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Health-related quality of life in HIV patients: a decennial data systematic review and meta-analysis

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Abstract

Introduction: Assessing health-related quality of life (HR-QOL) in human immunodeficiency virus (HIV) patients is important for evaluating the effect of disease and measures of the influence of intervention to improve quality of life of HIV patients. The aim of the study was to systematically review and assess HR-QOL in HIV patients.

Material and methods: Randomized control trials assessing HR-QOL in HIV patients published in PubMed, Scopus, and Google Scholar records from January 2010 till December 2020 were considered. Retrieved records were screened by two authors independently. Cochrane collaboration's tool was used to assess the risk of bias, and meta-analysis was performed using review manager software (RevMan v. 5.4.1).

Results: From 2,842 studies, 36 and 4 studies were included in qualitative and meta-analysis respectively. The overall standard mean difference in QOL of two studies with yoga intervention was 3.20 (95% CI: –1.55 to 7.95%; $p = 0.19$). The difference in quality of life in psychological and social domains of the yoga group was 2.81 (95% CI: –2.00 to 9.62%) and 6.62 (95% CI: 5.48-7.75%) respectively. HR-QOL from two studies that reported intervention in rehabilitation group with control group was not statistically significant ($p = 0.94$). However, physical domain of both the studies was statistically significant ($p = 0.04$).

Conclusions: Yoga and rehabilitation demonstrated significant positive outcomes in HR-QOL. Although few interventions had shown beneficial effects in HR-QOL, the results were not significant due to heterogeneity of studies. Therefore, more research are needed using similar outcome parameters to assess the quality of life among HIV patients.

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Key words: human immunodeficiency virus, yoga, health-related quality of life, rehabilitation, systematic review, meta-analysis.

Introduction

Worldwide, human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS) continues to be a significant public health issue. However, with the increased assessment of effective HIV prevention, diagnosis, treatment, and care, including opportunistic infections (OIs), HIV infection has become a manageable chronic health condition [1].

According to the World Health Organization (WHO), 68% adults, 53% children, and 85% pregnant and breastfeeding women living with HIV were receiving life-long antiretroviral therapy (ART), which protects their health and prevents HIV transmission from mothers to their newborns [2]. At the end of June 2020, 26 million people were accessing antiretroviral therapy, constituting a 2.4% increase

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from an estimate of 25.4 million at the end of 2019 [2]. In India, HIV prevalence among adults (range, 15-49 years) was estimated 0.2% in 2017, which is considered low compared to other middle-income countries [3]. Nevertheless, within 2000-2017, the HIV epidemic in India has declined by 39%, and HIV-related death rate fell by 51%, with 15.3 million lives saved due to an increased availability of ART [2].

Patients have direct access to free facilities of diagnostics, first, second, and third-line ART, prevention of parent-to-child transmission of HIV (PPTCT) services, prevention, diagnosis, and treatment of opportunistic infections. The national program provides psycho-social support and counselling, follow-up services, positive living, and prevention services, with appropriate referral linkages to various social beneficiary schemes [4]. People living with HIV (PLHIV) struggle with many social problems such as poverty, stigma, depression, substance abuse, cultural beliefs, loss of self-esteem, friendship, and lack of support from their families. All of these affect not only physical condition, but also mental health, which negatively impact their families, communities, and government [5].

The WHO defines quality of life as individuals perception of their position in life in the context of culture and value systems, in which they live as well as their goals, expectations, standards, and concerns [6]. This term is popularly used to convey the overall sense of well-being, and includes happiness and satisfaction with life as a whole. In PLHIV, issues such as living condition, finances, healthcare, and employment can improve or degrade quality of life. Health-related quality of life (HR-QOL) in HIV-infected patients can mostly be affected by disease conditions due to socio-economic problems and opportunistic infections [5].

Assessing HR-QOL determines to understand the impact of HIV/AIDS on people living with HIV/AIDS. It helps to verify patients' perceived burden of chronic disease, track changes in health over time, assess treatment effects, and evaluate their return on healthcare investment [5]. It is therefore essential to detect factors that affect quality of life of HIV patients, and thereby help to develop strategies to enhance quality of life of patients while also reducing the disease progression. Therefore, this study aimed to perform a systematic literature review to evaluate HIV-infected patients' health-related quality of life.

Material and methods

Search strategy

An extensive literature search was conducted in PubMed, Scopus, and Google Scholar. All the study-specific search terms with synonyms pertaining to disease condition (HIV), intervention randomized controlled trial, and outcome measures (quality of life) were gathered from various sources, such as Clinical trial.gov and previously published literature. The study was carried out according to preferred reporting items for systematic reviews and meta-analysis guidelines (PRISMA).

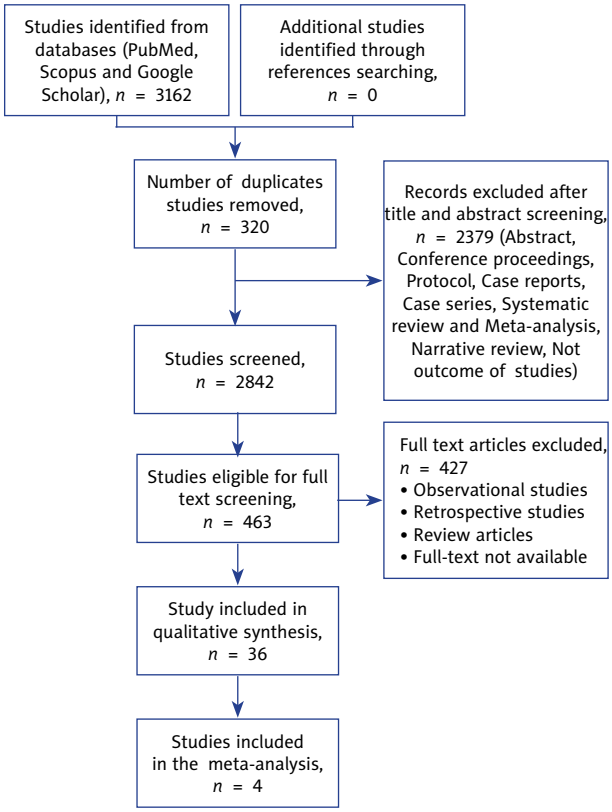

Figure 1. PRISMA flow chart

Eligibility criteria

Inclusion criteria

Studies that assessed quality of life in HIV patients using a standardized questionnaire/scale published between January 2010 to December 2020 were considered in the present study.

Exclusion criteria

Non-human studies and those published in languages other than English were excluded. Abstracts, conference proceedings, case studies, case reports, narrative reviews and review articles, retrospective studies, systematic review, and meta-analysis as well as observational studies were all excluded.

Study selection

All the search results were retrieved in excel format, and duplicate studies were removed. Firstly, two independent authors assessed the titles and abstracts of studies. Then, a full-text versions of suitable and eligible studies were undertaken to identify the final list of studies. Any discrepancies between the authors were resolved by consulting the third author.

Data extraction

The retrieved data were processed using Microsoft Excel. Two authors independently performed data extraction

Table 1. Characteristics of included studies

No.	First author, year [Ref.]	Country	Total sample size = *n* (IG/CG)* = *n*/*n* Age: average ± SD years or % or range Gender (M//F): (*n*) or % or *n* (%)	Tools used	Intervention group	Comparator group	Outcome
1.	Kuloor, 2018 [9]	India	Total sample size: 60 IG/CG: 30/30 Age (IG/CG): 41.90 ± 7.02/ 42.1 ± 7.32 Gender (*n*): 21/39	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Yoga practice of 2 months performed daily for 1 hour 5 days a week: loosening practices, Surya namaskar, breathing practices, Asanas, Pranayama, meditation, and relaxation techniques	Control group followed their normal routine activity	QOL improvements in all domains ($p < 0.001$) in yoga group compared to control group
2.	Yakasai, 2020 [10]	Nigeria	Total sample size: 136 IG/IG/CG: 45/44/47 Age: 36.79 (8.23) Gender (IG/IG/CG): 18 (40)/ 20 (45.5)/18 (38.3)// 27 (60)/24 (54.5)/29 (61.7)	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	1. Exercise in warm-up phase, exercise phase, and cool-down phase with voluntary counselling and treatment's routine services 2. PRE (progressive resisted exercise) with receiving voluntary counselling and treatment's routine care with warm-up, exercise, and cool down phase	Voluntary counselling and treatment's routine care with social and medical services for health and medical care for 12 weeks	Exercise of moderate intensity showed improvements in QOL in PLHIV related to distal symmetrical peripheral neuropathy (DSPN)
3.	Agarwal, 2015 [11]	United States	Total sample size: 24 IG/CG: 12/12 Age (IG/CG): 47.0 ± 8.9/49.3 ± 4.0 Gender: 8 (67)/7 (58)// 4 (33)/5 (42)	Short Form Health Survey (SF-36)	Yoga (60 min total of 16 session) techniques: warm-up, yogic body movements, yogic breathing techniques, meditation, yogic asana, and sava asana	Control group with no intervention	Yoga program showed positive effects on QOL
4.	Ananworanich, 2016 [12]	United States	Total sample size: 88 IG/CG: 41/47 Age, median (IQR): 12.6 (9.6-15.2) Gender (female): 50 (57%)	Pediatrics quality of life (PedsQL)	Continuous antiretroviral treatment	Partial treatment interruption	Mean scores of physical and psychological domain for both arms were similar in PedsQL
5.	Boulet, 2015 [13]	France	Total sample size: 169 IG/CG: 84/85 Age, median (IQR): 48.4 (44.0-54.3)/47.6 (43.0-53.7) Gender: 73 (86%)/70 (83%)// 12 (14%)/14 (17%)	Medical outcome study-HIV health survey (MOS-HIV)	Maintenance of enfuvirtide	Switch to raltegravir	A switch from enfuvirtide to raltegravir resulted in improvements in HR-QOL domains compared to maintenance under enfuvirtide
6.	Bunupuradah, 2013 [14]	Thailand and Cambodia	Total sample size: 299 IG/CG: 149/150 Age: 6.3 ± 2.8 Gender (female): 58%	General health assessment for children QOL questionnaire	Early group (ART at week 0)	Deferred group (ART when at CD4+ < 15%)	HIV-infected children QOL were lower than healthy control group

Table 1. Cont.

No.	First author, year [Ref.]	Country	Total sample size = *n* (IG/CG)* = *n*/*n* Age: average ± SD years or % or range Gender (M//F): (*n*) or % or *n* (%)	Tools used	Intervention group	Comparator group	Outcome
7.	Cella, 2010 [15]	United States	Total sample size: 1203 IG/CG: 599/604 Age: 46.0 ± 7.8 Gender: 89.3%/10.7%	Functional assessment of HIV infection (FAHI)	Etravirine	Placebo	Etravirine in combination with other antiretroviral agents showed improvements in HR-QOL compared to placebo
8.	Chen, 2018 [16]	China	Total sample size: 41 IG/CG: 20/21 Age: 41.88 ± 10.61/41.88 ± 10.61 Gender (female): 100.0%	Veterans short form (VSF-12)	Self- and family management intervention (SAFMI)	Usual care	Physical QOL in intervention arm was higher with lower probability of depression compared with women in control arm
9.	Chhatre, 2013 [17]	United States	Total sample size: 22 IG/CG: 11/11 Age: 49.7 ± 7.1/50.0 ± 4.4 Gender (male): 81.8%	SF-36 functional assessment of HIV infection (FAHI)	Transcendental meditation	Healthy eating	Role of emotional vitality, mental health, social function, and general health reported improvement and physical well-being according to FAHI
10.	Cobbing, 2016 [18]	South Africa	Total sample size: 76 IG/CG: 38/38 Age: 43.4 (29-63)/44.7 (25-67) Gender: 9 (23.7)/9 (23.7)// 29 (76.3)/29 (76.3)	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Home-based rehabilitation	Tips on healthy living with standard of care	Intervention group showed improvement across all outcome measures, but between-group differences were non-significant
11.	Bhatta, 2017 [19]	Nepal	Total sample size: 132 IG/CG: 66/66 Age: 43.4 (29-63)/44.7 (25-67)	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Intervention focused on autonomy and community activism, self-esteem/self-efficacy, self-care, optimism and control over the future, family and social relationships, power-powerlessness, management of stress and righteous anger, stigma and discrimination issues, legal provisions, and human and health rights	Standard care	Intervention group showed effective in improving QOL of HIV-infected people
12.	Shaik, 2018 [20]	South Africa	Total sample size: 112 IG/CG: 59/53 Median age: 33/34	European Organization for Research and Treatment of Cancer 30-item QOL questionnaire (EORTC QOL-C30)	Antiretroviral therapy (ART)	Antiretroviral therapy (ART) and chemotherapy	Significant improvements in global health status and functional scales

Table 1. Cont.

No.	First author, year [Ref.]	Country	Total sample size = *n* (IG/CG)* = *n*/*n* Age: average ± SD years or % or range Gender (M//F): (*n*) or % or *n* (%)	Tools used	Intervention group	Comparator group	Outcome
13.	Wang, 2010 [21]	China	Total sample size: 116 IG/CG: 58/58 Age: 36.7 ± 5.6	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Home visits by nurse provided information about HIV/ AIDS, ART, medication adherence, skills to facilitate medication adherence, motivation, mobilizing family support on medication adherence and lowering discrimination among family members and telephone calls	Control group received routine care	Effects of intervention were seen in physical, psychological, social, and environmental domains
14.	Joyce, 2012 [22]	United States, Canada, United Kingdom	Total sample size: 368 IG/CG: 192/176 Age: 47.5 ± 8.5 Gender: 98.1%/1.9%	Health utilities index mark 3 (HUI-3), EQ-5D, medical outcomes study HIV health survey	Standard ART	Intensified ART	There were no significant differences in HR-QOL among four groups during follow-up, temporary significant decline in HR-QOL on some measures within interruption group during interruption
15.	Mkandla, 2016 [23]	Zimbabwe	Total sample size: 160 IG/CG: 80/80 Age: 9 (23.7)/9 (23.7) Gender: 23 (28.7)/24 (30)	Euro-QOL-5 dimension (EQ-5D)	Lower limb PRE intervention	Standard of care and written health advice	Intervention participants group showed improvements in all outcome measures, but between-group differences were non-significant
16.	Khumsaen and Stephenson, 2019 [24]	Thailand	Total sample size: 40 IG/CG: 20/20 Age (IG/CG): 30.80 ± 8.24/ 27.80 ± 5.45	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Program consisted of sessions with supervised dialogue, physical activity and education in fourteen weekly sessions (120 to 150 minutes), and encouraged patients to take role and responsibility in managing their illness	Participants in control group received routine care	Intervention group participants reported increased HIV self-management, and improvement in QOL psychological domain
17.	Li, 2010 [25]	Thailand	Total sample size: 507 IG/CG: 260/247 Age: 37.1 ± 6.2/37.8 ± 7.0 Gender: 167 (32.8)//340 (67.2)	Medical outcome study-HIV health survey (MOS-HIV)	4 modules: healthy mind, healthy body, parenting and family relationships, and social and community integration	Standard care	Intervention participants showed improvements in general health and mental health

Table 1. Cont.

No.	First author, year [Ref.]	Country	Total sample size = *n* (IG/CG)* = *n*/*n* Age: average ± SD years or % or range Gender (M//F): (*n*) or % or *n* (%)	Tools used	Intervention group	Comparator group	Outcome
18.	Lifson, 2017 [26]	35 countries	Total sample size: 4561 IG/CG: 2262/2299 Age: 36 (29 ± 44) Gender: 73%/27%	Visual analogue scale (VAS), short form 12-item health survey version 2 (SF-12 v.2)	Immediate initiation of ART	Deferred ART group	ART immediate initiating was better than comparing to deferred group
19.	Suzan-Monti, 2015 [27]	Cameroon	Total sample size: 440 Age: 36 (30 ± 44) Gender: 70.5%	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Task shifting benefits	Control group (no information available)	Task-shifting HIV care to nurses benefited HR-QOL of PLHIV
20.	Maharaj and Chetty, 2011 [28]	South Africa	Total sample size: 52 IG/CG: 26/26 Age: 32 ± 10.9/37 ± 8.6// 35 ± 9.5/29 ± 7.1 Gender: 16 (62)/18 (69)// 10 (38)/8 (31)	Short form (SF-36)	Rehabilitation program; 20 min cycling, 20 min walking on treadmill, followed by home program of exercise	20 min heat therapy by shortwave machine to thigh muscles of each leg, followed by reading magazines	There were significant improvements in all QOL domains ($p < 0.05$) for experimental group compared with control group
21.	Malan, 2010 [29]	South Africa	Total sample size: 200 IG/CG: 95/105 Age [median (minimum – maximum)]: 35 (20-64)/34 (20-71) Gender: 74 (70)/69 (73)// 31 (30)/26 (27)	Medical outcome study-HIV health survey (MOS-HIV)	Atazanavir with ritonavir (ATV 300/r)	Atazanavir 400 (ATV 400)	Both regimens showed improvement in intervention group
22.	Tesfaye, 2016 [30]	Ethiopia	Total sample size: 282 IG/CG: 93/189 Age: 32.8 ± 9.0 Gender: 28 (30.1)/68 (36)// 65 (69.9)/121 (64.0)	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Lipid-based nutrient supplementation	Delayed group with lipid-based nutrient supplement for 4-6 months	QOL was better than in those who only received ART without LNS (lipid-based nutrient supplementation)
23.	Mawar, 2015 [31]	India	Total sample size: 61 IG/CG: 31/30 Median age (minimum – maximum): 32 (28.0-38.0) Gender: 22 (36)/39 (64)	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Sudarshan Kriya yoga: "Ujjai, bhastrika, Om, and Sudarshan Kriya"	Control group received standard of care with routine counselling and medical care	Post-training improvement in QOL was observed
24.	Blank, 2013 [32]	United States	Total sample size: 238 IG/CG: 128/110 Age: 43 ± 7.25 Gender (male): 54%	Short form survey (SF-12)	Preventing AIDS through health for positives (PATH) intervention group	Treatment as usual	Intervention group showed positive effect
25.	Moghadam, 2018 [33]	Iran	Total sample size: 120 IG/CG: 40/40/40 Age = 33.38 ± 7.07/ 33.68 ± 7/32.28 ± 7.42 Gender (female): 100%	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Empowerment and education	Routine care by nursing staff	Empowerment-education was effective in HIV-positive women in improving QOL

Table 1. Cont.

No.	First author, year [Ref.]	Country	Total sample size = *n* (IG/CG)* = *n*/*n* Age: average ± SD years or % or range Gender (M//F): (*n*) or % or *n* (%)	Tools used	Intervention group	Comparator group	Outcome
26.	Ogalha, 2011 [34]	Brazil	Total sample size: 70 IG/CG: 35/35 Age: 42.06 ± 7.45/44.25 ± 11.45 Gender: 17/17//18/11	Short form survey-36 (SF-36)	Physical activity plus counselling session: aerobic and resisted exercises and stretching programs	Counselling session	Exercise group showed improvement in QOL
27.	Pyne, 2011 [35]	United States	Total sample size: 276 IG/CG: 138/138 Age: 49.8 ± 8.7/49.8 ± 10.5 Gender: 120 (97.6)/3(2.4)// 122 (96.8)/4(3.2)	Quality of well-being self-administered scale	Depression collaborative care	Usual care	Intervention improved HIV symptoms and depression
28.	Shah, 2016 [36]	United States	Total sample size: 67 IG/CG: 31/28 Age: 54.64 ± 6.07/56.23 ± 5.93 Gender: 17 (60.71)/19 (61.29)// 12 (38.71)/11 (39.29)	Short form health survey (36-item)	Physical activity counselling program	Usual care	QOL improved in treatment group compared to control group ($p < 0.05$)
29.	Millard, 2016 [37]	Australia	Total sample size: 132 IG/CG: 68/64 Age: 42.3 ± 10.4 Gender (male): 100%	Patient-reported outcomes quality of life – HIV (PRO QOL-HIV)	Positive outlook: self-management	Usual care with primary health and community based services	Significant improvement in QOL in intervention group
30.	Torres, 2018 [38]	9 countries: Brazil (1 site), India (3 sites), Kenya, Malawi (2 sites), Peru (2 sites), South Africa (3 sites), Tanzania (1 site), Thailand (1 site), and Zimbabwe (1 site)	Total sample size: 512 IG/CG: 258/254 Age: 39 (34-44) Gender: 252 (49%)//260 (51%)	ACTG SF-21	Lopinavir/ritonavir (LPV/r) and raltegravir (RAL)	Lopinavir/ ritonavir (LPV/r) and nuceostide reverse transcriptase inhibitors (NRTIs)	No significant difference between different arms
31.	Cooper, 2011 [39]	UK-based, multicenter	Total sample size: 234 IG/CG: 117/117 Age: 42 ± 8.9 Gender: 197 (84%)//37 (16%)	Short form 12-item health survey version 2 (SF-12 v.2)	FTC/ TDF (emtricitabine) and EFV (efavirenz)	Zidovudine (AZT) and 3T and EFV	There were no significant differences between QOL or viral load
32.	Webel, 2019 [40]	United States	Total sample size: 179 IG/CG: 90/89 Age: 50 ± 8.5/49 ± 9.8 Gender (male/transgender): 52/2//54/2	HIV/AIDS-targeted quality of life	Community-based navigator-palliative care	Control group with normal follow-up	Program showed improvement over time in three outcome variables: self-blame, symptom distress, and HIV self-management

Table 1. Cont.

No.	First author, year [Ref.]	Country	Total sample size = *n* (IG/CG)* = *n*/*n* Age: average ± SD years or % or range Gender (M/F): (*n*) or % or *n* (%)	Tools used	Intervention group	Comparator group	Outcome
33.	Ghayomzadeh, 2015 [41]	Tehran	Total sample size: 30 IG/CG: 15/15 Age: 38 ± 6	Short form health survey (SF-36)	Lifestyle modification program	Standard care control group	Significant improvement in QOL score in LMP
34.	Van Tam, 2012 [42]	Vietnam	Total sample size: 228 IG/CG: 119/109 Age: ≤ 35 = 65.5/734; > 35 = 34.5/26.6 Gender: 34.5/29.4	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Standard care and peer support	Standard care	QOL significantly improved in treatment group compared to control group
35.	Oliveira, 2019 [43]	Brazil	Total sample size: 46 IG/CG: 25/21 Age: 45.5 ± 7.2	WHO quality of life – HIV brief (WHOQOL-HIV BREF)	Aerobic training and strength training	Light activities, such as stretching, recreational games and dancing	Demonstrated that 16 weeks of CET increased muscle strength, quality of life indexes in a small sample of PLHIV
36.	Lowther, 2015 [44]	Kenya	Total sample size: 120 IG/CG: 60/60 Age: 38.3 (8-2, 23-60)/ 40.5 (9-2, 22-64) Gender: 80/18//80/82	Medical outcome study-HIV health survey (MOS-HIV)	Palliative care training	Usual care from HIV clinic	No significant effect on pain, but patient-centered care had positive effect on HR-QOL

of the relevant studies in a pre-framed excel sheet that included the following characteristics: publication details (author, year, journal, type of article), study settings, trial information (randomization details, treatment and control arm, duration of the trial, sample size), patients' demographics, outcome assessment scale, and statistical details. All the data were extracted directly from the included studies into a standard excel sheet. Any discrepancies between the authors were resolved through consulting the third author.

Quality assessment

Two reviewers independently assessed methodological quality of the included studies using Cochrane collaboration's tool for assessing the risk of bias and according to the following domains: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome, selective reporting, and other sources of bias. Any disagreements between the authors were resolved by consulting the third author. According to the criteria mentioned, all the included studies were graded as low, high, or unclear risk of bias. Studies were graded as low risk if the presence of bias was unlikely to change the outcomes. High risk suggested that the bias could affect the study's outcome, while the unclear risk of bias meant the author did not specify the information that could likely affect the study's outcome. The risk of bias graph and summary were generated by transferring the included studies to RevMan v. 5.4.1 (review manager).

Data analysis

A meta-analysis was performed in this review using review manager software (RevMan v. 5.4.1). Findings were reported by constructing a forest plot. Studies with summarized domains along with standard deviation were included for meta-analysis. I^2 was done to estimate heterogeneity between the included studies: I^2, 0% to 30%: could not be important; 31% to 50% may represent moderate heterogeneity; 51% to 75% could represent substantial heterogeneity; 76% to 100% meant considerable heterogeneity [7]. Fixed-effect model was used for studies without heterogeneity, while random effect was incorporated for studies with heterogeneity [8].

Results

Of the 3,162 studies identified from the databases, 2,842 were included after removing duplicates (n = 320). Of them, 2,379 studies were excluded during the title and abstract screening due to non-English language, conference proceedings, abstracts, case reports, and case series. Based on the eligibility criteria of study, 463 studies were selected for full-text evaluation. Of them, 36 full-text randomized controlled trials (RCTs) were included in data

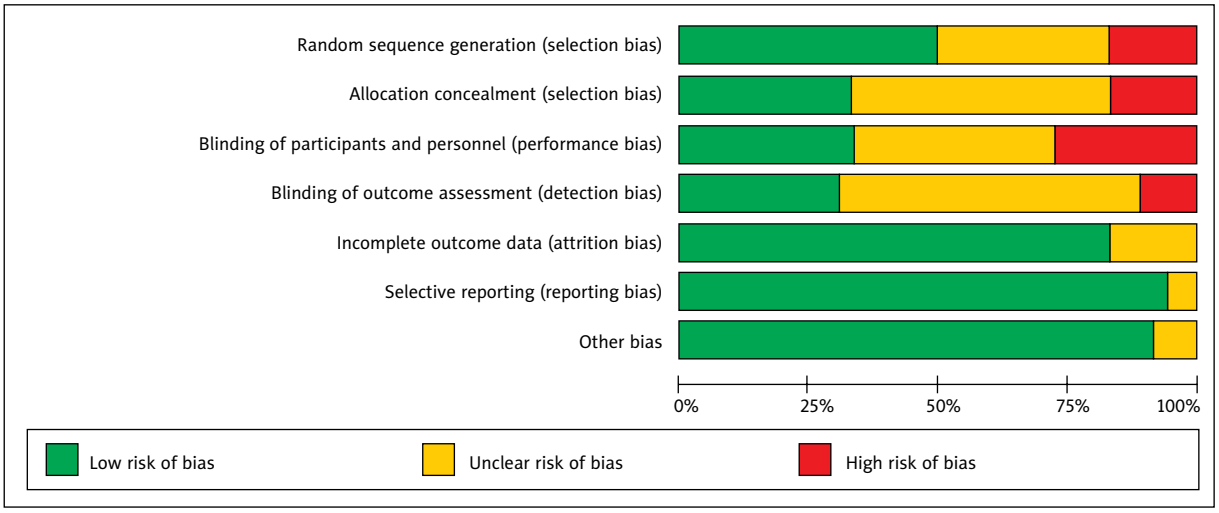

Figure 2. Risk of bias graph. Review authors' conclusions about each risk of bias item presented as percentage across all included studies

extraction, but 32 studies were not included for meta-analysis due to non-uniformity in the intervention and undesired outcome parameters. The process of the search strategy is presented in PRISMA flow chart described in Figure 1.

Study characteristics

Among 36 selected studies, 11,419 patients (ranging from 22 to 4,561) were randomized into an intervention group (5,715) and control group (5,704). Studies were conducted in India, Nepal, China, Nigeria, Thailand, United States of America (USA), Canada, Zimbabwe, South Africa, Ethiopia, Iran, Brazil, United Kingdom (UK), Kenya, Vietnam, and Australia. Descriptions of characteristics of included studies are shown in Table 1.

Risk of bias

The risk of bias of the included studies was performed by using Cochrane collaboration's tool. All the included studies had 50% low risk of selection bias, and 33.3% had low risk in each unclear risk in allocation concealment and performance bias, 30.5% had a low risk of bias in detection bias, 83.3% had a low risk of attrition bias, 94.4% had a low risk of reporting bias, and 91.6% were reported as low risk of other bias (Figures 2 and 3).

Effect of yoga intervention on QOL

Of the 36 studies, two studies had yoga as an intervention compared with control group (without yoga). Both studies had similar interventions along with the outcome data, to which meta-analysis was carried out. The overall result showed the standard mean difference of 3.20 (–1.55, 7.95), and reported the evidence of heterogeneity between the results of different studies (I^2 = 98%, p < 0.00001), due to which the random effect model was applied. The overall QOL of both studies included in the analysis was not statistically significant (p = 0.19). The overall QOL of yoga group compared with control group of two included studies is presented in Figure 4.

Due to the difference between instruments used in assessing quality of life, meta-analysis with standard mean difference was performed for two domains with the data available, i.e. psychological and social domains (Figures 5 and 6). The standard mean difference and 95% CI of psychological domain between the two studies was 3.81 (95% CI: –2.00 to 9.62%). It was not statistically significant (p = 0.20), with the heterogeneity between the results being 98%, with random effect model applied.

Similarly, social domain data was presented in both the studies included for the analysis. The overall standard mean difference of both the studies was 6.62 (95% CI: 5.48-7.75%), with no evidence of heterogeneity (I^2 = 0.0%). However, it was statistically significant (p < 0.00001).

Effect of rehabilitation program on QOL

Of the 36 studies included, two were considered for meta-analysis due to similar rehabilitation intervention group compared with control group. The overall QOL of rehabilitation group compared with control group was reported with a standard mean difference of 0.26 (95% CI: -0.10-0.62%), but was not statistically significant between the results of the two studies. There was no evidence of heterogeneity among the different studies (I^2 = 0.0%, p = 0.96), and the fixed effect model was applied (Figure 7).

Due to the presence of QOL data in two different tools, meta-analysis was carried out in the physical, psychological, and social domains involved in the tools. The physical domain in the rehabilitation group compared with the control group was statistically significant (p = 0.04), and the heterogeneity was I^2 = 0.0%, due to which the fixed-effect model was applied (Figure 8).

The overall results of the standard mean difference of both the studies was –0.01(95% CI: –0.37 to 0.34%) with no evidence of heterogeneity (I^2 = 0.0%), so a fixed-effect model was applied (Figure 9).

The social domain of both the studies was taken for meta-analysis, and the overall standard mean difference with 95% CI: 0.13 (–0.35 to 0.74%). The fixed effect model was applied due to I^2 = 0.0% heterogeneity (Figure 10).

Discussion

This systematic review and meta-analysis aimed to assess the health-related quality of life in HIV patients. It included 36 studies for qualitative analysis, with 11,419 randomized patients. Out of the total of included studies, four (two studies each on yoga and rehabilitation) were considered for meta-analysis as they presented similar outcome parameters. The remaining studies that were not included in the analysis showed an intervention that was not comparable for pooling the data. In our study, among 36 RCTs, 17 different QOL questionnaires were used. All the included studies that measured the quality of life, adopted a structure of similar questions, with many domains to assess the physical, psychological, environmental, emotional, and social health elements. Among the studies included in the meta-analysis, two interventions, such as yoga and rehabilitation, had similar data for quantitative analysis. Non-drug interventions, such as yoga, meditation, cognitive behavioral therapy (CBT), and tai chi, effectively improved several physical and psychological symptoms associated with chronic health conditions, such as HIV. The difficulties of everyday life, including active involvement in social life and physical activity were the underlying factors in low QOL scores. These difficulties challenge patients' families and their social lives [45].

The two studies considered for meta-analysis compared the overall QOL domains between the yoga group and the control group. 84 HIV patients, with 42 individuals each in the intervention group and control group, participated in the yoga program in the included studies. There was no statistically significant difference between the two studies (p = 0.19), although the forest plot showed favorable to the yoga group. Kuloor *et al.* [9] showed the significance of yoga intervention as an add-on therapy to ART in HIV care. Similarly, Agarwal *et al.* [11] reported an improvement in participants in the yoga group. Due to differences in the instruments used in the two studies, meta-analysis was conducted only for the psychological and social domains, for which the data were available. The overall comparison of the psychological domain in both the studies was not statistically significant (p = 0.20). Similarly, both the studies' social domains were pooled, and the difference was found to be statistically significant (p < 0.00001).

In this review, 120 HIV-positive patients participated in rehabilitation program, with 60 participants in the rehabilitation and control groups. The pooled estimated difference of the rehabilitation group with the control group was not statistically significant between the included studies (p = 0.15). The meta-analysis of both the studies was carried out for the physical, psychological, and social domains. The physical domain showed statistical significance (p = 0.04) in improving the quality of life. Maharaj and

Figure 3. Risk of bias summary. Review authors' conclusions about each risk of bias item for each included study

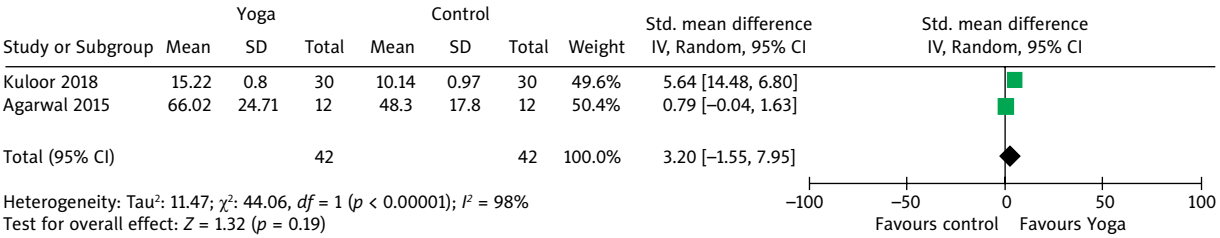

Figure 4. Overall QOL of yoga group with control group of two included studies

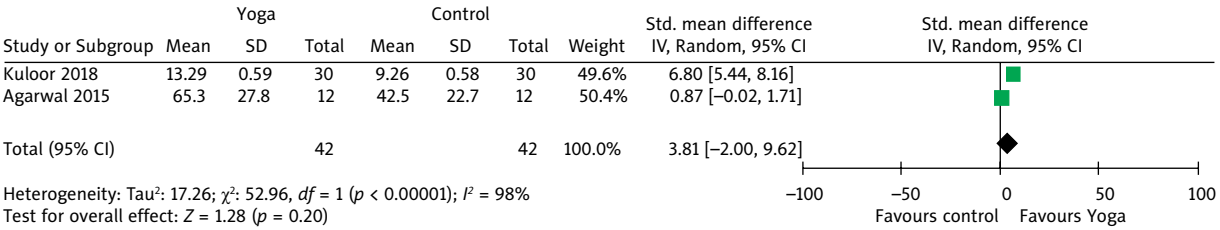

Figure 5. Forest plot of comparison of yoga vs. control groups: psychological domain

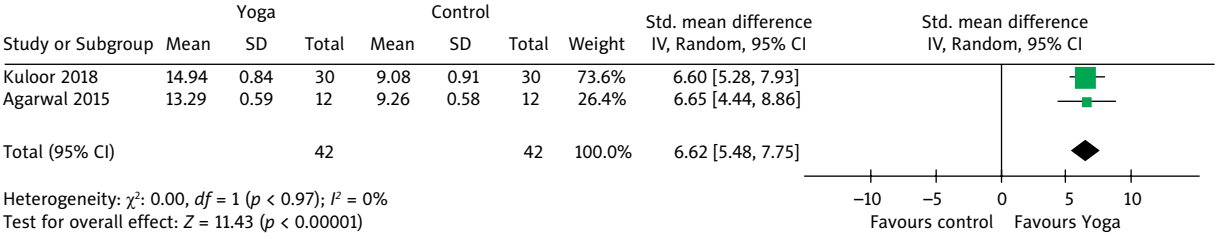

Figure 6. Forest plot of comparison of yoga vs. control groups: social domain

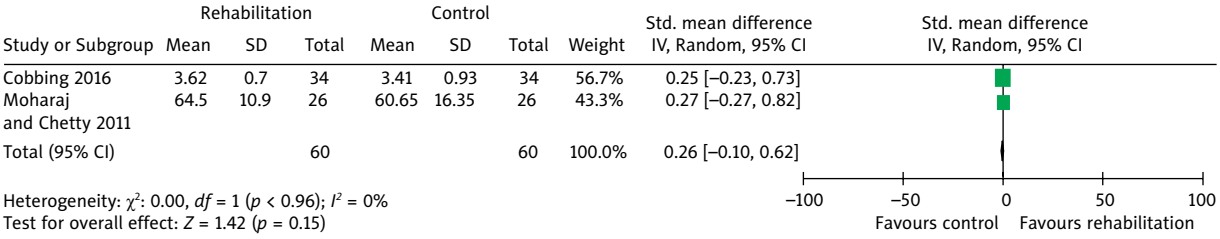

Figure 7. Overall QOL of rehabilitation group compared with control group

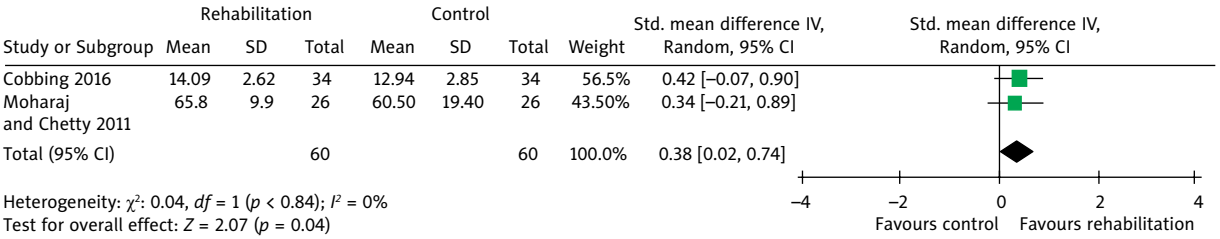

Figure 8. Forest plot of comparison of rehabilitation vs. control groups: physical domain

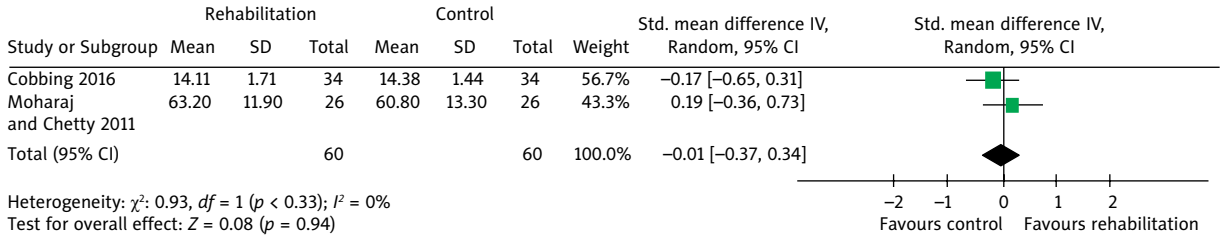

Figure 9. Forest plot of comparison of rehabilitation vs. control groups: psychological domain

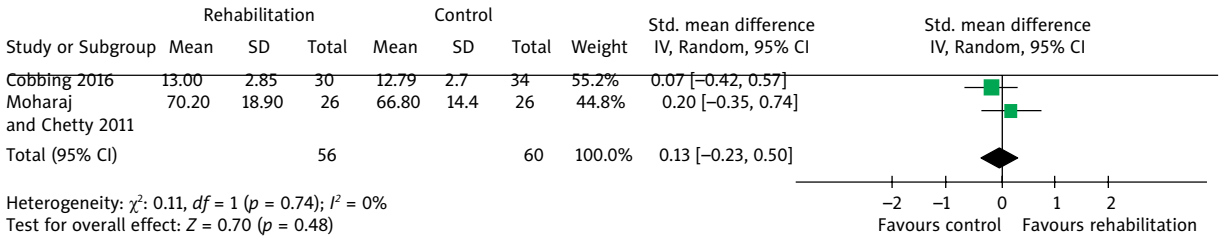

Figure 10. Forest plot of comparison of rehabilitation group vs. control group: social domain

Chetty [28] reported an improvement in both the physical and mental components scores following the rehabilitation program, while Cobbing *et al.* [18] showed improvement in the intervention group. However, the between-groups differences were non-significant. Similarly, the meta-analysis of the psychological domain in rehabilitation programs was found to be not statistically significant ($p = 0.94$) compared to the control group. Also, the social domain from QOL questionnaires of the two studies was found to be not statistically significant ($p = 0.48$).

From our study findings, we found that yoga have a beneficial effect on QOL of HIV patients. However, due to limited studies, we suggest carrying out further research on the impact of yoga on QOL to strengthen the available data, and to explore other parameters that can improve QOL of HIV patients.

This review has few limitations. Firstly, only a few studies were considered for meta-analysis due to data heterogeneity that resulted in non-significant outcomes. Also, the present study might have missed some successful studies, as this research included articles published in English only since Jan 2010 for the analysis. Moreover, variations in the quality, methodological approach, and lack of information in the included studies would have affected the outcomes of the review. Nevertheless, the current research and review suggest that yoga and rehabilitation positively influence HIV patients' quality of life. Although not significant due to the heterogeneity of included studies, few interventions, including yoga and rehabilitation, had shown beneficial outcomes in QOL of HIV patients.

Conflict of interest

The authors declare no conflict of interest.

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