intervention 66.5 (7.6) for control	Men	82	Lifestyle intervention	High scores=higher quality of life
Ddodd 2016	Australia	Randomized controlled trial	28-week 36-week 4-month	Overweight or obese	29.4 (5.4) for intervention 29.6 (5.4) for control	Women	2142	Lifestyle intervention	High scores=higher quality of life
Fakhravar 2021	Iran	Randomized controlled trial	Unknown	Cyclic mastalgia	≥20	Women	80	Lifestyle promotion intervention	High scores=higher quality of life
Garcia 2022	Spain	Randomized controlled trial	12-month	Treatment- resistant depression	≥18	69.2% women	65	Lifestyle modification program	High scores=higher quality of life
Ghavami 2017	Iran	Randomized controlled trial	24-week	Breast cancer	48.99±9.42	Women	80	Lifestyle interventions program	High scores=higher quality of life
Ghayomzadeh 2019	Iran	Randomized controlled trial	8-week	HIV infected patients	20–58	37% women	27	Lifestyle modification program	High scores=higher quality of life
Goldberg 2013	USA	Randomized controlled trial	6-month	Veterans with mental illness	18–75	19% women	71	MOVE	High scores=higher quality of life

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Table 1: Contd...

Author and Year	Country	Design	Follow-up	Population	Age	Sex % women	Sample size	Lifestyle intervention definition	Health-related quality of life
Guillaumier 2022	Australia	Randomized controlled trial	6-month	Stroke	20 Sidekick Health smartphone app 93	46.5% women	356	Behavior change intervention—prevent 2nd stroke	High scores=higher quality of life
Guo 2021	China	Multisite randomized clinical trial	3-month 6-month	Gestational diabetes mellitus	≥18	Women	320	Intensive lifestyle modification	High scores=higher quality of life
Hilmarsdóttir 2021	Iceland	Randomized controlled trial	6-month	Type 2 diabetes mellitus	25 Sidekick Health smartphone app 70	63.3% women	30	Sidekick Health smartphone app	High scores=higher quality of life
Holt 2019	UK	Randomized controlled trial	3-month 12-month	Schizophrenia	≥18	49% women	412	Structured education lifestyle program	High scores=higher quality of life
Imayama 2011	USA	Randomized controlled trial	12-month	Overweight/obese postmenopausal women	50–75	Women	204	Diet and/or exercise interventions	High scores=higher quality of life
Inouye 2014	USA	Randomized controlled trial	6-month	At risk for diabetes	≥30	Both	40	Lifestyle intervention	High scores=higher quality of life
Jahangiry 2014	Iran	Randomized controlled trial	6-month (uncertain)	Metabolic syndrome	18–78	33.8% women	117	Web-based lifestyle intervention	High scores=higher quality of life
Johnston 2016	Sweden	Multicenter, randomized trial	6-month	Myocardial infarction	56.8 (8.0) for intervention 58.4 (8.6) for control	19% women	166	Lifestyle changes	High scores=higher quality of life
Karimlou 2019	Iran	Randomized controlled	4-week 8-week	Middle-aged	40–60	Women	102	Health-promoting lifestyle counselling	High scores=higher quality of life
Kelly 2020	Australia	Randomized controlled feasibility trial	12-week 16-week	Mental illness	18–65	58% women	32	Better health choices	High scores=higher quality of life
Kempf 2017	Germany	Randomized controlled trial	12-week 26-week 52-week	Type 2 Diabetes	60±6 8 for control 59±6 9 for intervention	46.1% women	167	Tele medical lifestyle intervention	High scores=higher quality of life
Kim 2011	South Korea	Randomized controlled trial	12-week	Breast cancer	26–69	Women	45	Matched exercise and diet	High scores=higher quality of life
Li 2021	China	Randomized controlled trial	6-month	Heart valve replacement	28–75	40% women	130	Health education combined with healthy diet	High scores=higher quality of life
Mayer-Davis 2018	USA	Randomized controlled trial	18-month	Type 1 diabetes	13–16	38.8% women	99	Flexible lifestyles for youth	High scores=higher quality of life
Michalsen 2005	Germany	Randomized controlled trial	12-month	Coronary artery disease	59.4±8 8.6	22.8% women	101	Lifestyle modification program	High scores=higher quality of life
Morales-Fernández 2021	Spain	Open-label randomized controlled trial	3-month 6-month 9-month	Nonmalignant pain	45–61 percentile	67.7% women	279	Nurse-led intervention	High scores=higher quality of life
Moss 2014	UK	Randomized controlled trial	13-week 26-week	Obstructive Sleep Apnea	18–85	Both	60	Pragmatic lifestyle intervention	High scores=higher quality of life

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Table 1: Contd...

Author and Year	Country	Design	Follow-up	Population	Age	Sex % women	Sample size	Lifestyle intervention definition	Health-related quality of life
Mountain 2017	UK	Randomized controlled trial	6-month 24-month	Older adults	≥65	68.05% women	262	Occupation-based lifestyle intervention	High scores=higher quality of life
Niet 2012	The Netherlands	Multi-center randomized controlled trial	3-month	Overweight and obese	7–12	74% women	140	Behavioral lifestyle treatment	High scores=higher quality of life
Oh 2008	South Korea	Randomized controlled trial	4-week	Metabolic syndrome	64.6 (10.2) for intervention 70.1 (7.5) for control	Women	29	Therapeutic lifestyle modification	High scores=higher quality of life
Oh 2010	South Korea	Randomized controlled trial	3-month 6-month 12-month	Metabolic syndrome	62.7±9.0	Women	52	Therapeutic lifestyle modification	High scores=higher quality of life
Prasanth 2019	India	Randomized controlled trial	6-month	Metabolic syndrome	≥20	Both	136	Provide patient counseling and education	High scores=higher quality of life
Saboya 2017	Brazil	Randomized controlled trial	3-month 9-month	Metabolic syndrome	30–59	45.5% women	48	Lifestyle intervention	High scores=higher quality of life
Seib 2022	Australia	Randomized controlled trial	12-week 24-week	Cancer	53.2 (8.8)	Women	351	Lifestyle intervention	High scores=higher quality of life
Sevilla 2021	Spain	Randomized controlled trial	6-month	University Employees during the COVID-19	42.78±6.88 for intervention 40.46±7.77 for control	Both	24	Lifestyle exercise and nutrition intervention	High scores=higher quality of life
Slaman 2015	The Netherlands	Randomized controlled trial	6-month 12-month	Cerebral palsy	16–24	52.6% women	57	Lifestyle intervention	High scores=higher quality of life
So-Hi 2005	South Korea	Randomized controlled trial	4-week	Community dwelling	≥65	59.5% women	93	Wheel of wellness counseling intervention	High scores=higher quality of life
Soltero 2018	USA	Randomized controlled trial	3-month 6-month 12-month	Obesity	14–16	54.4% women	136	Comprehensive lifestyle intervention	High scores=higher quality of life
Stuifbergen 2003	USA	Randomized controlled trial	8-month	Multiple sclerosis	21–70	Women	113	Lifestyle-change classes	High scores=higher quality of life
Stuifbergen 2010	USA	Randomized controlled trial	8-month	Fibromyalgia syndrome	≥20	Women	187	Lifestyle Counts Intervention Program	High scores=higher quality of life
Toobert 2003	USA	Randomized controlled trial	6-month	Type 2 diabetes	<75	Women	279	Mediterranean Lifestyle Program	High scores=higher quality of life
Trento 2002	Italy	Randomized controlled trial	4-year	Type 2 diabetes	35–80	45.5% women	112	Lifestyle intervention	Lower scores=higher quality of life
Tsai 2021	Taiwan	Randomized controlled trial	2-week	At-risk mental state	20–35	55.4% women	92	Health-awareness-strengthening Lifestyle	High scores=higher quality of life
Ural 2021	Turkey	Randomized controlled trial	6-week	Gestational diabetes mellitus	≥18	Women	88	Health-promoting lifestyle education	High scores=higher quality of life

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Table 1: Contd...

Author and Year	Country	Design	Follow-up	Population	Age	Sex % women	Sample size	Lifestyle intervention definition	Health-related quality of life
Usher 2013	Australia	Randomized controlled trial	12-week	Mental illness	≥18	46.5% women	101	Healthy lifestyle booklet	High scores=higher quality of life
Vempati 2009	India	Randomized controlled trial	2-week 4-week 8-week	Asthma	33.5±11.4 for intervention 33.4±11.5 for control	42.1% women	57	Yoga-based lifestyle modification and stress management	High scores=higher quality of life
von Gruenigen 2009	Unknown	Randomized controlled trial	3-month 6-month 12-month	Cancer	Unknown	Unknown	45	Lifestyle intervention	High scores=higher quality of life
Wang 2017	China	Randomized controlled trial	1-month 3-month	Metabolic syndrome	24–78	50.9% women	173	Lifestyle intervention program	High scores=higher quality of life
Williams 2018	Australia	Randomized controlled trial	6-week 26-week	Low back pain	56.7±13.4	59.1% women	159	Healthy lifestyle intervention	High scores=higher quality of life
Wilson 2021	New Zealand	Randomized controlled trial	17-week	Airline pilots	42±12	17.7% women	79	Lifestyle intervention	High scores=higher quality of life
Woo 2007	China	Randomized controlled trial	6-month	Obese	18–50	Both	55	Lifestyle modification program	High scores=higher quality of life
Yang 2020	Taiwan	Randomized controlled trial	1-month 3-month	Colorectal cancer	≥20	52.9% women	68	Occupational therapy	High scores=higher quality of life
Zhang 2016	China	Randomized controlled trial	12-week	Metabolic syndrome	32–63	56.9% women	62	Lifestyle intervention	High scores=higher quality of life

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
Anderson 2015	1–12-item Short Form Health Survey 2- FACT-B	Low	Unclear	High	High	Low	Unclear	Physical component summary Intervention 26 (46.9±9.27) Control 25 (46.3±8.6) Mental component summary Intervention 26 (48.3±9.3) Control 25 (47.3±11.5) FACT-B Intervention 26 (103.9±15.4) Control 25 (101.3±25.0) Physical well-being Intervention 26 (22.9±3.3) Control 25 (22.2±4.8) Social well-being Intervention 26 (19.1±5.1) Control 25 (18.8±5.5) Emotional well-being intervention 26 (18.7±3.3) Control 25 (18.4±4.4) Functional well-being Intervention 26 (20.3±4.7) Control 25 (19.5±7.1) Breast cancer subscale Intervention 26 (22.8±5.1) Control 25 (21.9±6.8)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
Attux 2013	1-World Health Organization's WHOQOL-BREF	Low	Unclear	Unclear	Low	Unclear	Unclear	Physical Intervention 60 (58.7±15.4) Control 66 (60.5±17.4) Psychological Intervention 60 (58.4±18.9) Control 66 (61.1±19.3) Social relations Intervention 60 (56.9±22.2) Control 66 (56.9±24.5) Environmental Intervention 60 (57.1±14.4) Control 66 (56.5±16.2)
Austin 2005	1-EuroQol questionnaires.	Low	Low	Unclear	Low	Unclear	Unclear	Intervention** 100 (0.78±0.15) Control 100 (0.65±0.30)
Basen-Engquist 2006	1–36-item short-Form	Low	Unclear	Unclear	Low	Low	Unclear	Physical functioning Intervention** 35 (82.5±14.19) Control 25 (77.4±12) Mental health Intervention 35 (78.2±11.83) Control 25 (77.2±12.5) Vitality Intervention 35 (60.9±13.01) Control 25 (58.1±14) Role physical Intervention 35 (86.1±24.84) Control 25 (73.0±25.5) Bodily pain Intervention 35 (79.7±11.83) Control 25 (72.1±12) General health Intervention 35 (77.4±13.01) Control 25 (67.1±14) Social Functioning Intervention 35 (84.6±18.93) Control 25 (84.9±20) Role emotional Intervention 35 (81.2±25.5) Control 25 (79.4±31)
Bonham 2017	1-Impact of weight on quality of life	Low	Low	High	Unclear	Low	Low	Intervention 42 (72.8±14.5) Wait-list control 32 (72.7±14.5))
Bourke 2011 (1)	1-functional assessment of cancer therapy	Low	Low	Unclear	Low	Low	Unclear	12-week FACT-P Intervention 25 (128±14) Control 25 (121±25) FACT-G Intervention 25 (91±10) Control 25 (86±18) 6-month FACT-P Intervention 25 (125±20) Control 25 (122±26) FACT-G Intervention 25 (90±13) Control 25 (87±17)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
Bourke 2011 (2)	1-functional assessment of cancer therapy (FACT-C)	Low	Low	Unclear	Low	Low	Unclear	Intervention 9 (120±11) Control 9 (106±13)
Casañas 2012	1 - Euro quality of life questionnaire (EQ-5D)	Low	Low	High	High	Low	Unclear	3-month Intervention 119 (59.7±18.1) Control 112 (55.54±16.36) 6-month Intervention 119 (57.9±20.7) Control 112 (57.05±16.97) 9-month Intervention 119 (59.2±20.8) Control 112 (57.69±17.35)
Chiang 2019	1–36-Item Short-Form	Low	Low	Unclear	Low	Unclear	Unclear	Total Intervention 34 (74.6±11.3) Control 34 (47.6±15.5) Bodily pain Intervention 34 (78.7±14.3) Control 34 (59.5±19.9) General health Intervention 34 (67.4±6.4) Control 34 (45.6±18.6) Mental health Intervention 34 (68.7±9.6) Control 34 (56.0±14.5) Physical function Intervention 34 (82.8±11.8) Control 34 (68.2±16.7) Role-emotional Intervention 34 (84.3±34.1) Control 34 (18.6±36.8) Role-physical Intervention 34 (72.8±40.9) Control 34 (19.1±36.9) Social functioning Intervention 34 (80.9±11.6) Control 34 (64.0±16.2) Vitality Intervention 34 (61.5±12.1) Control 34 (49.7±13.3)
Clark 2012	1–36-item short-form	Low	Unclear	Low	Low	Low	Unclear	Physical function Intervention 187 (39.84±12.70) Control 173 (38.81±12.11) Role physical Intervention 187 (40.78±11.37) Control 173 (40.72±9.94) Bodily pain Intervention 187 (44.62±11.20) Control 173 (44.38±11.86) General health Intervention 187 (46.19±9.85) Control 173 (45.74±10.48) Vitality Intervention 187 (51.29±9.85) Control 172 (49.60±11.23)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Social function Intervention 187 (45.36±11.37) Control 173 (45.00±11.33) Role emotional Intervention 187 (40.72±12.95) Control 173 (40.69±12.86) Mental health Intervention 187 (49.07±10.70) Control 172 (47.16±11.81)
Croker 2012	1 - Pediatric Quality of Life Inventory	Low	High	High	Low	Unclear	Unclear	Intervention 33 (70.08±11.98) Control 30 (74.35±12.12)
Daubenmier 2006	1–36-item short-form	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Physical component summary Intervention 40 (53.2±6.6) Control 42 (50.2±9.5) Mental component summary Intervention 40 (50.7±9.3) Control 42 (56.0±6.7)
Ddodd 2016	1–36-item short-form	Low	Low	Unclear	Unclear	Unclear	Unclear	28-week Physical Functioning Intervention 975 (65.93±20.01) Control 956 (64.85±20.92) Physical Role Intervention 975 (59.02±40.12) Control 956 (59.60±39.39) Bodily Pain Intervention Intervention 975 (62.71±21.08) Control 956 (62.01±21.06) General Health Intervention 975 (69.84±18.46) Control 956 (69.45±19.17) Vitality Intervention 975 (52.35±18.53) Control 956 (52.91±19.06) Social Functioning Intervention 975 (81.31±20.95) Control 956 (80.89±21.78) Emotional Role Intervention 975 (87.02±28.76) Control 956 (85.42±30.00) Mental Health Intervention 975 (78.72±15.17) Control 956 (78.26±15.90) 36-week Physical Functioning Intervention 975 (53.15±23.30) Control 956 (53.19±23.76) Physical Role Intervention 975 (42.21±41.42) Control 956 (43.20±40.72) Bodily Pain Intervention Intervention 975 (56.39±21.58) Control 956 (55.36±21.24) General Health Intervention 975 (70.98±18.64) Control 956 (70.68±18.98)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Vitality Intervention 975 (49.08±19.46) Control 956 (49.81±19.47) Social Functioning Intervention 975 (77.50±22.13) Control 956 (78.48±21.50) Emotional Role Intervention 975 (86.78±29.88) Control 956 (84.08±31.49) Mental Health Intervention 975 (78.91±15.23) Control 956 (79.58±14.88) 4-month Physical Functioning Intervention 975 (88.22±16.01) Control 956 (87.62±17.05) Physical Role Intervention 975 (87.14b±27.99) Control 956 (86.80±27.66) Bodily Pain Intervention 975 (77.42±21.52) Control 956 (76.25±22.64) General Health Intervention 975 (71.76±19.06) Control 956 (72.37±18.46) Vitality Intervention 975 (58.26±19.86) Control 956 (58.57±19.96) Social Functioning Intervention 975 (85.51±21.64) Control 956 (86.58±20.11) Emotional Role Intervention 975 (87.21±28.22) Control 956 (87.27±27.62) Mental Health Intervention 975 (78.86±16.29) Control 975 (80.09±15.00)
Fakhravar 2021	1 - World Health Organization Quality of Life-BREF	Unclear	High	Low	Unclear	Low	Unclear	Total Intervention 40 (67.50±10.28) Control 40 (59.20±11.83) Physical health Intervention 40 (67.32±13.88) Control 40 (60.98±13.61) Mental health Intervention 40 (65.52±18.60) Control 40 (58.54±14.61) Social health Intervention 40 (65.62±16.25) Control 40 (55.62±17.84) Environmental health Intervention 40 (69.29±11.58) Control 40 (59.37±15.45) General health Intervention 40 (69.66±16.23) Control 40 (59.68±16.62)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
Garcia 2022	1-Visual Analog Scale of European Quality of Life-5 Dimensions Questionnaire dimension questionnaire	Low	Low	Unclear	Unclear	Low	Unclear	Intervention 34 (63.50±25.2) Control 31 (45.27±26.8)
Ghavami 2017	1 - European Organization of Research and Treatment for Cancer	Unclear	Unclear	Unclear	Unclear	Low	Unclear	Total Intervention 40 (91.25±8.00) Control 40 (57.28±14.01) Physical functioning Intervention 40 (93.00±5.00) Control 40 (72.00±17.49) Role functioning Intervention 40 (97.08±6.41) Control 40 (81.66±19.54) Emotional functioning Intervention 40 (87.91±14.49) Control 40 (62.91±26.48) Cognitive functioning Intervention 40 (96.25±7.05) Control 40 (78.50±18.83) Social functioning Intervention 40 (92.08±13.07) Control 40 (65.00±26.64)
Ghayomzadeh 2019	1–36-Item Short-Form	Low	Unclear	Low	Low	Low	Unclear	Total Intervention 13 (69.94±15.50) Control 14 (47.48±16.25) physical functioning Intervention 13 (67.85±16.64) Control 14 (46.25±16.7) Role physical intervention 13 (46.84±25.84) Control 14 (35.71±13.64) bodily pain Intervention 13 (84.29±16.27) Control 14 (60.42±18.98) general health Intervention 13 (77.56±10.30) Control 14 (48.65±9.35) vitality Intervention 13 (68.58±14.56) Control 14 (51.02±14.52) social functioning Intervention 13 (80.29±15.74) Control 14 (55.23±21.31) role emotional Intervention 13 (44.43±19.28) Control 14 (26.74±18.13) mental health Intervention 13 (69.73±18.98) Control 14 (55.80±18.60)
Goldberg 2013	1–12-item short form	Low	Unclear	Unclear	Unclear	Unclear	Unclear	Physical component summary Intervention 30 (45.2±12.2) Control 41 (43.9±12.7)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								mental component summary Intervention 30 (43.0±15.9)
								Control 41 (48.0±9.4)
Guillaumier 2022	1 - EuroQol Visual Analog Scale	Low	Unclear	Unclear	Low	Low	Unclear	Intervention 171 (0.85±0.17)
								Control 185 (CI 0.82±0.17)
Guo 2021	1 - WHOQOL-BREF questionnaire	Low	Low	High	Low	Low	Unclear	3-month Physiological Intervention 160 (14.53±2.01)
								Control 160 (14.77±1.73)
								Psychological Intervention 160 (14.20±2.17)
								Control 160 (14.46±1.92)
								Social relations Intervention 160 (14.82±2.15)
								Control 160 (15.41±1.89)
								Environment Intervention 160 (13.89±2.02)
								Control 160 (14.05±1.98)
								6-month Physiological Intervention 160 (14.70±2.02)
								Control 160 (14.75±1.83)
								Psychological Intervention 160 (14.24±2.16)
								Control 160 (14.26±2.04)
								Social relations Intervention 160 (15.08±2.50)
								Control 160 (15.27±1.95)
								Environment Intervention 160 (14.01±2.13)
								Control 160 (13.80±2.05)
Hilmarsdóttir 2021	1 - Icelandic health-related Quality of Life scale	Unclear	Low	High	Low	Unclear	Unclear	Intervention 15 (48.5±11.8)
								Control 15 (46±13)
Holt 2019	1 - EQ-5D-5L	Low	High	High	Low	Unclear	Unclear	3-month Intervention 178 (0.815±0.165)
								Control 180 (0.785±0.214)
								12-month 167 (0.793±0.237)
								Control 173 (0.793±0.239)
Imayama 2011	1–36-item short-form	Low	Unclear	Unclear	Low	Low	Unclear	Physical functioning Intervention 117 (92.4±11.3)
								Control 87 (84.5±15.5)
								Role-physical Intervention 117 (92.5±18.9)
								Control 87 (78.7±32.0)
								Bodily pain Intervention 117 (79.1±17.5)
								Control 87 (72.6±18.2)
								General health Intervention 117 (56.9±7.3)
								Control 87 (56.4±7.1)
								Vitality Intervention 117 (70.2±17.2)
								Control 87 (59.2±17.9)
								Social functioning Intervention 117 (91.6±17.0)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Control 87 (86.9±17.5)
								Role-emotional Intervention 117 (90.3±22.8)
								Control 87 (83.3±31.8)
								Mental health Intervention 117 (82.3±12.6)
								Control 87 (77.3±14.5)
Inouye 2014	1–36-item short-form 2- WHO_QOL	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Physical component summary Intervention** 22 (50.51±8.95)
								Control 18 (48.02±8.82)
								Mental component summary Intervention 22 (52.41±7.50)
								Control 18 (52.87±7.42)
								WHO_QOL Intervention 22 (3.89±0.70)
								Control 18 (4.05±0.72)
Jahangiry 2014	1–36-item short-form	Unclear	Low	High	Unclear	Low	Low	Physical functioning Intervention 64 (93.2±11.7)
								Control 53 (91.2±13.4)
								Role physical Intervention 64 (86.1±29.3)
								Control 53 (81.9±31.2)
								Bodily pain Intervention 64 (44.2±28.6)
								Control 53 (40.1±31.4)
								General health Intervention 64 (58.2±18.7)
								Control 53 (59.3±18.4)
								Social functioning Intervention 64 (87.5±18.1)
								Control 53 (85.4±23.2)
								Role emotional Intervention 64 (70.8±40.5)
								Control 53 (67.9±44.3)
								Vitality Intervention 64 (60.24±18.1)
								Control 53 (61.5±17.8)
								Mental health Intervention 64 (66.6±15.9)
								Control 53 (66.6±18.2)
Johnston 2016	1-European Quality of Life-5 Dimensions Visual Analogue scale	Unclear	Unclear	High	Unclear	Unclear	Unclear	Intervention 80 (82.7±11.6)
								Control 71 (78.2±15.3)
Karimlou 2019	1–36-Item Short-Form	Low	Low	Unclear	Unclear	Low	Unclear	4-week Intervention 51 (77.21±11.37)
								Control 51 (63.11±14.63)
								8-week Intervention 51 (82.53±8.34))
								Control 51 (62.44±13.17)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
Kelly 2020	1-WHO-8 EUROHIS Quality of Life scale	Low	Unclear	Unclear	Low	Unclear	Unclear	12-week Intervention 13 (24.92±7.09) Control 14 (24.93±6.86) 16-week Intervention 16 (24.69±5.72) Control 16 (25.47±6.78)
Kempf 2017	1–12-Item Short Form	Low	Low	Low	Low	Low	Unclear	12-week Physical component summary Intervention 93 (48±10) Control 74 (42±12) Mental component summary Intervention 93 (38±5) Control 74 (39±6) 26-week Physical component summary Intervention 93 (48±10) Control 74 (43±12) Mental component summary Intervention 93 (39±5) Control 74 (38±6) 52-week Physical component summary Intervention 93 (46±11) Control 74 (43±12) Mental component summary Intervention 93 (39±6) Control 74 (38±6)
Kim 2011	1 - European Organization for the Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-C30)	Unclear	Unclear	Unclear	Unclear	Low	Unclear	Total** Intervention 23 (73.33±17.69) Control 22 (68.02±16.18) Physical Intervention 23 (85.66±5.99) Control 22 (82.38±6.89) Role Intervention 23 (84.69±17.50) Control 22 (80.66±14.35) Emotional Intervention 23 (84.01±9.83) Control 22 (72.17±13.93) Cognitive Intervention 23 (83.44±8.87) Control 22 (81.05±14.39) Social Intervention 23 (86.18±18.46) Control 22 (81.91±21.20)
Li 2021	1 - World Health Organization Quality of Life (WHOQOLBREF)	Unclear	Unclear	Unclear	Unclear	Low	Unclear	Total Intervention 65 (122.65±13.39) Control 65 (99.80±13.23) Environment Intervention 65 (26.83±3.61) Control 65 (22.79±3.59) Social relations Intervention 65 (26.75±2.98) Control 65 (23.16±2.91) Independence Intervention 65 (26.63±3.25)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Control 65 (22.47±2.94)
								Physical health Intervention 65 (33.26±2.87)
								Control 65 (24.93±2.48)
								Physiological Intervention 65 (9.18±0.68)
								Control 65 (6.45±1.31)
Mayer-Davis 2018	1 - Pediatric Diabetes Quality of Life	Low	Low	Unclear	High	Low	Unclear	Intervention 118 (85·2 ± 11·4)
								Control 123 (82·2 ± 12·6)
Michalsen 2005	1–36-item short-form	Low	Low	Unclear	Unclear	Low	Unclear	General health Intervention 48 (63.1±15.5)
								Control 53 (59.6±19.7)
								Physical function Intervention 48 (83.8±15.1)
								Control 53 (78.8±18.4)
								Physical role Intervention 48 (76.6±36.2)
								Control 53 (64.1±39.7)
								Emotional role Intervention 48 (74.3±37.2)
								Control 53 (69.8±38.5)
								Social function Intervention 48 (82.6±20.6)
								Control 53 (81.6±18.6)
								Mental health Intervention 48 (75.8±15.7)
								Control 53 (74.6±16.1)
								Vitality Intervention 48 (63.8±15.8)
								Control 53 (60.0±16.6)
								Bodily pain Intervention 48 (77.8±24.7)
								Control 53 (73.5±24.9)
Morales-Fernández 2021	1–36-item short-form	Low	Low	High	Low	Low	Unclear	3-month Physical functioning Intervention 174 (47.24±17.92)
								Control 105 (41.14±22.05)
								Physical role Intervention 174 (21.07±29.4)
								Control 105 (6.19±21.71)
								Bodily pain Intervention 174 (47.57±16.66)
								Control 105 (39.79±20.91)
								General health Intervention 174 (30.64±15.07)
								Control 105 (23.62±16.8)
								Vitality Intervention 174 (53.56±5.89)
								Control 105 (51.29±3.71)
								Social function Intervention 174 (47.01±22.29)
								Control 105 (32.61±29.45)
								Emotional role Intervention 174 (50.15±36.76)
								Control 105 (30.09±43.67)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Mental Health Intervention 174 (49.95±17.47) Control 105 (38.59±22.29) 6-month Physical functioning Intervention 174 (46.95±18.92) Control 105 (40.57±22.2) Physical role Intervention 174 (14.29±24.09) Control 105 (6.12±19.49) Bodily pain Intervention 174 (45.41±16.53) Control 105 (40.05±18.99) General health Intervention 174 (29.5±15.88) Control 105 (21.58±16.18) Vitality Intervention 174 (52.44±3.99) Control 105 (51.61±3.06) Social function Intervention 174 (44.02±24.79) Control 105 (32.33±28.17) Emotional role Intervention 174 (47.94±36.4) Control 105 (26.46±41.55) Mental Health Intervention 174 (47.51±18.4) Control 105 (36.22±21.13) 9-month Physical functioning Intervention 174 (46.96±18.42) Control 105 (39.56±23.01) Physical role Intervention 174 (13.11±22.02) Control 105 (5.2±19.13) Bodily pain Intervention 174 (43.13±16.79) Control 105 (37.42±19.91) General health Intervention 174 (28.75±16.11) Control 105 (20.17±18.19) Vitality Intervention 174 (51.65±3.88) Control 105 (51.39±2.9) Social function Intervention 174 (42.35±24.4) Control 105 (28±27.6) Emotional role Intervention 174 (41.52±37.31) Control 105 (22.92±39.07) Mental Health Intervention 174 (46.33±20.46) Control 105 (31.6±22.13)
Moss 2014	1-EuroQol EQ5D-3L questionnaire	Low	Low	High	High	Unclear	Unclear	13-week Intervention 30 (63±19) Control 30 (60±20)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
Mountain 2017	1–36-item short-form	Low	Low	High	Low	Low	Unclear	26-week Intervention 30 (72±16) Control 30 (69±18) 6-month Mental health Intervention 136 (77.3±18.2) Control 126 (75.9±18.7) Physical function Intervention 136 (66.0±28.4) Control 126 (70.7±27.3) Role physical Intervention 136 (69.9±29.9) Control 126 (73.9±26.4) Bodily pain Intervention 136 (60.5±28.0) Control 126 (61.6±27.4) General health Intervention 136 (61.9±22.7) Control 126 (64.8±21.1) Vitality Intervention 136 (56.4±22.2) Control 126 (58.0±21.7) Social function Intervention 136 (77.8±28.2) Control 126 (81.3±26.0) Role emotional Intervention 136 (82.7±23.2) Control 125 (86.7±19.4) 24-month Mental health Intervention 122 (78.0±17.1) Control 117 (75.4±17.8) Physical function Intervention 123 (65.0±27.8) Control 118 (66.3±29.5) Role physical Intervention 123 (69.7±27.5) Control 117 (72.5±27.7) Bodily pain Intervention 123 (56.0±25.6) Control 117 (59.9±26.1) General health Intervention 123 (64.3±20.7) Control 117 (64.0±20.7) Vitality Intervention 123 (57.1±21.6) Control 117 (57.3±19.5) Social function Intervention 123 (80.7±25.4) Control 117 (79.2±25.2) Role emotional Intervention 121 (87.2±20.2) Control 117 (85.3±22.9)
Niet 2012	1 - Child Health Questionnaire- PF50	Unclear	Low	Unclear	Unclear	Low	Unclear	Physical Intervention 73 (52.9±6.3) Control 68 (51.6±8.4)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Psychological Intervention 73 (52.2±6.7)
								Control 68 (49.9±8.9)
Oh 2008	1 - EQ-5D	Unclear	Unclear	Unclear	Unclear	Low	Unclear	Intervention 14 (0.54±0.12)
								Control 11 (0.33±0.35)
Oh 2010	1–36-item short-form	Low	Unclear	Unclear	High	Low	Unclear	3-month Physical function Intervention 31 (72.6±28.39)
								Control 21 (60.7±16.49)
								Physical roles Intervention 31 (70.6±46.21)
								Control 21 (38.0±29.78)
								Bodily pain Intervention 31 (62.9±32.29)
								Control 21 (48.6±21.07)
								General health Intervention 31 (57.1±25.05)
								Control 21 (38.1±14.66)
								Vitality Intervention 31 (56.2±28.39)
								Control 21 (33.8±14.66)
								Social function Intervention 31 (88.9±22.82)
								Control 21 (77.8±24.74)
								Emotional roles Intervention 31 (79.7±40.08)
								Control 21 (58.2±37.11)
								Mental health Intervention 31 (70.5±23.38)
								Control 21 (54.9±20.16)
								6-month Physical function Intervention 31 (73.2±24.49)
								Control 21 (50.9±19.24)
								Physical roles Intervention 31 (73.2±42.87)
								Control 21 (52.7±40.78)
								Bodily pain Intervention 31 (65.1±30.62)
								Control 21 (46.3±17.87)
								General health Intervention 31 (62.0±26.72)
								Control 21 (36.7±17.41)
								Vitality Intervention 31 (62.8±25.61)
								Control 21 (38.0±19.24)
								Social function Intervention 31 (89.1±18.37)
								Control 21 (74.7±32.99)
								Emotional roles Intervention 31 (85.5±32.84)
								Control 21 (52.2±47.65)
								Mental health Intervention 31 (72.3±22.27)
								Control 21 (47.8±20.16)
								12-month Physical function Intervention 31 (66.3±22.27)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Control 21 (56.0±22.91) Physical roles Intervention 31 (59.0±42.87) Control 21 (50.5±39.41) Bodily pain Intervention 31 (67.7±28.39) Control 21 (59.8±27.95) General health Intervention 31 (51.4±18.37) Control 21 (47.6±17.87) Vitality Intervention 31 (57.0±20.60) Control 21 (49.0±21.07) Social function Intervention 31 (81.4±25.05) Control 21 (74.9±29.32) Emotional roles Intervention 31 (70.1±43.98) Control 21 (57.3±43.07) Mental health Intervention 31 (69.7±21.71) Control 21 (57.2±26.12)
Prasanth 2019	1 - WHOQOL-BREF questionnaire	Low	Unclear	Unclear	Unclear	Unclear	Unclear	Physical health Intervention 70 (20.90±2.88) Control 66 (21.60±3.09) Psychological Intervention 70 (17.48±2.41) Control 66 (17.00±2.15) Social relationships Intervention 70 (9.54±2.11) Control 66 (9.92±1.72) Environmental Intervention 70 (24.72±4.32) Control 66 (24.74±3.64)
Saboya 2017	1–36-Item Short-Form	Low	Unclear	Unclear	Unclear	Unclear	Unclear	3-month physical functioning Intervention 28 (87.7±2.8) Control 19 (76.7±3.5) Role-physical Intervention 28 (88.4±4.4) Control 19 (83.6±5.3) bodily pain Intervention 28 (79.3±4.2) Control 19 (72.8±5.0) general health Intervention 28 (85.8±2.3) Control 19 (79.6±2.8) Vitality Intervention 28 (77.6±2.6) Control 19 (69.5±3.1) Social Functioning Intervention 28 (92.7±3.5) Control 19 (84.2±4.2) role-emotional Intervention 28 (88.4±5.6) Control 19 (88.8±6.8)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								mental health Intervention 28 (82.7±2.5) Control 19 (77.8±3.0) 9-month physical functioning Intervention 20 (75.3±4.1) Control 17 (76.8±4.5) Role-physical Intervention 20 (82.7±8.2) Control 17 (86.5±9.0) bodily pain Intervention 20 (61.7±5.1) Control 17 (70.5±5.4) general health Intervention 20 (78.8±3.6) Control 17 (79.5±3.9) Vitality Intervention 20 (68.9±4.2) Control 17 (66.9±4.5) Social Functioning Intervention 20 (81.2±5.1) Control 17 (78.9±5.3) role-emotional Intervention 20 (81.7±6.7) Control 17 (79.6±7.3) mental health Intervention 20 (75.1±3.6) Control 17 (72.9±3.9)
Seib 2022	1–36-item short-form	Low	Low	Low	Low	Low	Low	12-week Physical functioning Intervention 120 (49.6±7.8) Control 126 (47.5±8.1) Role physical Intervention 120 (50.0±9.7) Control 126 (45.3±11.9) Bodily pain Intervention 120 (50.8±9.0) Control 126 (47.7±9.5) General health Intervention 122 (48.9±8.4) Control 126 (46.8±8.9) Vitality Intervention 120 (50.5±8.7) Control 126 (47.8±9.4) Social Functioning Intervention 120 (49.9±7.9) Control 126 (47.9±10.0) Role emotional Intervention 120 (47.2±10.9) Control 126 (49.7±10.1) Mental health Intervention 120 (42.5±8.6) Control 126 (41.8±9.1) 24-week Physical functioning Intervention 123 (50.6±7.6) Control 120 (47.4±9.3) Role physical Intervention 123 (48.6±10.3)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Control 120 (44.7±12.4)
								Bodily pain Intervention 123 (50.2±9.3)
								Control 120 (47.5±10.2)
								General health Intervention 123 (50.1±8.8)
								Control 120 (47.0±9.8)
								Vitality Intervention 123 (50.5±9.2)
								Control 120 (47.9±10.0)
								Social Functioning Intervention 123 (50.1±8.3)
								Control 120 (48.0±10.6)
								Role emotional Intervention 123 (48.4±10.5)
								Control 120 (47.1±12.2)
								Mental health Intervention 123 (50.2±8.5)
								Control 120 (48.8±10.4)
Sevilla 2021	1–36-item short-form	Low	Unclear	High	High	Low	Unclear	Physical Component Summary Intervention 12 (54.51±4.02)
								Control 12 (50.25±8.52)
								Mental Component Summary Intervention 12 (53.07±5.99)
								Control 12 (43.70±11.73)
Slaman 2015	1–36-item short-form health survey	Low	Unclear	High	Low	Low	Unclear	6-month Physical functioning Intervention 22 (78.86±18.96)
								Control 24 (77.50±27.11)
								role physical Intervention 22 (78.41±35.60)
								Control 24 (73.96±37.94)
								bodily pain Intervention 22 (82.09±25.07)
								Control 24 (75.78±22.45)
								general health Intervention 22 (75.18±17.39)
								Control 24 (66.09±23.57)
								Vitality Intervention 22 (58.41±8.78)
								Control 24 (57.71±14.37)
								social Functioning Intervention 22 (90.34±11.53)
								Control 24 (89.06±17.02)
								role emotional Intervention 22 (96.97±9.81)
								Control 24 (90.28±28.62)
								mental health Intervention 22 (82.36±8.52)
								Control 24 (74.67±15.99)
								12-month Physical functioning Intervention 18 (79.72±19.44)
								Control 21 (76.90±26.34)
								role physical Intervention 18 (84.72±33.36)
								Control 21 (69.05±46.03)
								bodily pain Intervention 18 (88.61±18.39)

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Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Control 20 (73.55±19.29) general health Intervention 18 (74.50±18.22) Control 20 (66.85±22.80) Vitality Intervention 18 (53.61±11.22) Control 20 (54.00±12.73) social Functioning Intervention 17 (86.03±15.23) Control 20 (90.00±17.01) role emotional Intervention 18 (98.15±7.86) Control 21 (87.30±32.45) mental health Intervention 18 (81.56±10.81) Control 20 (73.40±15.59)
So-Hi 2005	1 - Short Form SF-8	Low	Low	High	Unclear	Unclear	Unclear	Physical Component Summary Intervention 43 (44.97±8.15) Control 46 (43.92±7.18) Mental Component Summary Intervention 43 (50.55±6.40) Control 46 (49.68±6.70)
Soltero 2018	1 - Weight-specific QoL	Low	Unclear	High	High	Low	Unclear	3-month Self Intervention 67 (73.2±22.91) Control 69 (60.6±27.41) Relationships Intervention 67 (83.6±18) Control 69 (72.3±23.25) Environment Intervention 67 (77.6±19.64) Control 69 (64.3±24.08) 6-month Self Intervention 67 (73.0±25.37) Control 69 (63.2±25.75) Relationships Intervention 67 (83.6±18.82) Control 69 (74.8±23.25) Environment Intervention 67 (77.5±21.28) Control 69 (64.1±27.41) 12-month Self Intervention 67 (77.1±22.10) Control 69 (63.6±28.24) Relationships Intervention 67 (86.2±17.18) Control 69 (74.1±25.75) Environment Intervention 67 (76.6±22.91) Control 69 (65.9±24.91)
Stuifbergen 2003	1–36-item short-form health survey	Low	Unclear	Unclear	Unclear	Unclear	Unclear	Physical function Intervention 56 (51.0±29.1) Control 57 (40.2±30.8) Role–physical Intervention 56 (46.9±43.8) Control 57 (41.4±42.0)

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Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Bodily pain Intervention 56 (66.7±24.6) Control 57 (63.8±28.2) General health Intervention 56 (57.1±24.9) Control 57 (60.4±23.9) Vitality Intervention 56 (44.0±22.3) Control 57 (41.2±21.5) Social functioning Intervention 56 (69.6±25.9) Control 57 (70.2±24.4) Role–emotional Intervention 56 (76.2±36.0) Control 57 (65.5±42.5) Mental health Intervention 56 (74.6±15.0) Control 57 (71.7±19.7)
Stuifbergen 2010	1–36-item Short-Form health survey	Low	Unclear	Low	Low	Low	Unclear	Physical Component Summary Intervention 98 (33.4±8.3) Control 89 (31.9±9.5) Mental Component Summary Intervention 98 (40.4±14.8) Control 89 (44.6±12.5)
Toobert 2003	1–12-Item Short Form	Unclear	Unclear	Unclear	Unclear	Low	Unclear	Physical Component Summary Intervention 163 (40.68±11.34) Control 116 (41.32±12.62) Mental Component Summary Intervention 163 (46.67±9.71) Control 116 (46.13±9.45)
Trento 2002	1 - Diabetes Quality of Life questionnaire	Low	Unclear	Low	Low	Unclear	Unclear	Intervention 56 (44.0±7.5) Control 56 (89.8±28.1)
Tsai 2021	1 - World Health Organization Quality of Life-Brief	Low	Unclear	Unclear	Unclear	Low	Unclear	Total Intervention 46 (59.3±7.3) Control 46 (55.0±8.8) Physical Intervention 46 (13.4±2.3) Control 46 (13.2±2.4) Psychological Intervention 46 (12.1±2.3) Control 46 (10.9±2.5) Social Intervention 46 (12.9±1.8)) Control 46 (12.3±2.7) Environmental Intervention 46 (14.2±1.9) Control 46 (13.6±2.1)
Ural 2021	1–36-item Short-Form health survey	High	High	Unclear	Unclear	Unclear	Unclear	Physical Functioning Intervention 46 (76.52±14.90) Control 42 (76.19±18.27) Physical Role Intervention 46 (76.09±32.89) Control 42 (39.88±37.06)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Bodily Pain Intervention 46 (68.70±18.81) Control 42 (58.33±22.73) General Health Intervention 46 (66.20±11.84) Control 42 (62.50±15.23) Vitality Intervention 46 (51.85±16.84) Control 42 (54.40±18.48) Social Functioning Intervention 46 (57.07±24.67) Control 42 (56.55±26.65) Emotional Role Intervention 46 (64.49±33.99) Control 42 (42.06±37.58) Mental Health Intervention 46 (62.96±15.42) Control 42 (62.86±16.22)
Usher 2013	1–36-item Short-Form health survey	Unclear	Low	High	High	Low	Unclear	Physical Component Summary Intervention 51 (57.9±8.0) Control 50 (57.5±8.8) Physical Component Summary Intervention 51 (44.0±6.2) Control 50 (44.3±5.7)
Vempati 2009	1-self-administered Asthma Quality of Life Questionnaire	High	Unclear	High	Unclear	Unclear	Unclear	2-week Intervention 29 (4.93±1.3) Control 28 (3.90±1.5) 4-week Intervention 29 (5.28±1.0) Control 28 (4.17±1.4) 8-week Intervention 29 (5.46±1.1) Control 28 (4.50±1.5)
von Gruenigen 2009	1 - Functional Assessment of Cancer Therapy-General (FACT-G)	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	3-month Total Intervention 23 (81.1±14.0) Control 22 (80.1±15.5) Physical well-being Intervention 23 (23.6±4.3) Control 22 (23.3±4.5) Functional well-being Intervention 23 (22.0±5.6) Control 22 (22.0±5.6) Emotional well-being Intervention 23 (19.1±4.5) Control 22 (19.2±4.0) Social/family well-being Intervention 23 (16.6±3.0) Control 22 (15.6±3.4) 6-month Total Intervention 23 (82.4±14.5) Control 22 (81.8±13.2) Physical well-being Intervention 23 (24.0±4.4) Control 22 (24.2±4.1) Functional well-being Intervention 23 (22.0±5.7) Control 22 (22.0±5.0)

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Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
								Emotional well-being Intervention 23 (19.3±4.5)
								Control 22 (19.5±4.1)
								Social/family well-being Intervention 23 (17.2±2.7)
								Control 22 (16.3±3.0)
								12-month Total Intervention 23 (80.1±14.2)
								Control 22 (82.2±14.9)
								Physical well-being Intervention 23 (23.3±4.3)
								Control 22 (23.7±4.1)
								Functional well-being Intervention 23 (21.2±6.2)
								Control 22 (22.0±6.1)
								Emotional well-being Intervention 23 (18.8±4.5)
								Control 22 (20.0±3.7)
								Social/family well-being Intervention 23 (16.9±2.6)
								Control 22 (16.6±3.4)
Wang 2017	1–12-item short form	Low	Low	Unclear	Low	Low	Unclear	1-month Physical Component Summary Intervention 86 (43.03±8.25)
								Control 87 (43.51±8.52)
								Mental Component Summary Intervention 86 (45.55±8.71)
								Control 87 (47.88±8.29)
								3-month Physical Component Summary Intervention 86 (46.35±7.75)
								Control 87 (44.95±9.16)
								Mental Component Summary Intervention 86 (50.71±7.16)
								Control 87 (49.87±7.78)
Williams 2018	1–12-item Short form health survey	Low	Low	Unclear	Low	Low	Low	6-week Physical Component Summary Intervention 57 (31.8±9.1)
								Control 69 (30.3±10.6)
								Mental Component Summary Intervention 57 (46.6±11.0)
								Control 69 (45.0±11.6)
								26-week Physical Component Summary Intervention 43 (32.1±10.9)
								Control 61 (30.5±10.1)
								Mental Component Summary Intervention 43 (46.5±13.8)
								Control 61 (44.3±13.3)
Wilson 2021	1–12-item Short Form Health Survey	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Physical Component Summary Intervention 38 (52.6±4.9)
								Control 41 (51.5±6.0)
								Mental Component Summary Intervention 38 (54.8±1.0)
								Control 41 (51.9±4.5)

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Table 1: Contd...

Author and Year	Measure	Quality dimensions						Results *n* (Mean, Standard deviation)
		Selection bias		Performance bias	Detection bias	Attrition bias	Reporting bias	
		Random sequence generation	Allocation concealment					
Woo 2007	1–36-item Short-Form health survey	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Intervention 27 (48.7±20.1) Control 28 (30.1±14.2)
Yang 2020	1 - WHOOQOL-BREF	Unclear	Unclear	Low	Unclear	Low	Unclear	1-month Physical health Intervention 34 (14.5±1.9) Control 34 (14.1±1.9) Psychological Health Intervention 34 (13.7±2.5) Control 34 (13.2±2.0) Social relationships Intervention 34 (13.7±1.9) Control 34 (13.6±1.7) Environment Intervention 34 (14.3±2.1) Control 34 (14.3±1.9) 3-month Physical health Intervention 34 (15.3±1.7) Control 34 (14.6±1.7) Psychological Health Intervention 34 (14.2±2.2) Control 34 (13.6±1.8) Social relationships Intervention 34 (14.5±2.1) Control 34 (13.7±1.6) Environment Intervention 34 (14.5±2.0) Control 34 (14.4±1.6)
Zhang 2016	1–36-item Short-Form health survey	Unclear	Unclear	High	Unclear	Unclear	Unclear	Mental health Intervention 31 (69.9±13.0) Control 31 (63.9±16.6) Role-emotional Intervention 31 (77.4±15.8) Control 31 (62.2±24.4) physical functioning Intervention 31 (79.0±13.8) Control 31 (61.5±13.3) role –physical Intervention 31 (81.2±14.6) Control 31 (61.7±26.9) bodily pain Intervention 31 (82.0±12.8) Control 31 (68.6±20.7) social functioning Intervention 31 (87.1±8.7) Control 31 (70.8±13.7) vitality Intervention 31 (80.4±11.5) Control 31 (76.7±15.1) general health Intervention 31 (80.4±10.8) Control 31 (64.7±18.2)

**Calculated by author (s)

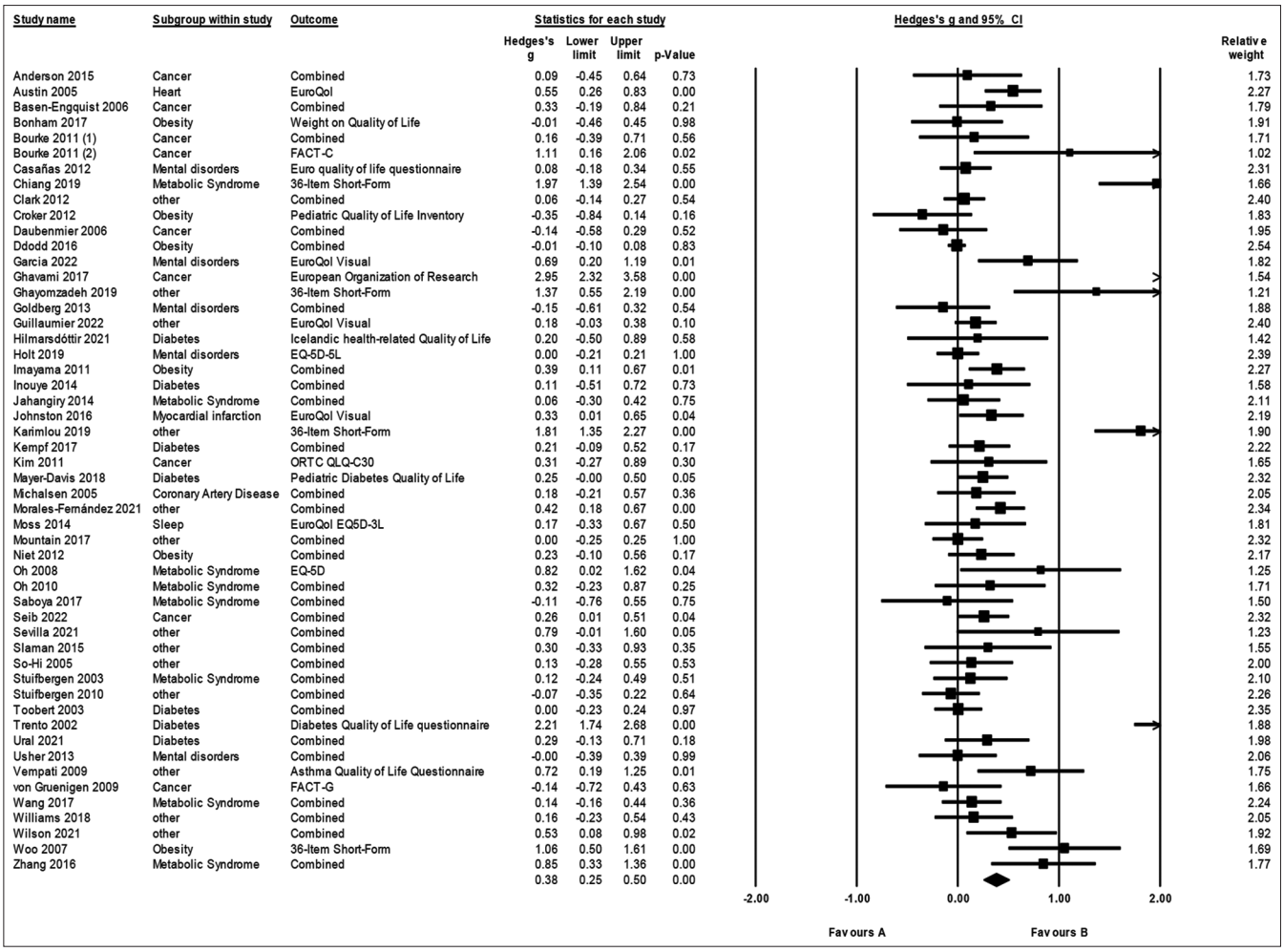

Figure 2: Forest plot of lifestyle intervention on health-related quality of life

The evaluation of subgroups based on follow-up duration is included in Table 2, and meta-regression analysis was also reported to check whether the effect of lifestyle interventions on HRQoL depends on the follow-up period. Hedges' g was 0.42 with 95% CI 0.23–0.60 (Z = 4.35; $P < 0.001$; $I^2 = 76.18\%$) for the 3-month follow-up. Hedges' g was 0.34 with 95% CI 0.14–0.54 (Z = 3.28; $P < 0.001$; $I^2 = 83.83\%$) for the 6-month follow-up. Hedges' g were nonsignificant for the 1-month, 9-month, and 12-month follow-ups.

Publication bias and heterogeneity

The Q test was equal to 331.046 (d.f 51; $P < 0.001$), I^2 was 84.59%, and showed high heterogeneity.[46] The funnel plot in Figure 7 examines the publication bias in studies based on Egger's test which is equal to $P < 0.001$ and was significant. This showed publication bias and the trim-and-fill[51] showed that 10 missing studies and new Hedges' g were 0.50 with 95% CI 0.36–0.64.

Discussion

In this systematic review and meta-analysis, lifestyle interventions were examined for their impact on HRQoL. In this analysis, 61 randomized clinical trials were included, providing comprehensive evidence on the effects of lifestyle interventions on HRQoL. HRQoL was significantly improved by lifestyle interventions, in line with previous studies.[30,32] Although a few studies failed to show significant improvements,[31,33] this study's comprehensive analysis further supports the positive impact of lifestyle interventions on HRQoL.

Nevertheless, this study showed that lifestyle interventions can increase HRQoL, making it the most comprehensive study conducted in this field to date Discrepancies in previous studies may be due to the focus on specific patient populations and the limited inclusion of studies. Lifestyle interventions can improve HRQoL by addressing unhealthy behaviors such as poor diet, physical inactivity, smoking, and alcohol consumption.[113] Physical and mental health can be improved by addressing these behaviors.[114-120] Furthermore, lifestyle interventions can improve patients' self-esteem, improve their ability to control their diseases, and improve their quality of life.[121]

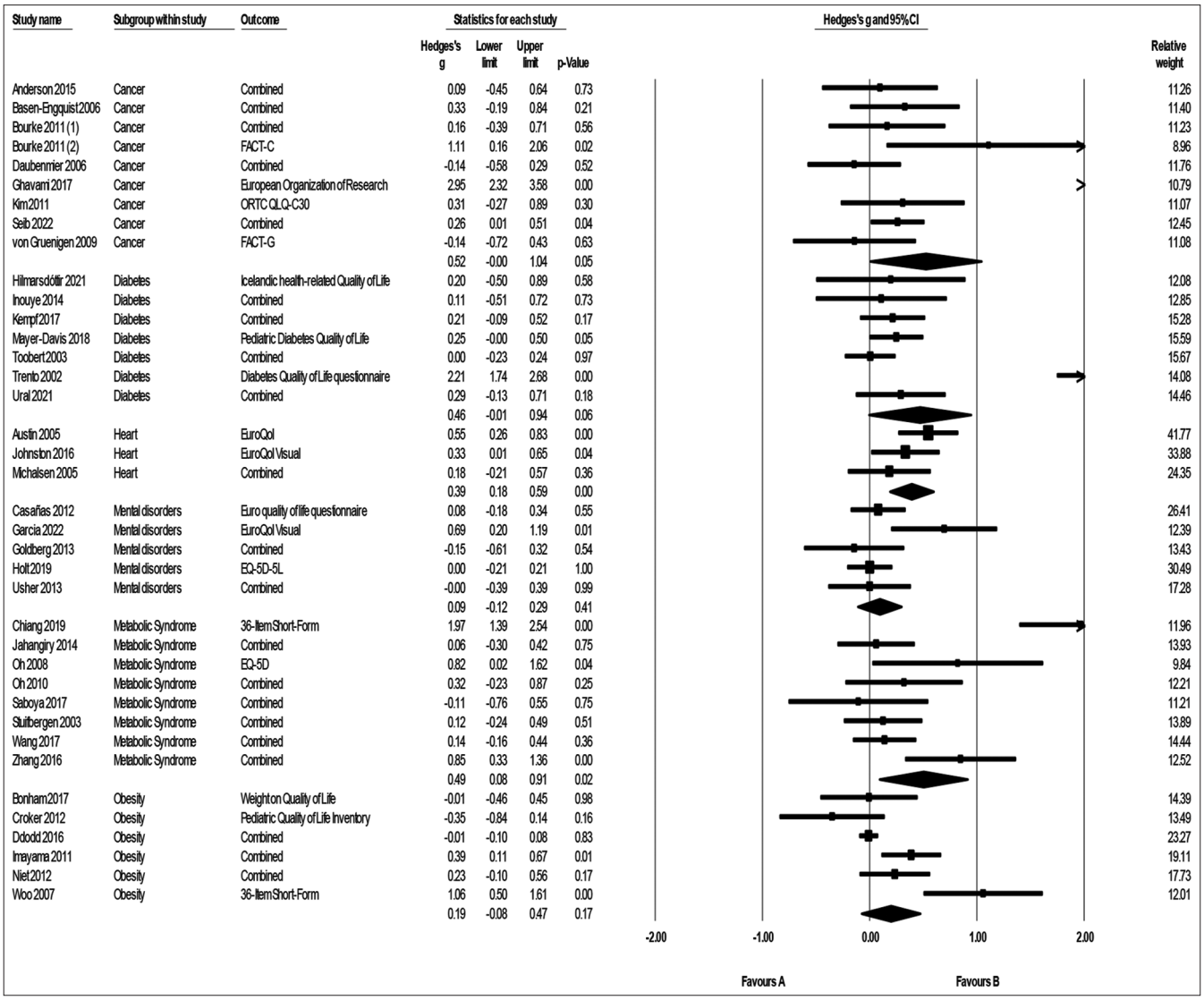

Figure 3: Forest plot of lifestyle intervention on health-related quality of life based on diseases

Table 2: Lifestyle intervention on health-related quality of life based on follow-up duration

Follow-up duration	Number of studies	Hedges' g	Lower limit	Upper limit	*Z*	*P*	I^2
1-month	5	0.52	-0.02	1.07	1.87	0.061	86.49
3-month	18	0.42	0.23	0.60	4.35	<001	76.18
6-month	20	0.34	0.14	0.54	3.28	0.001	83.83
9-month	4	0.13	-0.10	0.35	1.09	0.277	71.12
12-month	8	0.19	-0.01	0.38	1.91	0.056	44.57

This study expands the scope of lifestyle interventions to include conditions such as heart-related diseases and metabolic disorders whereas previous studies have mainly focused on the impact of lifestyle interventions on HRQoL in patients with metabolic disorders[30,31] and cancer[32-34] in terms of HRQoL. HRQoL is positively affected by lifestyle interventions. Among metabolic disorders and heart-related diseases, lifestyle interventions were particularly effective in improving HRQoL, illustrating how they can be applied to both mental and physical health conditions.

Also examined were the effects of lifestyle interventions on HRQoL among different genders and follow-up periods. The quality of life for women improved. The discrepancy may be explained by the underrepresentation of men in the studies. In terms of follow-up duration, short-term interventions were more effective than long-term interventions in improving HRQoL. Lifestyle intervention adherence is crucial in achieving positive outcomes, and short-term adherence tends to be higher. Therefore, it is necessary to identify the factors that affect this adherence.[122]

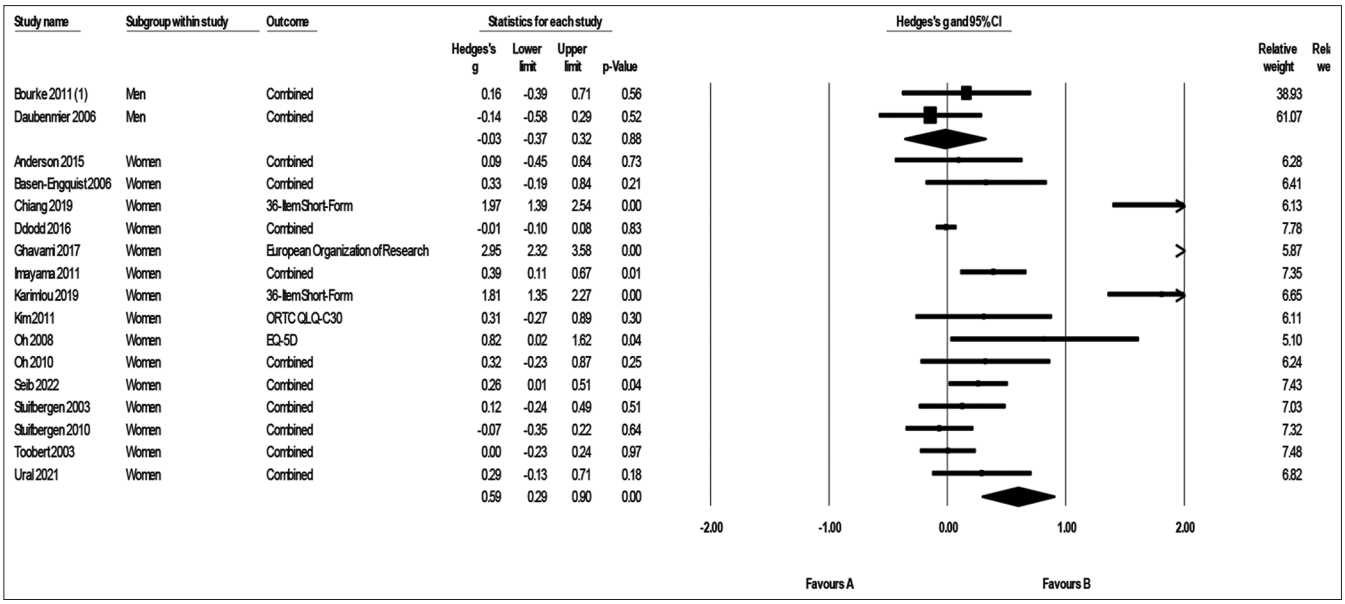

Figure 4: Forest plot of lifestyle intervention on health-related quality of life based on sex

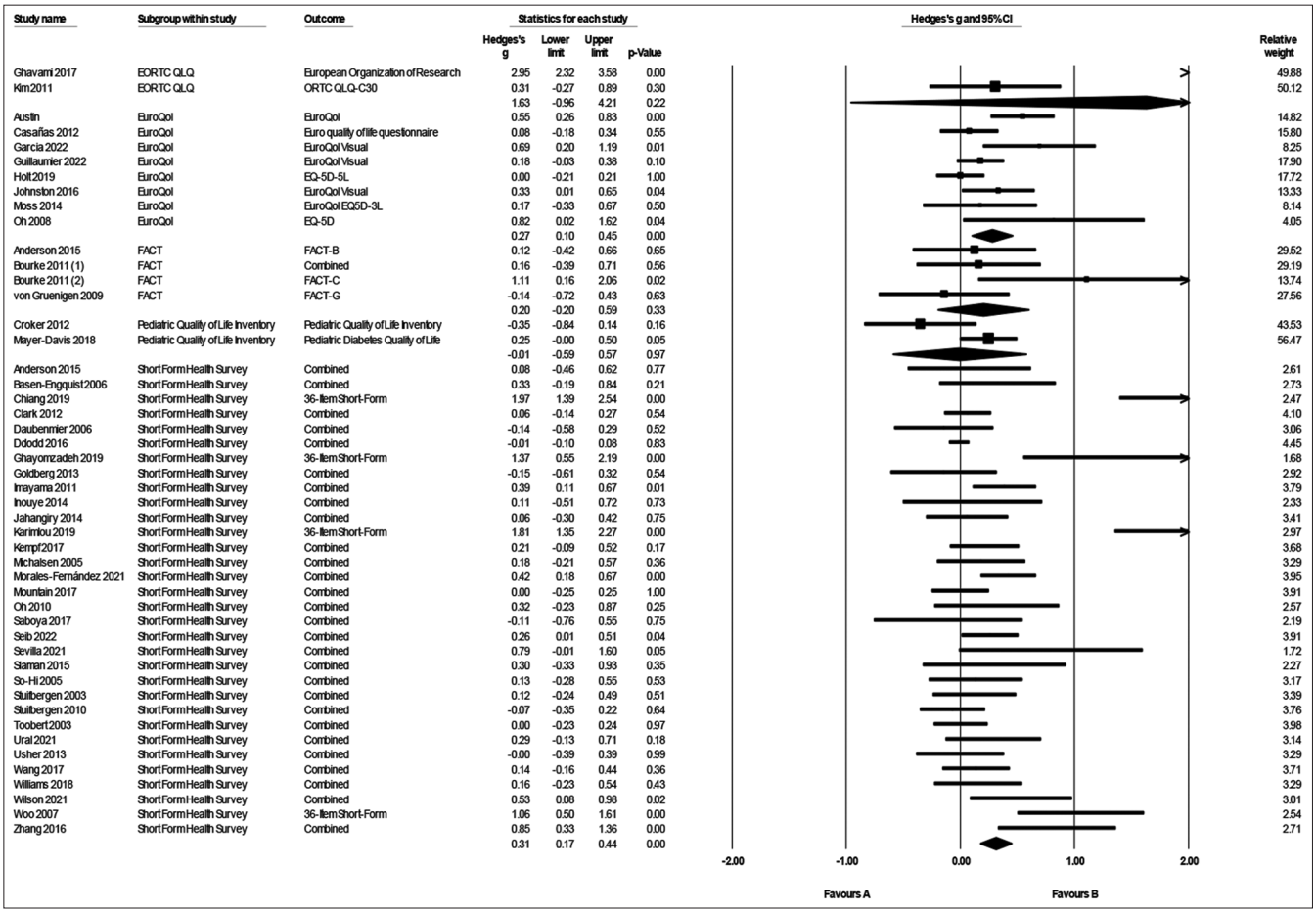

Figure 5: Forest plot of lifestyle intervention on health-related quality of life based on health-related quality of life scale

Several clinical implications can be drawn from the results of this study. Healthcare professionals should recognize that lifestyle interventions have a significant impact on HRQoL and consider incorporating them into routine patient care. Lifestyle interventions that target unhealthy behaviors and promote healthy habits can improve not only physical health but also mental well-being and social functioning. In order to improve patients' quality of life

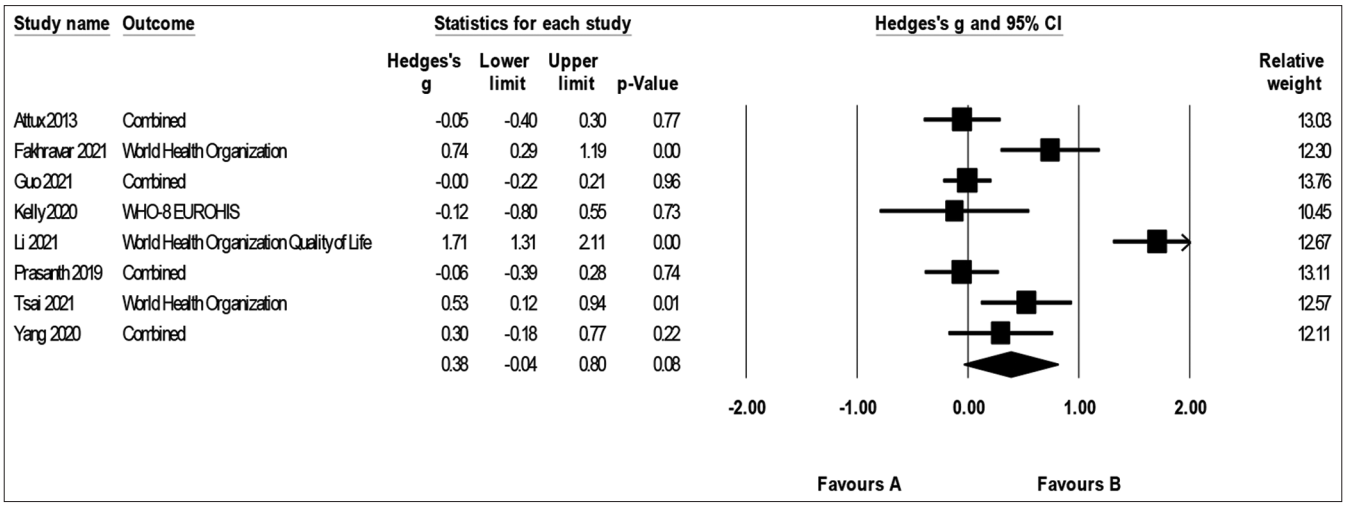

Figure 6: Forest plot of lifestyle intervention on quality of life

Figure 7: Funnel plot of lifestyle intervention and health-related quality of life

comprehensively, lifestyle interventions must address not only physical health but also mental well-being and social functioning. For sustained improvements in HRQoL, it is essential to promote long-term adherence to lifestyle interventions. In order to maintain positive lifestyle changes, healthcare providers should emphasize the importance of continuing to engage in healthy behaviors and provide ongoing support and motivation to patients. There is no doubt that lifestyle interventions are beneficial for both women and men, but it is important to understand that women and men may benefit differently from one another. The underrepresentation of men in studies should be addressed in future research as well as strategies to optimize the impact of lifestyle interventions on HRQoL in both sexes. Implementing lifestyle interventions effectively requires a multidisciplinary approach. In order to ensure the successful integration of lifestyle interventions into clinical practice, healthcare professionals, including physicians, nurses, dietitians, psychologists, and exercise specialists, can collaborate in order to provide comprehensive support and guidance to patients.

Among the strengths of this study is its comprehensive approach to examine lifestyle interventions' effects on HRQoL. Through the systematic review and meta-analysis design, multiple randomized clinical trials were rigorously evaluated. Including a wide range of studies, this study provides a more comprehensive understanding of lifestyle interventions' impact on HRQoL.

Moreover, this study addressed the limitations of previous research by conducting subgroup analyses based on specific diseases, gender, and follow-up duration. By applying this approach, we can gain valuable insight into the differential effects of lifestyle interventions in different patient groups and over varying time periods. The study contributes to the existing knowledge and provides a more nuanced understanding of how lifestyle interventions can improve HRQoL.

There are some limitations to this research. In the first place, there are few studies focusing on men, which limits the generalizability of the results. Secondly, lifestyle interventions can vary depending on cultural factors, which can lead to inconsistencies. It may be limited in its applicability to diverse populations because the majority of the studies included in this study were from developed countries. In addition, the included studies showed heterogeneity due to differences in interventions, populations, and tools for measuring health-related quality of life. In future studies, these limitations should be addressed as well as factors influencing adherence to lifestyle interventions should be explored.

Conclusion

This study provides compelling evidence that lifestyle interventions can improve HRQoL. Healthcare professionals can improve patient outcomes and well-being by targeting unhealthy behaviors and promoting healthy lifestyle choices. In order to address the burden of noncommunicable diseases and improve

the quality of life of individuals, lifestyle interventions should be incorporated into healthcare practices. To better understand the factors influencing the effectiveness of lifestyle interventions across different patient populations, future research should address the identified limitations, such as gender representation and cultural variations. Based on the study's findings, lifestyle interventions should be prioritized based on their cost-benefit ratio, allowing more targeted prevention efforts to be implemented. To improve HRQoL and reduce the overall burden of diseases, healthcare systems must devote more attention and resources to lifestyle interventions. In summary, the study supports a proactive and comprehensive approach to lifestyle interventions for health and well-being.

Registration and protocol

The review protocol has been registered in the PROSPERO International Register of Systematic Reviews under the registration number CRD42023397903. The present research protocol was based on standards Preferred reporting items for systematic reviews and meta-analyses.

Availability of data, code, and other materials

The data used in the meta-analysis was available in the imported articles.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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