BMC Public Health

SYSTEMATIC REVIEW

Open Access

Gender differences in psychological status of infertile couples: a systematic review and meta-analysis

Fahimeh Khorasani[1], Elnaz Iranifard[1,2] and Robab Latifnejad Roudsari[3,4*]

Abstract

Background and aim Infertility affects approximately millions of individuals of reproductive age worldwide and can lead to significant psychological consequences, dramatically impacting the lives of those involved. This systematic review aimed to measure the gender differences in psychological status experienced by infertile couples.

Methods A comprehensive search of observational studies in English was conducted across several databases, including PubMed, Web of Science, Cochrane Library, and Scopus, with no time restrictions applied until September 2024. The review adheres to the MOOSE Guidelines and is registered with PROSPERO (CRD42024541801). Comprehensive Meta-Analysis Version 2 was used to estimate mean difference and 95% CI and prediction interval by the random-effects model. A subgroup analysis was conducted based on the study region, stage of treatment, and measurement tools. Also, sensitivity analysis was performed using the one-study removed method. To assess publication bias, the Funnel plot and Egger's test were used.

Results Out of 748 documents from the initial search, 27 studies, involving 10,083 infertile men and women, were included in this systematic review, of which 21 studies were included in the meta-analysis. There was a significant difference between the mean scores of infertile women and men in all aspects of psychological status (Std diff in Mean: 0.31, CI 95% [0.23–0.39]; p-value ≤ 0.001). Also, there were significant differences in mean levels of anxiety (0.42, CI 95% [0.34–0.50], p-value ≤ 0.001), depression (0.39, CI 95% [0.29–0.49], p-value ≤ 0.001), stress (0.34, CI 95% [0.23–0.45], p-value ≤ 0.001), and self-efficacy (-0.54, CI 95% [-0.69–0.39], p-value ≤ 0.001) between infertile women and men. The difference in mean levels of self-esteem and sexual satisfaction did not differ significantly between infertile women and men.

Conclusion Considering the differences in psychological status between infertile women and men, paying attention to gender differences is crucial when formulating policies and planning strategies for implementing solutions. It is important to consider how men and women may be affected differently when designing programs to address their infertility issues.

*Correspondence:
Robab Latifnejad Roudsari
rlatifnejad@yahoo.com; latifnejadr@mums.ac.ir

Full list of author information is available at the end of the article

Plain English summary
Infertility affects millions of people of reproductive age around the world, and it can have a big impact on mental health. This study looked at how men and women experience infertility differently. The study found that infertile women and men have different levels of anxiety, depression, stress, and self-efficacy, i.e., the belief in one's ability to handle challenges. However, there were no significant differences in self-esteem and sexual satisfaction between the two groups. Since men and women react differently to infertility, it is important to take these differences into account when creating support programs. Programs designed to help couples dealing with infertility should consider how each person may feel and cope in different ways.

Keywords Infertility, Gender, Distress, Stress, Depression, Anxiety

Introduction

Infertility is a worldwide health concern, affecting approximately 168 million people of reproductive age globally [1], with women usually bearing a disproportionate share of the psychological burden [2]. Infertile patients consider infertility as the top stressor in their life, which causes continuous crisis throughout their life due to stressful diagnosis and treatment course [3–5]. Infertility as a crisis puts too much stress on couples; in other words, negative infertility-related psychological status can affect a person's sense of self, negatively alter their interpersonal relationships and marriage, and harm their mental, physical, sexual, and even social health [6–8]. Infertility treatment also can harm infertile couples' wellbeing; painful procedures, treatment failures, and the need for reproductive donors or surrogates are among treatment-related stressors [9–12].

Childbearing and motherhood, especially in pronatalist communities, are considered an important part of womanhood, therefore, infertile women can feel incomplete or a loss in their personality and womanhood [13–16]. In men, infertility can cause feelings of shame, anger, and a negative impact on sexual satisfaction [17–20]. Also, men's work and financial status can be jeopardized by infertility [21]. Additionally, it can alter infertile patients' self-efficacy [22, 23], which is a concept encompassing various processes such as managing or caring for oneself [24].

Although both women and men face negative psychological status of infertility, including anxiety, depression, stress, and frustration [19, 25–27], studies show that women and men perceive infertility-related stressors differently, so their psychological status can differ [15, 16, 28, 29]. In a cohort study from Saudi Arabia, Alosaimi et al. reported the difference between how men and women experience infertility-related psychosocial distress. They reported that while men were under social pressure to divorce their wives or remarry, women were more mentally and emotionally drained by family and society; women also experienced marital disputes [30]. Most studies reported that women are at a greater risk of isolation, feeling alone, depressed, worthless, and socially outcasted [15, 28, 31]. But few studies reported no difference between men and women in their psychosocial responses to infertility [32]. It is also important to note that men are sometimes left out of research regarding the burdens of infertility [33].

In order to provide better care and counseling for both infertile men and women, it is important to understand that men and women can react differently to their infertility. Discovering these differences is the first step to creating a gender-sensitive care plan. There are some systematic reviews regarding gender differences in infertile patients.

Previous systematic reviews and meta-analyses, including Jordan and Revenson (1999), who investigated gender differences in coping with infertility [34], Ying et al. (2015), who studied gender differences in experiencing and adjusting to infertility [35], and Ying et al. (2016), who conducted a systematic review on gender differences in emotional reactions to in vitro fertilization (IVF) [36], found significant differences between men and women in response to their investigated outcome variables. It is important to note that although these studies provide a good insight into how men and women respond differently to infertility, they had some limitations, including not reporting the difference between men and women regarding diverse psychological outcomes or focusing only on one stage of infertility experience, frequently IVF treatment. In addition, the aforementioned findings are from reviews of studies published between 2000 and 2016. This time limitation can cause the loss of important data. Also, with nearly a decade passing since these reviews were done, updating data can provide better insight into gender differences between men and women regarding psychological status. Therefore, this systematic review and meta-analysis aimed to investigate the gender differences in psychological status, including anxiety, depression, stress, self-efficacy, self-esteem, and sexual satisfaction experienced by infertile couples.

Methods

This study followed the MOOSE Guidelines for Meta-Analyses and Systematic Reviews of Observational Studies [37]. The protocol is registered in PROSPERO, the

international prospective register of systematic reviews (CRD42024541801). Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42024541801.

Search strategy and data sources

All Observational studies, including case-control, cross-sectional, or cohort studies regarding gender differences and psychological status among infertile couples, were searched by two researchers (FKH and EI), working independently, with no time limit until September 2024. Databases of PubMed, Web of Science, Cochrane Library, and Scopus were searched by search strings using the keywords of infertile, infertility, psychosocial, distress, gender, gender role, and gender differences in combination with Boolean operators of OR/AND. EndNote reference management software version 9 was used for database search and data selection. The search strategy can be accessed in Additional file 1.

After searching different databases, duplicate articles were removed. In the next step, the titles and abstracts of the remaining articles were reviewed carefully, and the irrelevant articles were excluded. Then full text of remaining articles was sought, and articles without access to the full text were excluded. Finally, the full text of the remaining articles was reviewed, and those articles that met our inclusion criteria were included in the data extraction process (Fig. 1). Two researchers (FKH and EI), independently, assessed inclusion and exclusion criteria for each study.

Inclusion and exclusion criteria

All observational studies in English focused on gender differences and the psychological status of infertile couples, included in this systematic review. PECO was as follows: Population: Infertile couples; Exposure: Infertility; Comparator: Gender (men vs. women); Outcomes: Psychological status of infertile couples, including anxiety, depression, stress, self-efficacy, self-esteem, and sexual satisfaction. Designs other than observational studies, including systematic reviews, reviews, commentaries, letters to the editor, or conference abstracts, as well as guidelines, and studies in languages other than English, were excluded from the study.

Quality assessment

The Joanna Briggs Institute (JBI) checklist was used for quality assessment of the studies. The checklist consists of eight, 10, and 11 questions for cross-sectional, case-control, and cohort studies, respectively. Each question is answered by one of the four options of yes, no, unclear, or not applicable [38, 39]. For each "yes," there is one point, and for each "no" or "unclear," there are no points. If the question does not apply to the study, then the final score will be summed without the mentioned question. After the assessment, each study is categorized based on the points they achieved, as strong (more than 75% of total points), moderate (50–75% of total points), or weak (less than 50% of total points) [40]. Two researchers (FKH and EI), independently, assessed the quality of studies. They shared their results, and in cases of inconsistency, the third and senior researcher (RLR) assessed and scored the study. The results of the quality assessment are shown in Table 1.

Data extraction

Two researchers (FKH and EI), independently, reviewed the full texts of included studies and carried out data extraction. Any disagreement was resolved by the third researcher (RLR). Data were extracted based on the checklist already prepared, including the first author's name, publishing year, country of origin, study design, sample size, age of patients, tools for data collection, outcomes, as well as total score of quality assessment (Table 1).

Data analysis

Data analysis was conducted based on the extracted data from the included studies. Extracted data were first tabulated (Table 1). The standard mean difference (SMD) of psychological status, including anxiety, depression, stress, self-efficacy, self-esteem, and sexual satisfaction between women and men was estimated using the random-effects model. The standardized mean differences (SMD), also known as Cohen's d, is used when different studies use different instruments/tools to measure the same outcomes [41, 42]. In this study, to do the standardization of the scores across diverse instruments before pooling them in the meta-analysis, SMD was used, which is the recommended approach for pooling data obtained from various measurement tools. This method enables comparison across studies despite scale differences. Only studies that reported either the mean difference of outcomes in men and women or the mean score of outcomes in both men and women were included in the meta-analysis. Heterogeneity between studies was assessed by the I-squared statistical index. An I^2 index greater than 75 indicates high heterogeneity [43]. A subgroup Analysis based on the study region, treatment stage, and tools used for measuring psychological variables was conducted. Also, the one-study removed sensitivity analysis was performed. Funnel plot and Egger's test were used to test any publication bias. The funnel plot can be accessed in Fig. 2- Funnel plot. One researcher (EI) conducted the meta-analysis. Comprehensive Meta-Analysis Version 2 was used to estimate the mean difference and 95% CI and prediction interval by the random-effects model. A *p*-value less than 0.05 was considered significant.

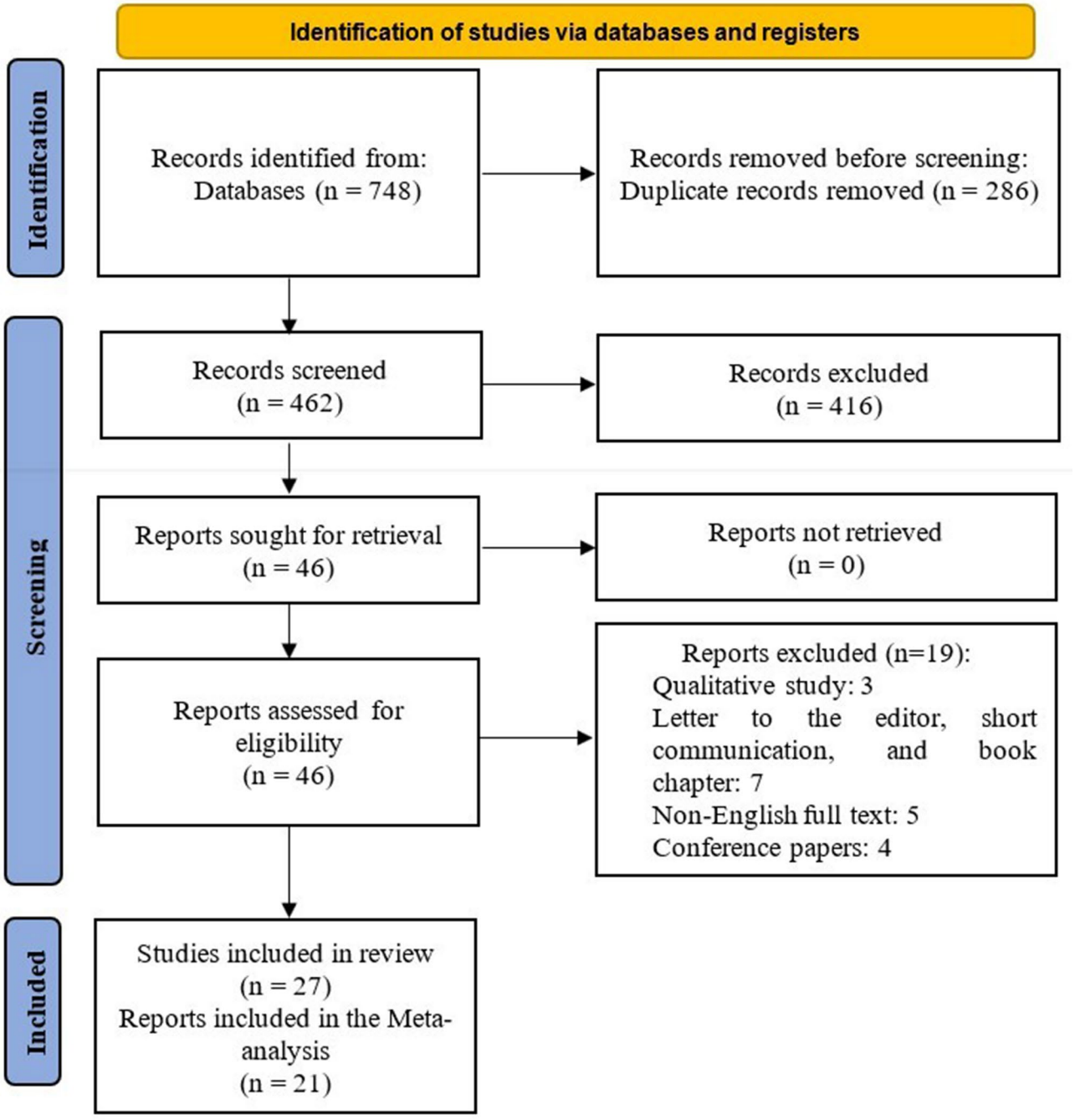

Fig. 1 PRISMA 2020 flowchart of study selection

Results

Search results

In total, 748 studies were identified by searching the databases. After removal of duplicates, 462 studies were screened for inclusion criteria, and 416 studies were excluded. 46 retrieved articles were assessed for eligibility. Of these, 19 studies (three qualitative studies, seven studies including short communications, commentaries, letters to the editor, book chapters, four conference papers, and five non-English articles) were excluded as they were not eligible for inclusion based on our pre-specified criteria. So, 27 studies, including 10,083 infertile men and women, were included in this systematic review. Also, 21 studies were included in the meta-analysis. The process of study selection is seen in Fig. 1.

Study characteristics

There was diversity in the region of the studies. Nine studies were conducted in Europe [22, 23, 32, 44–49], six

Table 1 Characteristics of the studies included in the systematic review and meta-analysis

*	Author	Country	Study design	Sample size	Treatment stage	Outcome	Tool	Results	Quality assessment result
1.	Alosaimi (2016) [30]	Saudi Arabia	Cross-sectional	206 women and 200 men	Not mentioned	Mental health, Sexual life	Researcher-made questioner	Women had a more negative sexual life and mental health.	Moderate
2.	Anderson (2003) [49]	Scotland	Cohort	T1:($n=113$ couples) T2:($n=64$)	T1: starting treatment T2: during treatment	Anxiety Depression	Hospital Anxiety and Depression Scale (HADS)	Women had significantly higher scores in anxiety and depression.	Good
3.	Andrei (2021) [22]	Italy	Cross-sectional	69 women 38 men	Starting treatment	Self-Efficacy	Infertility Self-Efficacy Scale (ISE)	Women had a significantly lower mean score in ISE.	Good
4.	Arhin (2023) [63]	Ghana	Cross-sectional	71 women and 49 men	Not mentioned	Anxiety Depression Stress	Depression Anxiety and Stress Scale 21(DASS-21)	No significant difference between genders	Moderate
5.	Beaurepair (1993) [66]	Australia	Cross-sectional	330 couples, 113 starting treatment and 217 repeated cycles	Starting treatment and Repeated cycles	Anxiety Depression	State Trait Anxiety Inventory (STAI) Center for Epidemiologic Studies Depression Scale (CES-D)	Women had significantly higher mean scores in anxiety and depression.	Good
6.	Benazon (1992) [54]	Canada	Cohort	I65 couples, including 48 couples with successful treatment and 117 with unsuccessful treatment	Successful/ Unsuccessful treatment	Stress Sexual satisfaction	The Psychological State of Stress (PSS)	Women had a significantly higher mean score for stress. The mean sexual satisfaction score was high in men with unsuccessful treatment and women with successful treatment.	Moderate
7.	Benyamini (2009) [50]	Israel	Cross-sectional	72 couples	Starting treatment	stress	Infertility Distress Scale (IDS)	Women had a significantly higher mean score for stress.	Moderate
8.	Berg (1991) [57]	USA	Cross-sectional	104 couples	During treatment	Sexual satisfaction Stress	Index of psychiatric symptomatology (ISS) Fertility Problem (FP) Stress Inventory	No significant difference was found.	Good
9.	Boivin (1998) [45]	Sweden	Cohort	40couples	Starting IVF/ICSI	Stress	Research made a questionnaire	Women were significantly more distressed.	Moderate
10.	Boivin (2005) [44]	Denmark	Cohort	818 couples T1: ($n=330$ couples) T2: ($n=488$ couples)	T1: During treatment T2: Unsuccessful treatment/ Successful treatment	Stress	Fertility Problem (FP) Stress Inventory	Women had a significantly higher mean score for stress.	Good
11.	Edelmann (2000) [32]	England	Cross-sectional	T1: ($n=130$)116 women and 107 Men T2: ($n=150$ Couples)	T1: Starting treatment. T2: First IVF	Stress Depression	State Trait Anxiety Inventory (STAI) Beck Depression Inventory (BDI)	Women had significantly higher mean scores in anxiety and depression.	Good

Table 1 (continued)

*	Author	Country	Study design	Sample size	Treatment stage	Outcome	Tool	Results	Quality assessment result
12.	El Kissi (2013) [62]	Tunisia	Cross-sectional	100 couples	Before starting a new treatment cycle	Stress Self-esteem	Hospital Anxiety and Depression Scale (HADS) Rosenberg Self-Esteem Scale (RSE)	Women had significantly higher mean scores in anxiety and depression and lower mean scores in self-esteem.	Moderate
13.	Fang (2019) [61]	China	Cross-sectional	500 couples	Not mentioned	Stress	Kessler Psychological Distress Scale (K-10)	Women had a significantly higher mean score for stress.	Good
14.	Holter (2006) [46]	Sweden	Cohort	T1: ($n=116$ women and 117 men) T2: ($n=96$ women and 95 men T3: ($n=50$ couples' unsuccessful treatment and 38 women and 39 men with successful treatment)	T1: starting treatment T2: during treatment T3: Unsuccessful/Successful treatment	Depression Anxiety	Psychological General Well-Being Index (PGWB)	Women had significantly higher mean scores in anxiety at all three measurement points and significantly higher depression in the 1st, 2nd, and 3rd (unsuccessful treatment) measurements, but lower and non-significant depression mean scores in the 3rd (successful) measurement	Moderate
15.	Iordachescu (2021) [48]	Romania	Cross-sectional	76 couples	Not mentioned	Anxiety Depression Stress	Beck's Depression Inventory (BDI)	Women had significantly higher mean scores in anxiety, depression, and stress.	Good
16.	Karimzadeh (2017) [53]	Iran	Cross-sectional	256 couples	Starting IVF/ICSI	Anxiety Depression	The Symptom Checklist-90-Revised (SCL-90-R), The Cattle Inventory (CI)	Women had a higher mean score in anxiety and depression.	Good
17.	Kazandi (2017) [51]	Turkey	Cross-sectional	248 women and 96 men	Not mentioned	Distress, Anxiety Depression	Beck's Depression Inventory (BDI) and the State Trait Anxiety Inventory (STAI)	No significant difference was found.	Good
18.	Kumar (2024) [65]	India	Cross-sectional	160 couples, including 82 starting treatment and 78 repeat cycle	Starting treatment and repeated cycles	Anxiety Depression	Hospital Anxiety and Depression Scale (HADS)	Women had higher mean anxiety (significant) and depression (non-significant) Scores.	Moderate
19.	Laffont (1994) [47]	France	Cross-sectional	101 men and 117 women	During IVF cycles	Anxiety	General Health Questionnaire – 28 (GHQ 28)	Women had a significantly higher mean score in anxiety.	Moderate
20.	Mahadeen (2018) [52]	Jordan	Cross-sectional	248 couples	Not mentioned	Depression Stress	Beck's Depression Inventory (BDI-II)	Women had a significantly higher mean score for depression. No significant difference was found in stress score.	Moderate
21.	Musa (2014) [60]	Malaysia	Cross-sectional	124 couples	Various stages of treatment	Anxiety Depression Stress	The Depression, Anxiety and Stress Scale (DASS)	Women had significantly higher mean scores in anxiety, depression, and stress.	Good

Table 1 (continued)

*	Author	Country	Study design	Sample size	Treatment stage	Outcome	Tool	Results	Quality assessment result
22.	Patel (2018) [64]	India	Crosssectional	81 couples	Undergoing IUI	Anxiety Depression Stress	Fertility Problem (FP) Stress Inventory Hamilton anxiety and depression scales (HAM-A)	Women had significantly higher mean scores in anxiety, depression, and stress.	Moderate
23.	Thanscheidt (2023) [23]	Germany Switzerland Austria	Cross-sectional	320 couples	Not mentioned	Anxiety Depression Self-efficacy	psychological screening and care of couples who seek infertility treatment (SCREENIVF-R) Infertility Self-Efficacy Scale (ISE)	Women had significantly higher mean scores in anxiety and depression, and a significantly lower mean score of self-efficacy.	Good
24.	Thomas (2002) [59]	Thailand	Cross-sectional	42 couples	Before starting a new treatment cycle and after treatment	Depression Stress	Center for Epidemiologic Studies Depression Scale (CES-D) Perceived Stress Scale (PSS)	Women had significantly higher mean scores in depression and stress pre-treatment and post-treatment.	Good
25.	Tuzer (2010) [29]	Turkey	Cross-sectional	60 couples	Starting treatment	Anxiety Depression	State Trait Anxiety Inventory (STAI) Beck's Depression Inventory (BDI)	No significant difference was found.	Good
26.	Wichman (2011) [56]	USA	Cohort	160 couples	Starting IVF	Anxiety Depression Stress	State Trait Anxiety Inventory (STAI) Beck's Depression Inventory (BDI) Perceived Stress Scale (PSS)	Women had significantly higher mean scores in anxiety, depression, and stress.	Good
27.	Wright (1991) [55]	Canada	Case–control	449 couples	Starting treatment	Anxiety Depression Sexual satisfaction Self-esteem	Index of psychiatric symptomatology (ISS) Rosenberg Self-Esteem Scale (RSE)	Women had significantly higher mean scores in anxiety, depression, and lower scores in self-esteem. Regarding the sexual satisfaction score, no significant difference was found.	Moderate

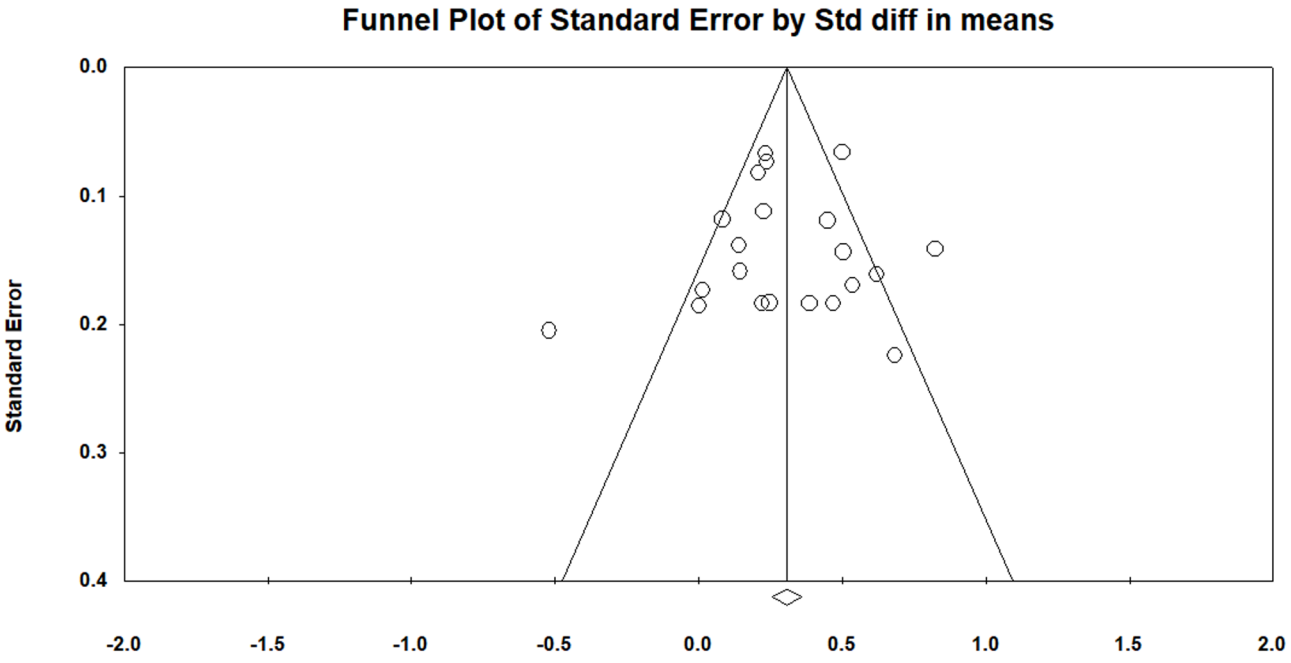

Fig. 2 Funnel plot of standard error by Std diff in means

studies in the Middle East [29, 30, 50–53], six studies in North America [54–59] and three studies in East Asia [59–61]. There were two studies from different regions of Africa [62, 63], and South Asia [64, 65], and one study was from Oceania [66]. This diversity in geographical locations provided a diverse socio-economic and cultural background for the samples. The study sample included infertile women and men in various stages of treatment, including those at their initial IVF clinic visit, those starting new treatment cycles, those with repeated ART cycles, those with successful treatment and those with treatment failure. Study characteristics is shown in Table 1.

Psychological status

The majority of the studies in this systematic review reported a significant difference between infertile women and men regarding psychological status, indicating that infertile women suffer more from psychological disturbances related to infertility than men. 21 studies were included in the meta-analysis, including 13 studies on anxiety [23, 29, 32, 46, 47, 53, 55, 56, 62–66], 14 studies on depression [23, 29, 32, 46, 52, 53, 55, 56, 59, 62–66], 11 studies on stress [44, 50, 52, 54, 56, 57, 59, 61–64], two on self-efficacy [22, 23], two studies on self-esteem [55, 66], and three sexual satisfaction [54, 55, 57]. Notably, some studies analysed more than one variable. The result of the meta-analysis was consistent with the findings of the systematic review, i.e., there was a significant difference between mean scores of women and men in all aspects of psychological states (Std diff in Mean: 0.31, CI 95% [0.23–0.39]; p-value ≤ 0.001). The funnel plot appears asymmetrical, suggesting potential publication bias or small-study effects (Fig. 2). Also, the I^2 was 87.75 (Begg and Mazumdar's test for rank correlation p-value: 0.73, Egger's test p-value: 0.97).

Subgroup analysis based on geographical region and stage of treatment

As mentioned before, studies were from different countries with diverse socio-economic and cultural backgrounds. Additionally, infertile patients at various stages of treatment participated in the studies; therefore, a subgroup analysis was conducted based on geographical region and stage of treatment.

The subgroup analysis based on geographical region showed that it is not a source of heterogeneity, with the Q-value for the difference being 4.79 with df of 6 and a p-value of 0.571. However, the subgroup analysis based on the treatment stage suggested that it is a source of heterogeneity, with the Q-value for the difference being 20.95 with df of and a p-value of 0.033. Although sensitivity analysis using the one-study removed method showed that the pooled effect size remained consistent (Std diff in Mean: 0.32, CI 95% [0.25–0.39]; p-value ≤ 0.001), showing that no single study significantly altered the pooled estimate.

Anxiety

Most studies (N = 14) reported a significantly higher score of anxiety in infertile women [23, 32, 46–49, 53, 55, 56, 60, 62, 64–66], however, three studies reported no

significant difference between women and men [29, 51, 63]. Mean score of anxiety was measured and reported in 13 studies [23, 29, 32, 46, 47, 53, 55, 56, 62–66]. Different tools were used to screen anxiety. Three studies were conducted on two groups of infertile couples, those undergoing first IVF treatment and those under treatment or with repeated cycles [32, 65, 66]. One study categorized the couples based on the female or male cause of infertility [53]. Finally, one study measured anxiety at three different time points [46]. Therefore, even though 13 studies examined anxiety, 28 sets of data were analyzed. The result of meta-analysis showed that the difference in the mean score of anxiety between infertile women and infertile men was 0.42 (CI 95% [0.34–0.50], p-value ≤ 0.001) (Fig. 3). Subgroup analysis was performed based on the tools used to measure anxiety, and the Q-value for the difference was 32.08 with df 10 and p-value ≤ 0.001. So, there is evidence that the tools can be a source of heterogeneity. I^2 was 60.13 (Begg and Mazumdar's test for rank correlation p-value: 0.93, Egger's test p-value: 0.69).

Legend of Fig. 3. Forest plot of standardized mean differences (SMD) in anxiety scores between infertile women and men. Positive values indicate higher anxiety scores in women. The size of the square represents the weight of each study in the meta-analysis, and horizontal lines indicate 95%.

Depression

The majority of studies (N = 13) reported a significantly higher score for depression in infertile women [23, 32, 46, 48, 52, 53, 55, 56, 59, 60, 62, 64, 66], but four studies found no significant difference between women and men [29, 51, 63, 65]. The mean score of depression was measured by different tools in 14 studies [23, 29, 32, 46, 52, 53, 55, 56, 59, 62–66]. Two studies were conducted on two groups of infertile couples, those undergoing first IVF treatment and those with repeated cycles [65, 66]. One study categorized the couples based on female or male causes of infertility, and one used pre-treatment and post-treatment measures [53, 59]. Finally, one study measured depression at three different time points [46]. Therefore, even though 14 studies examined depression, 21 sets of data were analyzed. According to the result of meta-analysis, the difference in means of the two groups of infertile women and men was 0.39 (CI 95% [0.29–0.49], p-value ≤ 0.001) (Fig. 4). Subgroup analysis was performed based on the tools used to measure depression, and the Q-value for the difference was 28.09 with df 9 and p-value of 0.001. So, there is evidence that the tools can be a source of heterogeneity. I^2 was 60.02 (Begg and Mazumdar's test for rank correlation p-value: 1, Egger's test p-value: 0.30).

Legend of Fig. 4. Forest plot of standardized mean differences (SMD) in depression scores between infertile women and men. Positive values indicate higher depression scores in women. The size of the square represents

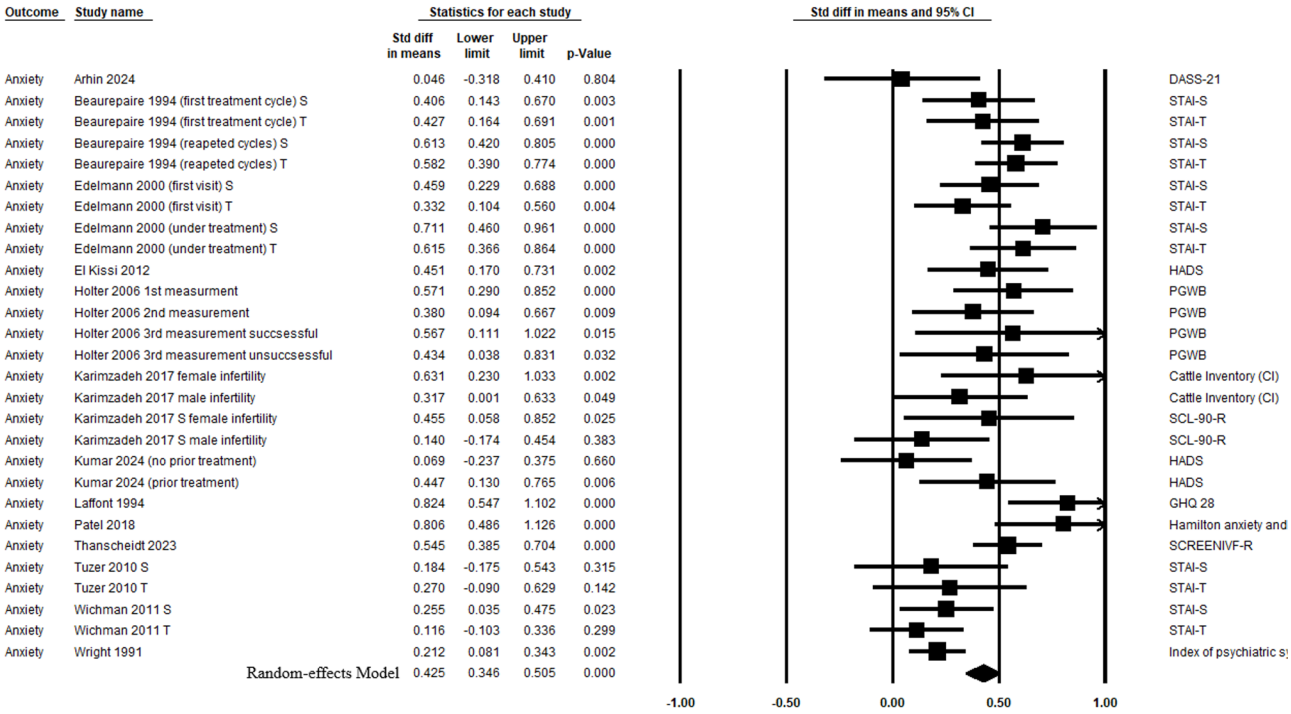

Fig. 3 Difference in means of two groups of infertile women and men regarding anxiety

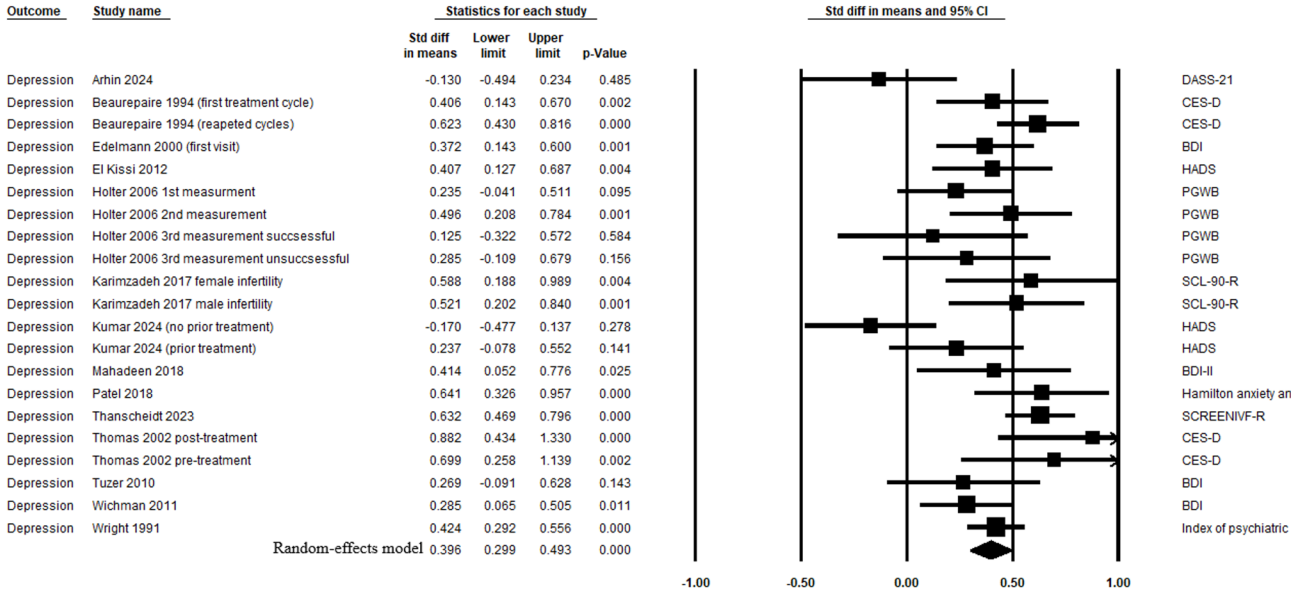

Fig. 4 Difference in means of two groups of infertile women and men regarding depression

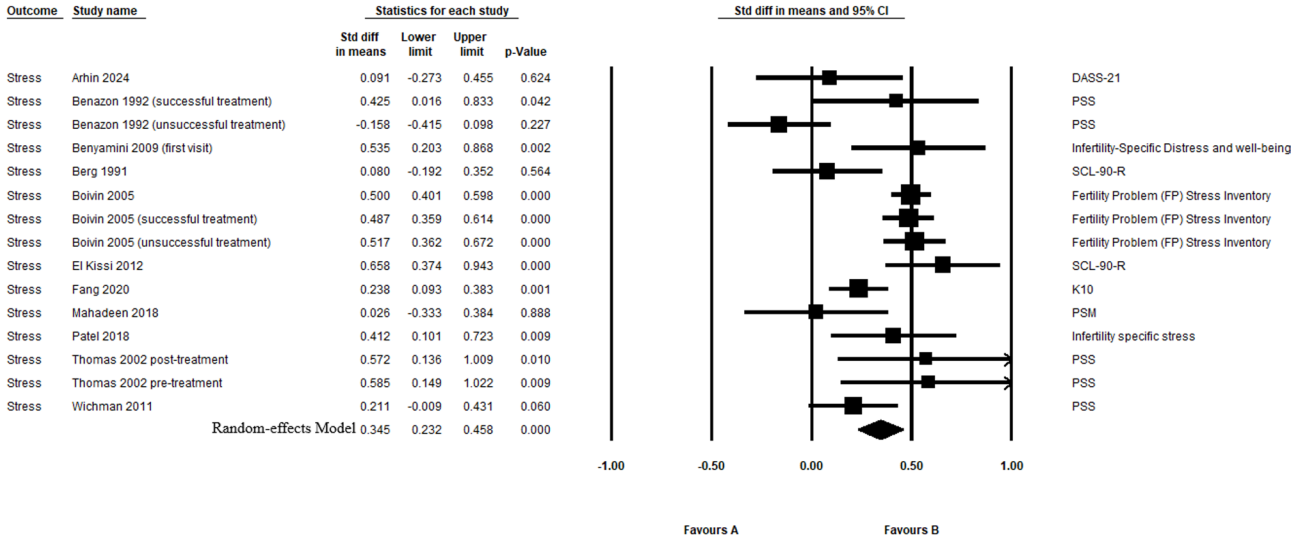

Fig. 5 Difference in means of two groups of infertile women and men regarding stress

the weight of each study in the meta-analysis, and horizontal lines indicate 95%.

Stress

The majority of studies ($N = 10$) reported a significantly higher score of stress in infertile women [44, 45, 48, 50, 54, 56, 59–61, 64], but four studies found no significant difference between women and men [51, 52, 57, 63]. The mean score of stress was measured in 11 studies [44, 50, 52, 54, 56, 57, 59, 61–64]. Different tools were used to screen stress. One study categorized the couples based on pre-treatment and post-treatment measures [59]. Two studies were conducted on two groups of infertile couples, those with successful treatment and those with unsuccessful treatment [44, 54]. Therefore, even though 11 studies examined stress, 15 sets of data were analyzed. The result of meta-analysis demonstrated that the difference in means of two groups of infertile women and men was 0.34 (CI 95% [0.23–0.45], p-value ≤ 0.001) (Fig. 5). Subgroup analysis was performed based on the tool used to measure stress, and the Q-value for the difference was 20.17 with df 7 and p-value of 0.005. So, there is evidence that the tools can be a source of heterogeneity. I^2 was 72.59 (Begg and Mazumdar's test for rank correlation p-value: 0.96, Egger's test p-value: 0.24).

Legend of Fig. 5. Forest plot of standardized mean differences (SMD) in stress scores between infertile women and men. Positive values indicate higher stress scores

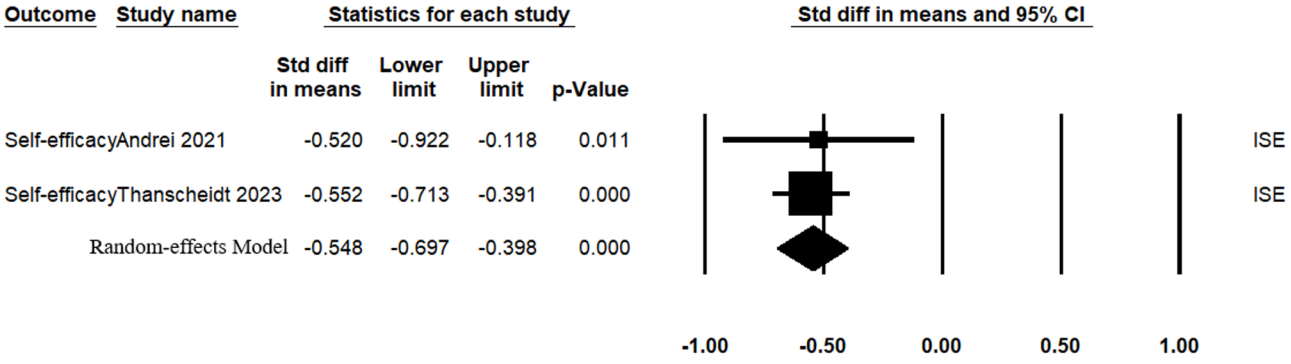

Fig. 6 Difference in means of two groups of infertile women and men regarding self-efficacy

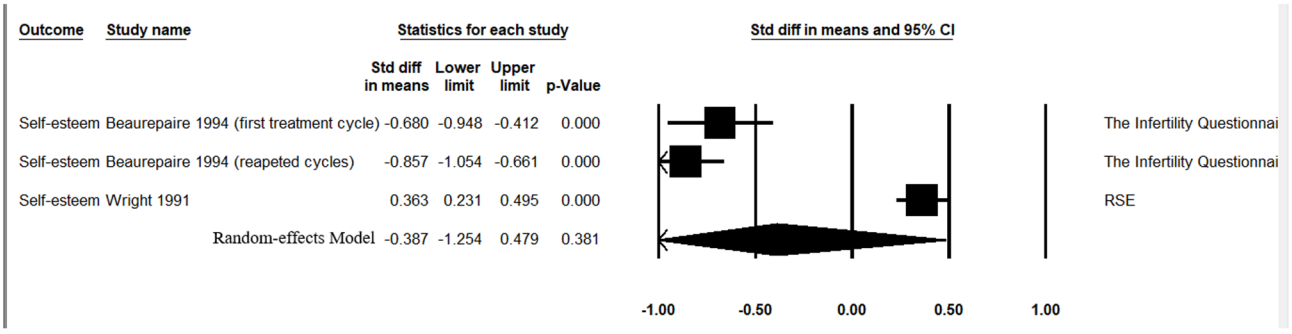

Fig. 7 Difference in means of the two groups of infertile women and men regarding self-esteem

in women. The size of the square represents the weight of each study in the meta-analysis, and horizontal lines indicate 95%.

Self-efficacy

Self-efficacy was measured in two studies [22, 23]. Both studies used the Infertility Self-Efficacy Scale (ISE) to measure self-efficacy, and both reported significant differences between infertile women and infertile men, with infertile men having a higher mean score of self-efficacy. Based on the result of meta-analysis, the difference in means of two groups of infertile women and men was – 0.54 (CI 95% [-0.69–0.39], p-value ≤ 0.001) (Fig. 6). Since only two studies reported on self-efficacy, subgroup analysis was not performed on this outcome.

Legend of Fig. 6. Forest plot of standardized mean differences (SMD) in self-efficacy scores between infertile women and men. Negative values indicate lower self-efficacy scores in women. The size of the square represents the weight of each study in the meta-analysis, and horizontal lines indicate 95%.

Self-esteem

Self-esteem was measured in two studies [55, 66]. Different tools were used to measure self-esteem in each study. Both reported significant differences between infertile women and men, with infertile men having a better sense of self-esteem. One study was conducted on two groups of infertile couples, those undergoing first IVF treatment and those with repeated cycles [66]. Therefore, even though two studies examined self-esteem, three sets of data were analyzed. The result of meta-analysis showed that the difference in means of two groups of infertile women and men was – 0.38 (CI 95% [-1.25-0.47], p-value: 0.38) (Fig. 7). Since only two studies reported their results on self-esteem, subgroup analysis was not carried out on this outcome.

Legend of Fig. 7. Forest plot of standardized mean differences (SMD) in self-esteem scores between infertile women and men. Negative values indicate lower self-esteem scores in women. The size of the square represents the weight of each study in the meta-analysis, and horizontal lines indicate 95%.

Sexual satisfaction

Sexual satisfaction was measured in three studies [54, 55, 57]. One study used a researcher-made questionnaire [57], and two used the Index of Sexual Satisfaction (ISS) [54, 55]. One study reported a significant difference in sexual satisfaction between women and men, with women having a higher mean score in the case of successful treatment, and men having a higher mean score in the case of unsuccessful treatment [54]. Also, two studies found no significant differences [55, 57]. One study was conducted on two groups of infertile couples: those with successful treatment and those with unsuccessful

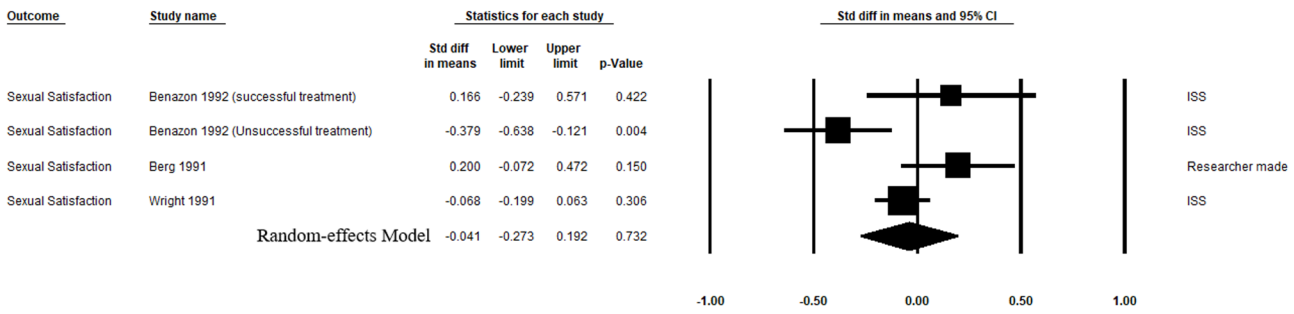

Fig. 8 Difference in means of two groups of infertile women and men regarding sexual satisfaction

treatment [54]. Therefore, even though three studies examined sexual satisfaction, four sets of data were analyzed. The difference in means of two groups of infertile women and men was – 0.04 (CI 95% [-0.27-0.19], *p*-value: 0.73) (Fig. 8). Since only three studies reported results related to sexual satisfaction, subgroup analysis was not performed on this outcome.

Legend of Fig. 8. Forest plot of standardized mean differences (SMD) in sexual satisfaction scores between infertile women and men. Negative values indicate lower sexual satisfaction scores in women. The size of the square represents the weight of each study in the meta-analysis, and horizontal lines indicate 95%.

Discussion

This systematic review and meta-analysis was carried out by incorporating 27 carefully chosen research studies picked from an initial group of 748 records after undergoing a thorough assessment procedure that followed certain inclusion criteria. The meta-analysis of 21 studies revealed a significant difference between the mean scores of infertile women and men in all aspects of psychological status, offering a strong argument for the greater average levels of psychological disturbances reported by women. Also, it showed significant differences in mean levels of anxiety, depression, stress, and self-efficacy between infertile women and men. However, the difference in mean levels of self-esteem and sexual satisfaction did not differ significantly between infertile women and men.

The observed significant gender disparity remained stable across different geographical regions, stages of infertility, and measurement tools as seen by the subgroup analyses. This finding further highlights the universal nature of the gender gap in psychological suffering among infertile couples. While previous studies, such as those by Dadipoor et al. and Wdowiak et al., echo similar conclusions regarding the emotional toll of infertility, our analysis extends these findings by integrating a meta-analytical approach that quantifies the strain on mental health across diverse populations, providing a unique perspective. The differences mentioned emphasize the complex relationship between biological and psychological aspects of infertility and emphasize the need for a thorough understanding of gender roles and expectations in this context. Infertility has a significant influence on both physical health and mental well-being, especially in women. Indeed, the findings of this study are indicative of the greater emotional toll that infertility diagnoses and treatments exert on women. Dadipoor et al. reported that women who are unable to conceive are more likely to feel significant psychological anguish, with 44% reporting mental health problems [67]. They are also twice as likely as infertile males to acquire mental disorders. Studies by Wdowiak et al. [68], Alam et al. [69], Negoita et al. [70], and Dere et al. [71] have consistently found that infertile women suffer from higher levels of anxiety and depression than their male counterparts. These scholars have highlighted the considerable emotional burden that infertility diagnoses and treatments place on women. Alam et al. also point out that this burden is often intensified by factors like age, unsupportive spouses, and in-law violence [69]. Bagade et al. also underscore the significant prevalence of mental health disorders among women with infertility [72], revealing that 24–41.1% of these women report concurrent anxiety and depression [73]. This is a critical concern, considering that infertility affects over 10% of the global population, with a marked increase observed in recent years [74]. A study by Arhin et al. on 120 Ghanaian couples following unsuccessful infertility treatments, including 71 women and 49 men, from four fertility clinics in Cape Coast Metropolis, found minimal gender differences in anxiety levels, but severe stress was common among women.

The psychological impact of infertility has gained considerable attention in recent years, highlighting the emotional challenges faced by individuals and couples navigating this difficult journey [75, 76]. To further advance understanding, it is crucial to examine how cultural factors may mediate these psychological outcomes, as different cultural contexts may uniquely shape emotional responses to infertility. One significant aspect that requires deeper exploration is the influence of cultural factors on psychological outcomes related to infertility

[77]. Research indicates that regional cultural differences play a crucial role in shaping the psychological experiences of men and women facing infertility challenges. For instance, societal expectations regarding childbirth can impose substantial pressure on women, often framing infertility as a personal failure. In many cultures, including those similar to the findings of Ergin et al. in Turkey, infertility is perceived not only as a medical issue but also as a failure in fulfilling societal roles associated with motherhood [78]. This cultural context can lead to heightened feelings of guilt, anxiety, and depression among women, who may internalize these societal expectations and suffer adversely due to their perceived inability to conceive [79]. Further, in cultures with strong pronatalist values, women may face stigmatization and isolation, exacerbating their mental health challenges during infertility struggles. This aspect is crucial to understanding infertile women's psychological state [80, 81].

In addition, the stage of infertility treatment significantly influences the psychological well-being of infertile couples [75, 82]. The stage of fertility treatment in our study varied, however, the differences between women and men remained the same, meaning that women, regardless of treatment stage, had significantly higher levels of anxiety, depression, and stress. They also had significantly lower levels of self-efficacy. Furthermore, studies indicate that couples who reach the IVF stage often experience higher levels of stress and anxiety compared to those in the earlier stages of fertility treatment [83, 84]. Research indicates that the emotional burden increases as couples progress through more advanced treatments, with IVF being associated with greater psychological distress, including heightened stress, anxiety, and feelings of helplessness [85–87]. However, in line with our findings, a prior systematic review by Ying et al. (2015) revealed the presence of a gender difference in the psychological effects of IVF treatment, with women reporting more negative impacts than men, especially during the period before the disclosure of the results of the pregnancy test. Additionally, treatment failure, particularly after undergoing invasive procedures like IVF, can further deteriorate mental health, exacerbating feelings of disappointment and hopelessness [88, 89]. In our systematic review and meta-analysis, three studies grouped infertile couples based on the results of their treatment into those with successful and those with unsuccessful treatment [44, 46, 54], except for sexual satisfaction, which was higher in women with successful treatment [54], the difference between genders regarding anxiety, depression, and stress was in line with the main findings of the meta-analysis, with infertile women having significantly higher scores in all three psychological variables, in both successful and unsuccessful treatment, in comparison to infertile men.

According to our findings, women experienced much higher levels of anxiety, depression, and stress compared to men. A study by Arhin et al. on 120 Ghanaian couples following unsuccessful infertility treatments, including 71 women and 49 men, from four fertility clinics in Cape Coast Metropolis reported minimal gender differences in anxiety levels, but noted severe stress among women. The study also highlighted the cultural context of Ghana, where infertility is often seen as a role failure for women, leading to feelings of guilt and increased stress [63]. In another study, Kumar et al. examined anxiety and depression among couples undergoing assisted reproductive techniques (ARTs) in India and found a high prevalence of both. This 18-month study revealed that women had higher anxiety scores than men, particularly during the first year and after ten years of treatment. This pattern suggests a critical need for culturally sensitive mental health support, recognizing that women's emotional experiences are often shaped by the pressure to conform to societal norms regarding motherhood. These findings underscore the interplay between demographic factors and cultural expectations, illustrating how they collectively shape individuals' psychological states. Demographic factors, such as age and treatment duration, significantly influenced the levels of anxiety and depression. Younger men aged 20–24 years reported higher anxiety scores, while depression scores declined with increasing age in both genders [65]. Women experiencing infertility tend to exhibit elevated stress levels, which is further exacerbated by perceptions of their marital relationship as average and a younger age. Conversely, high stress in men is associated with contemplating adoption, awareness of their fertility challenges by others, and considering their marital relationship as outstanding [90]. Additionally, the financial and emotional strain associated with infertility treatments, which frequently yield uncertain results, compounds the stress endured by these women, underscoring the necessity for impactful mental health interventions [72]. Increasing awareness of infertility as a common reproductive health problem through health education and mass media is essential to challenge societal stigma and improve support systems for those affected [91].

The differences in self-efficacy between genders in infertility contexts which was found in our study, is noteworthy; although the self esteem did not differ significantly between infertile women and men. It should be noted that our analyses of self-efficacy and self-esteem were based on only two studies each, which could result in reduced reliability of the pooled results and significantly limits the generalizability of these findings. So, we acknowledge that these results should therefore be

interpreted with caution and require more robust evidence on these psychological constructs and their replication in future research. Research indicates that women facing infertility often report lower self-efficacy and self-esteem relative to their male counterparts. This disparity can be exacerbated by cultural factors that define and constrain gender roles in marriage and parenthood. In communities where traditional gender roles are emphasized, women might feel an increased burden to fulfill societal expectations of motherhood, which can further diminish their self-worth during infertility [92]. Studies suggest that men may benefit from social support structures that boost their confidence in managing infertility challenges, while women do not receive similar reinforcement, leading to a worrying trend where female infertility is linked to greater psychological distress. Lee et al. and Nagórska et al. concluded that infertile women with high neuroticism had lower self-esteem and that infertile men tended to have higher self-efficacy and self-esteem than women [93, 94]. Tabrizi et al. support this, noting that infertile women with higher self-esteem and self-efficacy often have better treatment results [95]. However, Zouari et al. highlight that male infertility can adversely affect self-esteem, especially in men with lower education and longer infertility [96].

Sexual satisfaction among infertile couples has been explored in a limited number of studies, with three studies included in this systematic review. The findings regarding sexual satisfaction among infertile couples are mixed. One study indicated that women experienced higher sexual satisfaction when treatment was successful. In contrast, men tended to report lower sexual satisfaction when treatments were unsuccessful, which may reflect the emotional and psychological strain associated with infertility rather than an actual sense of fulfillment [97]. However, two other studies found no significant differences in sexual satisfaction between genders. Overall, this meta-analysis revealed no significant difference in sexual satisfaction scores between infertile women and men. Similarly, Mahadeen et al. found no significant difference in sexual satisfaction between genders despite higher stress levels in infertile women [98]. Additionally, Radoš et al. highlighted the impact of infertility-related stress on sexual satisfaction, with both men and women experiencing lower satisfaction when facing greater stress [99]. However, one possible explanation for the mixed findings is the impact of societal expectations and emotional processing on sexual satisfaction. For men, successful treatment may alleviate the pressure associated with traditional masculine roles that emphasize fertility as a point of pride, thus enhancing their sexual satisfaction [100]. In contrast, women might experience a surge in sexual satisfaction post-treatment due to relief from the emotional burden of infertility, resulting in an increased sense of intimacy with their partners [101]. Conversely, unsuccessful treatment can amplify feelings of inadequacy in both genders, but women may feel a deeper societal stigma that impacts their sexual confidence and satisfaction [35]. Emotional processing also plays a role, as women may engage in more intense emotional responses to treatment outcomes, affecting their sexual experience differently than men [102]. Therefore, understanding these gendered dynamics can provide essential insights into the psychosocial needs of infertile couples and help designing targeted interventions. However, due to the limited number of studies, further research is needed to draw more definitive conclusions about sexual satisfaction in the context of infertility. These findings underscore the need for targeted interventions to address the specific psychosocial needs of infertile women, particularly in the areas of sexual satisfaction.

One of the strengths of this study is following the MOOSE Guideline for meta-analysis and systematic review of observational studies included in this review, ensuring a structured and systematic approach. It also employed a comprehensive search strategy across multiple databases, including PubMed, Web of Science, Cochrane Library, and Scopus. The diverse study population, including participants from various socio-economic statuses, enhances the generalizability of the findings. The Joanna Briggs Institute checklist was also used for quality assessment, and robust statistical methods were used to assess the psychological status of infertile couples. The research team also cross-checked the included studies in the current systematic review with the similar review conducted by Ying et al. (2016). Only four studies had overlap. Our review expands on their study by including additional outcomes and more recent data. It is important to note that Yang et al. also searched Chinese databases, which we had no access to them. The stage of infertility treatment varied among studies, and the subgroup analysis indicated this may partly explain the differences observed between studies, which suggests that where individuals are in their treatment journey might influence their psychological outcomes. However, the sensitivity analysis confirmed that the overall findings were robust: even when each study was removed one at a time, the pooled effect size remained stable. This consistency indicates that the overall result is reliable and not driven by any single study. Nevertheless, the study had some limitations. Publication bias could alter effect estimates and reduce the generalizability of the results. Also, heterogeneity in measurement tools, as well as limited studies on self-efficacy and self-esteem, and potential for overlapping samples, could cause reduced reliability of the pooled results. Additionally, although the geographical region was not a source of heterogeneity, regional differences in the included studies could impact the results.

It means that differences in healthcare systems, cultural practices, or environmental factors could influence psychological outcomes, potentially limiting the generalizability of the findings. The exclusion of non-English studies and unpublished research, as well as the limitation of some databases used, like Embase, may limit the comprehensiveness of the review and introduce potential bias. It is noteworthy that our initial approach for search aimed to balance comprehensiveness with feasibility, as Scopus and Web of Science provide broad interdisciplinary coverage and collectively index more than 90% of psychology-related journals covered by Embase. In addition, our search strategy included supplementary methods such as backward/forward citation tracking to mitigate database constraints. However, we still agree that future reviews with access to Embase could be critical for certain subfields and further strengthen the evidence base.

Despite these limitations, the study provides valuable insights into the psychological impact of infertility, particularly highlighting the greater distress experienced by women compared to men. In contrast to the findings of Ying et al. (2016), which focused primarily on the experiences and adjustments of infertile couples, our study advances the discussion by examining a broader outcome set across a larger sample size. This allows for a more nuanced understanding of the varying psychological impacts on men and women, particularly regarding anxiety, depression, and stress levels.

Despite these insights, it is important to recognize the limitations within the existing literature. Although some studies have examined the impact of cultural context on psychological outcomes in infertility, further investigation is necessary to explore these relationships in greater depth. Future research must aim to consider regional differences in healthcare systems, cultural practices, and societal norms that contribute to the variability in psychological outcomes for individuals facing infertility. Other studies on this topic could include conducting longitudinal studies to better understand the long-term psychological impact of infertility on women and men, with a focus on developing culturally sensitive approaches to care. In addition, studies examining the impact of gender-specific psychological interventions should be designed to address these disparities. Focusing studies on specific research questions such as: "How do cultural stigma and duration of treatment affect women's psychological status?" and "What role do social expectations play in men's and women's sexual satisfaction outcomes after treatment?" could guide research toward effective and actionable findings that may enhance interventions.

It is essential for policymakers when developing interventions to emphasize the importance of gender-focused approaches, particularly in addressing the distinct experiences of women and men dealing with infertility. Additionally, it is vital for clinicians to recognize the sociocultural contexts to fully understand the correlation between infertility and mental health issues such as anxiety, depression, stress, self-efficacy, self-esteem, and sexual satisfaction. This study would yield useful insights into the psychological phenomena experienced by women and contribute to the planning of focused interventions aimed at enhancing their mental well-being.

Conclusion

In light of the differences in psychological status between infertile women and men, specifically regarding anxiety, depression, stress, and self-efficacy, it is crucial to prioritize gender disparities in addressing infertility issues. Future interventions should focus on gender-tailored mental health support to effectively address the distinct psychological impacts of infertility on both sexes. For example, implementing counseling sessions tailored to women's specific anxiety and men's self-efficacy can improve outcomes by providing targeted support that resonates with each gender's unique experiences. By developing strategies that recognize and incorporate these differences, we can promote a more inclusive and effective approach to assisting individuals navigating infertility challenges.

Abbreviations

JBI	Joanna briggs institute
BDI	Beck's depression inventory
HADS	Hospital anxiety and depression scale
PGWI	Psychological general well-being index
CES-D	Center for epidemiologic studies depression scale
SCL-90-R	Psychiatric symptomatology, and symptom checklist-90-revised
IVF	In vitro fertilization
PSS	Perceived stress scale
FP	Fertility problem
K-10	Kessler psychological distress scale
ISDWS	Infertility-specific distress and well-being scales
PSM	Psychological stress measure
ISE	Infertility self-efficacy scale
RSE	Rosenberg's self-esteem scal
ARTs	Assisted reproductive technique

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-025-23314-x.

Supplementary Material 1

Acknowledgements

We thank all authors of the primary studies included in this systematic review. Also, the financial support of the Vice Chancellor for Research, Mashhad University of Medical Sciences, Mashhad, Iran, is sincerely appreciated. The protocol of the study was registered in the International Prospective Register of Systematic Reviews, PROSPERO (CRD42024541801). Available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42024541801.

Author contributions

FKH, EI, and RLR contributed substantially to the conception and design of the study. FKH and EI performed the database search and study selection as well as quality assessment and data extraction, and prepared Figure 1;

Table 1, and Additional File 1. EI performed the data synthesis and prepared Figs. 2, 3, 4, 5, 6, 7 and 8. RLR supervised the database search, study selection, quality assessment, and data extraction. FKH and EI were involved in drafting the manuscript. RLR critically revised its content. All the authors read and approved the final manuscript and agreed to be accountable for all aspects of the published work, ensuring that issues related to the accuracy or completeness of any part of the work are properly investigated and resolved.

Funding
This study was funded by the Vice Chancellor for Research, Mashhad University of Medical Sciences, Mashhad, Iran (Grant Number: 4010026).

Data availability
Data is provided within the manuscript or supplementary information files.

Declarations

Ethics approval and consent to participate
This study was approved by the Local Research Ethics Committee, Mashhad University of Medical Sciences, Mashhad, Iran (Code of ethics: IR.MUMS.NURSE.REC.1401.056).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Author details
[1]Reproductive Health, Student Research Committee, Mashhad University of Medical Sciences, Mashhad, Iran
[2]Department of Midwifery, May.C., Islamic Azad University, Islamic Republic of, Maybod, Iran
[3]Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran
[4]Department of Midwifery, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran

Received: 28 December 2024 / Accepted: 23 May 2025
Published online: 07 June 2025

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