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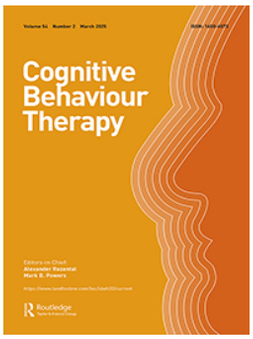

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Cognitive-behavioural therapy (CBT) for outpatients with anorexia nervosa: a systematic review and meta-analysis of clinical effectiveness

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ABSTRACT

Anorexia nervosa is commonly treated using outpatient cognitive-behavioural therapy (CBT), but its effectiveness needs to be established. This systematic review and meta-analysis (PROSPERO CRD42023484924) assessed outpatient CBT's effectiveness for anorexia nervosa and explored potential moderators (pre-treatment Body Mass Index (BMI), age, illness duration, protocol duration of therapy, dropout). Searches (SCOPUS, PsycINFO, MEDLINE, grey literature) identified 26 studies reporting pre- to post-treatment outcomes for at least one primary measure (weight, eating disorder symptoms). Studies were medium to high quality. Secondary outcome data (depression, anxiety, quality of life) were also extracted. Meta-analyses (26 studies) found medium to large post-treatment effect sizes for weight (g = 0.87; 95% CI 0.67–1.08) and eating disorder symptoms (g = -0.74; 95% CI −0.93 – −0.54), with change starting early and increasing to follow-up. Effect sizes for secondary outcome measures were medium to large. Pre-treatment BMI moderated weight gain. This review was constrained by excluding non-English language papers and the limited number of papers reporting minimum data for inclusion. Overall, results suggest an optimistic picture for patients with anorexia nervosa treated with outpatient CBT. Clinicians can expect good outcomes using CBT, regardless of patients' starting weight, age, or illness duration.

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Anorexia nervosa; cognitive behavioural therapy; CBT; moderator; meta-analysis

Introduction

Anorexia nervosa comes with high personal and societal costs (Beat, 2015). It has high mortality rates of 9.6% to 9.8% (Hoek, 2006; Zipfel et al., 2014), stressing the importance of effective treatments that can be implemented in everyday clinical settings. However, in research studies, anorexia nervosa has limited treatment outcomes. Furthermore, it has relapse rates of 9% to 52% (Khalsa et al., 2017) and is also expensive to treat due to the number of recommended outpatient treatment sessions. The importance of effective outpatient treatment is emphasised by the much greater

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costs of more intensive treatment (Egger et al., 2016; Van den Berg et al., 2022) and the absence of effective medical interventions. Consequently, the UK National Institute for Health and Care Excellence [NICE] (2017) recommended limited time in intensive treatment settings, focusing on facilitating a shift to effective outpatient treatment.

Early treatment results in better outcomes for patients with anorexia nervosa (Brown et al., 2018; Russell, 2004) and can reduce the need for expensive hospital-based care. With that in mind, it is important to understand how well outpatient psychotherapies work, and to consider what elements of therapies (beyond simple early implementation) might enhance those outcomes.

Cognitive-behavioural therapy (CBT) works well for many psychological problems in outpatient settings (e.g., depression, anxiety), teaching patients to identify and address problematic cognitions, emotions, and behaviours (Fenn & Byrne, 2013; Williams & Garland, 2002). CBT has better outcomes than other therapies when used with adults with non-underweight eating disorders (e.g., bulimia nervosa, binge eating disorder) (NICE, 2017). However, for adults with anorexia nervosa, outpatient CBT is less effective, placing it on par with other evidence-based therapies (NICE, 2017; Solmi et al., 2021). CBT is typically considered as a second-line intervention for children and adolescents, after family-centred approaches (Le Grange et al., 2020; NICE, 2017) or as an alternative where that therapy is not viable (Craig et al., 2019).

Reviews of randomised controlled trials (RCTs) and other designs have found that CBT has comparable efficacy to other evidence-based psychological treatments (Bulik et al., 2007; Galsworthy-Francis & Allan, 2014; Hay, 2013; Hay et al., 2015; Linardon, Wade, et al., 2017; Madden et al., 2015; NICE, 2017; Öst et al., 2024; Solmi et al., 2021). However, those existing reviews provide a limited understanding of how well outpatient CBT works for anorexia nervosa. Meta-analyses (Hay et al., 2015; Solmi et al., 2021) have compared the effectiveness of different outpatient psychotherapies for adults with anorexia nervosa, but this approach did not allow for in-depth exploration of any individual therapy. Most recently, Öst et al. (2024) conducted a meta-analysis of CBT for eating disorders, including anorexia nervosa, in routine clinical practice. However, they did not focus solely on outpatients, nor did they conduct subgroup analyses by diagnosis. To summarise, while previous systematic reviews and meta-analyses of CBT have included outcomes for anorexia nervosa, none have specifically focused on outpatients in sufficient depth to inform clinicians' expectations of what CBT can offer their patients. Therefore, this systematic review and meta-analysis will focus specifically on the effectiveness of CBT in routine practice for outpatients with anorexia nervosa.

The relatively modest outcomes of outpatient therapies for this disorder mean that it is also important to identify potential factors that moderate treatment outcomes, so that the therapy can be enhanced in the future. At present, little is known about factors that influence the effectiveness of CBT or other therapies for patients with anorexia nervosa. Across eating disorders, previous reviews have shown that early change is a clear predictor of outcome (Chang et al., 2021; Linardon, Piedad Garcia, et al., 2017; Vall & Wade, 2015). However, none of those reviews specifically consider moderators for underweight patients. Such moderators can be divided into therapy factors (the structure and content of CBT) and patient characteristics (individual differences). Potential moderating factors that merit investigation in CBT for anorexia nervosa include:

(1) Manual use, which improves patient outcomes in eating disorder treatments (Brown et al., 2014; Mulkens et al., 2018; Waller, 2016);
(2) Early cognitive and behavioural changes (Cardi et al., 2019; Raykos et al., 2013; Turner et al., 2015; Waller, 2012), and whether leading with cognitive or behavioural interventions achieves better outcomes;
(3) Patients' baseline weight, which has been used as an indicator of illness severity (American Psychiatric Association, 2013), though there is limited evidence of its impact on treatment outcomes (Dalle Grave et al., 2018);
(4) Therapy duration, given evidence that longer therapies might not be more effective than briefer therapies (Pellizzer et al., 2019; Tatham et al., 2020), including in underweight cases (Bell et al., 2017; Rose et al., 2021);
(5) Temporal characteristics, including age (Calugi et al., 2015; Dalle Grave et al., 2012) and illness duration (Calugi et al., 2013, 2015, 2024; Cooper et al., 2016; Raykos et al., 2018). Illness duration has limited evidence of any relevance to outcomes where effective therapies are applied (Craig et al., 2019, Linardon, Piedad Garcia et al., 2017; Radunz et al., 2020; Raykos et al., 2018), but needs more consideration among underweight patients;
(6) Neurodiversity, particularly autism spectrum disorder (ASD) diagnoses, given the inconsistent early literature on its comorbidity with anorexia nervosa and the possibility of poorer treatment outcomes (Adamson et al., 2018; Leppanen et al., 2022).

Exploring these potential moderators will determine how well they are reported in the existing literature, and (where possible) whether they impact the effectiveness of outpatient CBT for anorexia nervosa, allowing clinicians to adapt interventions to improve patient outcomes.

In summary, this systematic review and meta-analysis will address the following questions:

(1) How well does CBT work for outpatients with anorexia nervosa, primarily comparing pre- and post-treatment outcomes?
(2) Do therapy factors and patient characteristics affect how well CBT works for outpatients?

Methods

This review was pre-registered on PROSPERO (CRD42023484924) and followed PRISMA 2020 guidelines (Page et al., 2021).

Search strategy

Online searches of academic databases (23 February 2024) and grey literature (1 February 2024) were conducted to incorporate as many published and unpublished studies as possible (Siddaway et al., 2019), using SCOPUS, PsycINFO, and MEDLINE. The following search terms were modified (Appendix A): CBT OR "cognitive behavio* therap*" OR "behavio* therap*" OR "cognitive therap*" AND anorexi*. Search terms

were validated using 10 papers expected to emerge from initial searches (Supplementary Materials Table A.1). Fingertip searches, backwards searches of six relevant review articles (Galsworthy-Francis & Allan, 2014; Hay et al., 2015; Murray et al., 2019; NICE, 2017; Solmi et al., 2021; Zeeck et al., 2018), and searches of five databases (ProQuest Dissertations and Theses, Conference Proceedings Citation Index via Web of Science, OSF preprints, OSF registry, ISRCTN registry) were conducted to identify any further papers in the grey literature. The study selection process is summarised in Figure 1.

Study selection and data extraction

After de-duplicating search output in Zotero (v.6.0.33), study selection and data extraction were conducted in Google Sheets. Table 1 details the criteria used for study selection, presented using the Population, Intervention, Comparison, Outcomes (PICO) framework (Eriksen & Frandsen, 2018). Inclusion was limited to outpatients diagnosed with anorexia nervosa receiving first- or second-wave CBT, defined as time-limited, structured, evidence-based psychotherapy containing cognitive and/or behavioural interventions (Fenn & Byrne, 2013; Williams & Garland, 2002). Third-wave CBT was excluded because the foci of treatment are far broader than first- and second-wave CBT, and the evidence base is less robust (Linardon, Fairburn, et al., 2017). Post-registration, we decided to include subclinical/atypical samples (Brown et al., 2013; Herzog et al., 2022) if the patients were underweight and had all but one other diagnostic criterion for anorexia nervosa, because they were sufficiently similar to patients meeting full diagnostic criteria. Studies where patients received CBT in combination with any pharmaceutical treatment (Brambilla et al., 1995a, 1995b; Brambilla,

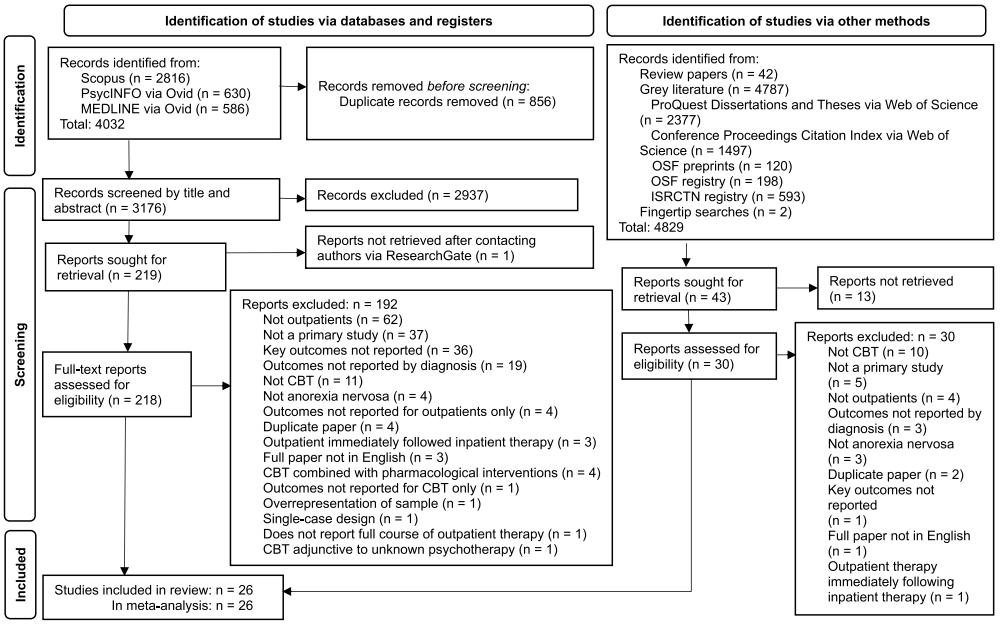


Figure 1. PRISMA flow diagram (Page et al., 2021).

Table 1. Inclusion and exclusion criteria.

PICO	Inclusion Criteria	Exclusion Criteria
Population	Humans. Primary clinical diagnosis of anorexia nervosa (any subtype). Subclinical patients included in analyses if they met the key criterion of being underweight and had all but one other diagnostic criterion for anorexia nervosa. Outpatients. Any other characteristics (e.g. age, sex, ethnicity).	Non-human animals. Known comorbid diagnoses that affect CBT delivery (i.e. psychosis, learning disabilities). Other primary diagnoses of eating disorders like atypical anorexia nervosa, bulimia nervosa, binge-eating disorder, ARFID, EDNOS, or OSFED). In-patients or day-patients. Outpatient therapy immediately following in-patient therapy. Studies where it is unclear whether patients are outpatients.
Intervention	Primary studies. First- or second-wave CBT (e.g. Enhanced CBT (CBT-E), Cognitive Therapies (CT), Behaviour or Behavioural Therapies (BT), Exposure Therapies, Body Image Therapies).	Non-CBT interventions (e.g. Family Therapy, Psychotherapy). Intensive CBT incorporating both in-patient and day-patient treatment. Third-wave CBT (e.g. Acceptance and Commitment Therapy (ACT), Cognitive Analytical Therapy (CAT), Cognitive Remediation Therapy (CRT), Mindfulness Therapies). Studies which include pharmaceutical interventions, with and without placebo groups.
Comparison	Original primary research studies. Any quantitative design. Sample >1 to allow for calculation of effect size. Outcomes reported separately by diagnosis. Published or non-published papers and reports. With and without control or comparator groups. Any year of publication. Any country or original language, but the full paper must be accessible in English.	Non-primary research studies. Qualitative studies. Case studies, including single-case designs. Studies that do not report outcomes by diagnosis. Non-English language publications.
Outcomes	Reports within-subject pre-to-post-treatment scores for at least one primary outcome measure of either weight or eating disorder symptoms.	Does not report quantifiable outcomes in at least one primary outcome measure.

Garcia, et al., 2007; Brambilla, Monteleone, et al., 2007) were also excluded post-registration, given this review's focus on the effectiveness of CBT. Studies where nutritional treatment was specified as a concurrent treatment to CBT (Ball, 1998) were included.

The first author (HD) screened initial search results by title and abstract, sought full papers for screening, and completed the data extraction and quality assessments for the included studies. Reasons for exclusion at full screening are given in the Supplementary Materials (Table B.1). Data extracted included study details (e.g., authors, publication date and type, study location and design), patient characteristics (e.g., age, sex, illness duration, ethnicity, ASD diagnoses), therapy characteristics (e.g., therapy name, format, session frequency, manual use), key findings, and quantitative data required to calculate effect sizes for the review's primary and secondary outcome variables. A single reviewer completed these stages of this review due to limited resources. Any queries about study inclusion and data extraction were discussed and agreed upon with another author (GW).

Inter-rater agreement

A second reviewer (RNC) independently completed the data extraction process for nine (34.62%) randomly selected papers (Supplementary Materials Table C.1). Reviewers had 91.63% inter-rater agreement, after which discrepancies were discussed, and 100% agreement was obtained. Percentage agreement is reported because it is the most reliable measure of inter-rater agreement (Zhao et al., 2022).

Outcome measures

The primary outcome measures were pre- and post-treatment weight and global scores for eating disorder symptoms (Bulik et al., 2007). Studies needed to report at least one of these primary outcome measures to be included in this review. Scores for depression, anxiety, and quality of life were recorded as secondary outcome measures. If available, early change and follow-up data were also recorded. The most commonly used measures for each of our outcome variables were the Body Mass Index (BMI), Eating Disorder Examination Questionnaire (EDE-Q; Mond et al., 2004), Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001), Generalised Anxiety Disorder Questionnaire (GAD-7; Spitzer et al., 2006), and the Clinical Impairment Assessment (CIA; Bohn et al., 2008). These measures were used for the meta-analyses wherever possible. Alternatively, the measure defined in a paper as the primary outcome variable for the same construct or the measure reported in the main results tables was used.

Calculating effect sizes

The data required to calculate effect sizes was extracted from the included studies in the following order of prioritisation. First, HD sought to extract effect sizes. If effect sizes were not reported, then pre- and post-treatment means, standard deviations, and within-group correlation coefficients were extracted to calculate an effect size. If pre- and post-treatment means and standard deviations were not reported, the mean differences and standard deviations of mean differences were extracted. If none of these data were reported, the study was excluded. None of the included studies reported effect sizes. Most papers reported means and standard deviations, and in a few cases (Byrne et al., 2017; Calugi et al., 2015; Jenkins et al., 2019), mean differences and standard deviations of mean differences were reported. An empirically derived correlation coefficient estimate of $r = 0.57$ (Balk et al., 2012; Gaskell et al., 2023) was used to calculate an effect size for the included studies, as none reported within-group correlations.

Meta-Essentials workbooks (Workbook 4 - Differences between dependent groups—continuous data) (Suurmond et al., 2017) were used to calculate effect sizes. Effect sizes for differences between dependent-group means were calculated by using the standard error of the difference scores, which is calculated from the standard deviations of both groups' pre- and post-treatment scores and the correlation (r) between them. The following formulae were used (personal correspondence with the creator of Meta-Essentials, Dr Robert Suurmond, with additional reviewer advice):

$$\text{Cohen's } d\text{: } ES_{sg} = \frac{\bar{X}_{T2} - \bar{X}_{T1}}{Sp} = \frac{\bar{G}}{S_g/\sqrt{2(2-r)}}$$

$$\text{Standard } error : SE_{sg} = \sqrt{\frac{2(1-r)}{n} + \frac{ES_{sg}^2}{2n}}$$

"where $\bar{X}_{T2}$ is the mean at Time 1, $\bar{X}_{T2}$ is the mean at Time 2, $\bar{G}$ is the mean Time 2 minus Time 1 gain score, Sp is the pooled standard deviation of the gain scores, specifically $\sqrt{\left(S_{T1}^2 + S_{T2}^2\right) + /2}$, n is the common sample size at Time 1 and Time 2, and r is the correlation between the Time 1 and Time 2 scores" (Lipsey & Wilson, 2001, p. 44).

$$\text{Hedges}'g\text{: } d_{unb} = \left(1 - \frac{3}{4\,df - 1}\right) \times d$$

where d is Cohen's d and d_{unb} is Hedges (1981) unbiased estimate for Cohen's d (Cumming, 2012, p. 294). Effect sizes were weighted using the inverse of study variance and were reported as Hedges' g to account for potential biases in smaller sample sizes (Hedges, 1981). Cohen's (1992) criteria for small (≤0.2), medium (0.5), and large (≥0.8) effects were used to interpret effect sizes.

Quality assessment

Critical Appraisal Skills Programme (CASP) forms (Long et al., 2020) were used to assess study quality (Appendix B). These cover a range of quantitative and qualitative study designs. Included studies were matched to the most appropriate form depending on the study design. Randomised controlled trials (RCTs) were matched to the RCT form, case-control studies to the case-control form, and cohort and case-series studies were matched to the cohort form. Rossi et al.'s (2024) quasi-experimental study was matched to the case-control form because a significant part of this study followed a case-control design. Forms were scored according to how many questions could be answered in the affirmative (different forms have different numbers of questions (13 for RCTs, 10 for case-control, 12 for cohort). Therefore, scores were converted to percentages to enable comparability between types of study. Specific cut-offs were decided prior to conducting the quality assessments to allow for comparisons of study quality. Papers scoring ≥ 66.7% were ranked as high quality, those scoring 33.4% – 66.6% were medium quality, and studies scoring below 33.4% as low quality.

Inter-rater agreement

The second reviewer also independently completed the quality assessment process for nine (34.62%) randomly selected papers (Supplementary Materials Table C.2). There was 88.89% inter-rater agreement on the ratings of papers as low, medium, or high quality. Agreement on individual papers ranged from 46.67% to 75.00%, and studies were rated medium to high quality overall (Table 2). Discrepancies between reviewers were discussed, leading to 100% agreement.

Table 2. Included study characteristics.

Study Author/s (Date) Location	Study Design (R/NR)[a]	N as (ITT/C/CDS)[b]	Subsamples (n)[c]	Patient Characteristics[d]	Therapy Name[e]	Therapy Structure[f]	Manual author/s (Date)	Quality Rating[g]
Ball (1998) Australia	RCT (R)	ITT = 13 C = 9*	NA	100%F BMI 15.86 (C)	CBT + NC	Indiv. In person 25 Varied C →B E	Garner and Bemis (1985)	M
Brown et al. (2013) UK	Case Series (NR)	ITT = 65* C = 39	NA	25.7 98.46%F BMI 15.9 81% white (ITT)	CBT	Indiv. In person 40 weekly B →C E	Waller et al. (2007)	M
Byrne et al. (2017) Australia	RCT (R)	ITT = 39* C = 26	NA	24.18 97.44%F BMI 16.59 ID 4 (median) (ITT)	CBT-E	Indiv. In person 40 C →B E	Fairburn (2008)	H
Calugi et al. (2015) Italy	Cohort (NR)	ITT = 95 C = 61*	Adol. (30) Adults (31)	15.5 & 24.6 100% & 98%F BMI centile (kg/m^2) 2.86 & BMI 15.7 ID 0.5 and 0.3 (median) (C)	CBT-E	Indiv. In person 40 weekly C →B E	Fairburn (2008)	H
Calugi et al. (2021) Italy	Case Series (NR)	ITT = 30* C = 20	NA	22.4 96.67% BMI 15.1 ID 4.1 100% white (ITT)	CBT-E	Indiv. In person 40 weekly C →B E	Fairburn (2008)	H
Cassioli et al. (2022) Italy	Case Control (NR)	ITT = 120 C = 105*	NA	25.22 100%F BMI 16.28 (C)	CBT-E	Indiv. In person 40 weekly C →B E	Fairburn (2008)	H

(*Continued*)

Table 2. (Continued).

Study Author/s (Date) Location	Study Design (R/NR)[a]	N as (ITT/C/CDS)[b]	Subsamples (n)[c]	Patient Characteristics[d]	Therapy Name[e]	Therapy Structure[f]	Manual author/s (Date)	Quality Rating[g]
Dalle Grave et al. (2013) Italy	Case Series (NR)	ITT = 46* C = 29	NA	15.5 100%F BMI centile (kg/m^2) 2.86 ID 0.86 100% white (ITT)	CBT-E	Indiv. In person 40 weekly C →B	Fairburn (2008); Cooper & Stewart (2008)	H
Dalle Grave et al. (2019) Italy	Case Series (NR)	ITT = 49* C = 35	NA	15.5 100%F BMI centile (kg/m^2) 5.7 ID 0.95 100% white (ITT)	CBT-E	Indiv. In person 40 weekly C →B E	Dalle Grave & Cooper (2016); Dalle Grave in Hebebrand & Herpertz-Dahlmann (2019)	H
Dalle Grave et al. (2023) Italy	Cohort (NR)	ITT = 115* C = 72	Adol. (61) Adults (54)	15.8 & 20.5 98.40% & 98.10%F BMI centile (kg/m^2) 5.5 & BMI 16.1 ID 1 & 2.8 (ITT)	CBT-E	Indiv. In person 40 Varied C →B E	Dalle Grave (2012)	H
Fairburn et al. (2013) UK & Italy	Cohort (NR)	ITT = 99* C = 63	UK (50) Italy (49)	23.4 & 24.6 96 & 98%F BMI 16.5 & 15.7 ID 3 90% white (Asian, Mixed) & 100% white (ITT)	CBT-E (focused)	Indiv. In person 40 weekly C →B E	Fairburn et al. (2009)	H
Frostad et al. (2018) Norway	Case Series (NR)	ITT = 44* C = 22	NA	23.3 97.70%F BMI 16.3 ID 6.1 (ITT)	CBT-E	Indiv. In person 40 Varied C →B E	Fairburn (2008)	H

(*Continued*)

Table 2. (Continued).

Study Author/s (Date) Location	Study Design (R/NR)[a]	N as (ITT/C/CDS)[b]	Subsamples (n)[c]	Patient Characteristics[d]	Therapy Name[e]	Therapy Structure[f]	Manual author/s (Date)	Quality Rating[g]
Frostad et al. (2021) Norway	Case Series (NR)	ITT = 21 C = 10*	NA	25.9 BMI 14.9 ID 7.8 (C)	CBT-E	Indiv. In person 40 C →B	Fairburn (2008)	M
Gu et al. (2021) China	Cohort (NR)	ITT = 37 (35* for analyses) C = 25	NA	17 (median) 94.29%F BMI 16.14 (median) (ITT)	G-CBT	Group In person 10 Varied C →B E	Fairburn (2008)	M
Hamatani et al. (2022) Japan	Case Series (NR)	ITT = 14* C = 12	NA	29.7 100%F BMI 14.89 (ITT)	ICBT	Indiv. Online 12	NA	H
Hay et al. (2018) Australia, UK, & USA	RCT (R)	ITT = 78* C = 43	CBT-AN + LEAP (38) CBT-AN (40)	26.1 & 28.6 97.40%F BMI 16.58 & 16.47 (ITT)	CBT-AN + LEAP or CBT-AN only	Indiv. In person 34 Varied E	Pike et al. (2003)	H
Herzog et al. (2022) Germany	RCT (R)	ITT = 80* C = 72	NA	27.4 100%F BMI 16.82 100% white (ITT)	CBT-E	Indiv. In person 40 C →B E	Fairburn (2008)	H
Jenkins et al. (2019) UK	Cohort (NR)	ITT = 43* C = 24	NA	23.32 BMI 16.65 ID 5.85 85% white (Other) (ITT)	CBT-E	Indiv. In person 40 weekly C →B	Fairburn (2008)	H
Kessler et al. (2022) Norway	Case Series(NR)	ITT = 33* C = 10	NA	20 BMI 16.43 (ITT)	CBT-E	Indiv. In person 40 C →B E	Fairburn (2008)	M
Leung et al. (1999) UK	Case Series(NR)	ITT = 30 C = 20*	NA	26 100%F (C)	G-CBT	Group In person 10 weekly	NA	H

(*Continued*)

Table 2. (Continued).

Study Author/s (Date) Location	Study Design (R/NR)[a]	N as (ITT/C/CDS)[b]	Subsamples (n)[c]	Patient Characteristics[d]	Therapy Name[e]	Therapy Structure[f]	Manual author/s (Date)	Quality Rating[g]
Nyman-Carlsson et al. (2020) Sweden	RCT (R)	ITT = 38 C = 37*	NA	19.1 100%F BMI 16.49 ID 2.63 (C)	CBT-YA	Indiv. In person 60 Varied C →B E	Bespoke (based on Fairburn et al., 2003; Fairburn & Wilson, 1993)	H
Ricca et al. (2010) Italy	Cohort (NR)	ITT = 53* C = 43	NA	27.48 100%F BMI 15.58 ID 6.22 (ITT)	CBT	Indiv. In person 40 weekly E	Garner et al. (1997); Pike et al. (1996)	H
Rossi et al. (2021) Italy	Cohort (NR)	C = 73* (ITT not reported for subsample of interest)	NA	25.73 100%F BMI 16.25 ID 6.79 (C)	CBT-E	Indiv. In person 40 weekly C →B E	Fairburn (2008)	H
Rossi et al. (2024) Italy	Quasi-Experimental (NR)	ITT = 111 C = 107**	CBT-E + early trauma (40) CBT-E + early trauma + EMDR (17) CBT-E + no early trauma (50)	25.54, 25.12, & 22.84 100%F BMI 16.82, 16.97, & 16.73 ID 8.52, 9.39, & 4.52 (C)	CBT-E	Indiv. In person 40 Varied C →B E	Fairburn (2008)	M
Serfaty et al. (1999) UK	RCT (R)	ITT = 25* C = 23	NA	22.1 92%F BMI 16.1 ID 5 (ITT)	CT	Indiv. In person 20 weekly C →B E	Manual not named	M
Touyz et al. (2013) Australia & UK	RCT (R)	ITT = 31* C = 28	NA	34.6 100%F BMI 16.3 ID 17.7 (ITT)	CBT-AN	Indiv. In person 30 E	Pike et al. (2003)	M

(*Continued*)

Table 2. (Continued).

Study Author/s (Date) Location	Study Design (R/NR)[a]	N as (ITT/C/CDS)[b]	Subsamples (n)[c]	Patient Characteristics[d]	Therapy Name[e]	Therapy Structure[f]	Manual author/s (Date)	Quality Rating[g]
Watson et al. (2012) Australia	Cohort (NR)	ITT = 34* C = 11	NA	25.21 97%F BMI 15.85 ID 9.35 (ITT)	CBT-E	Indiv & Group In person 50 weekly C →B	Fairburn (2008)	M

NA = not applicable. Full reference list of included papers is given in Appendix C.

[a]R= Random participant allocation, NR = non-random participant allocation, RCT = randomised controlled trial.

[b]Patients with anorexia nervosa allocated to CBT. ITT = intention to treat, C = completers, CDS = complete dataset, meaning that all patients allocated to start CBT completed a full course of treatment. *N used in meta-analyses.

[c]Reported n for subsamples of N included in the meta-analyses. Adol. = adolescents.

[d]Reported by subgroup (if applicable) in the order presented in the previous column. Mean age (years), sex (% female), mean baseline BMI, ID = mean illness duration (in years), ethnicity (% white, other ethnicities if reported), type of data reported.

[e]CBT = Cognitive-Behavioural Therapy, CBT-AN = CBT for Anorexia Nervosa, CBT-E = Enhanced CBT, CBT-YA = CBT for Young Adults, ICBT = Internet-based CBT, CT = Cognitive Therapy, EMDR = Eye Movement Desensitisation and Reprocessing, G-CBT = Group CBT, LEAP = CompuLsive Exercise Activity TheraPy, NC = nutritional counselling, Psychoed. = psychoeducation..

[f]Delivery mode (Indiv. = individual), protocol number of sessions, session frequency, B →C = behavioural interventions delivered predominantly before cognitive interventions or C →B = cognitive interventions delivered predominantly before behavioural interventions, E = experienced therapists.

[g]Based on a percentage of affirmative answers to CASP form questions. H = high (≥66.7%), M= medium (33.4% − 66.6%), L = low (≤33.3%). Further details are given Appendix B and See Supplementary materials.

Risk of bias assessment

Risk of bias was assessed using the Cochrane Risk of Bias 2 (RoB 2; Sterne et al., 2019) for RCTs, the Newcastle-Ottawa Scale (NOS; Wells et al., n.d.) for case-control and cohort studies, and the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Case Series (Munn et al., 2020). The RoB 2 provides domain-specific and overall indications of risk of bias (low risk, some concerns, high risk). The NOS gives star ratings for the three categories in its scales (case-control: selection, comparability, exposure; cohort: selection, comparability, outcome). The total number of stars (maximum = 9) gives an overall indication of risk of bias, with more stars indicating lower risk of bias. The JBI Critical Appraisal Checklist for Case Series contains 10 questions (yes, no, or unsure). Higher numbers of "yes" responses indicate lower risk of bias, and higher numbers of "no" and "unsure" responses indicate higher risk of bias.

Data analysis

Data were synthesised using the Meta-Essentials workbooks (Suurmond et al., 2017), which allow for meta-analyses and moderator analyses of parametric data. Intention to treat data were prioritised over completer data wherever possible to minimise completer bias and to maintain sample sizes and between-group comparability in randomised studies (Ranganathan et al., 2016). Statistical significance was reported at $p < .05$ following Holm-Bonferroni corrections (Holm, 1979) for multiple comparisons to correct for the family-wise Type 1 error rate.

Meta-analyses

Given the included studies' expected heterogeneity, a random-effects model was chosen to calculate pooled effect size estimates (standardised mean difference) and 95% confidence intervals for each outcome variable. For random-effects models, Meta-Essentials uses inverse variance weighing plus a between-studies variant component based on the DerSimonian Laird estimator (DerSimonian & Laird, 1986; Van Rhee et al., 2018, p. 33). Workbooks automatically pool studies in the same way for all analyses. Effect sizes were reported as Hedges g and interpreted using Cohen's (1992) criteria. The Q-statistic (and associated p-value) was used to test whether statistically significant heterogeneity was present (Higgins et al., 2003).

Measures for all outcome variables except for quality of life were scored in the same direction and were therefore entered straight into Meta-Essentials. For measures where decreasing scores indicated improved quality of life, effect sizes were first calculated using a within-subjects effect size calculator (Virginia Tech, 2021), and then entered into Meta-Essentials to standardise the direction of effect so that positive effect sizes reflected better quality of life.

Moderator analyses

Pre-planned moderator analyses were conducted to explore possible causes of heterogeneity in meta-analyses with sufficient studies ($k > 10$) (Higgins et al., 2023). Subgroup

analyses were planned for the binary categorical variables of manual use, ASD diagnoses, and order of interventions. Separate meta-regression analyses were planned for the continuous moderator variables of mean age (in years), mean illness duration (in years), mean baseline BMI, and the protocol number of sessions. For all moderator analyses, heterogeneity was assessed as previously described.

A post-hoc potential moderator of dropout rates was added because high dropout rates might indicate potential issues with the quality of included studies or the quality of the intervention being delivered, possibly causing bias that could explain some heterogeneity in meta-analyses and limit the generalisability of the findings (Barrett et al., 2008; Bell et al., 2013). Outpatient therapies for anorexia nervosa have reported dropout of 20% to 40% (DeJong et al., 2012). For this review, the percentage dropout rate for outpatients with anorexia nervosa was calculated from patients allocated to receive CBT and those completing treatment. Dropout rates were pooled using the same meta-analytic method as previously described.

Publication bias

Publication bias was assessed in meta-analyses with sufficient studies ($k > 10$) (Higgins et al., 2023), primarily by inspecting funnel plots of standard error plotted against effect sizes. Egger's regression statistics were also reported to assess the statistical significance of any potential bias (Egger, Smith, et al., 1997).

Sensitivity analyses

Sensitivity analyses tested the robustness of the meta-analytic results for primary outcome variables (Deeks et al., 2023). The studies selected for removal as part of the sensitivity analyses were those identified as potential outliers or with a higher risk of bias. Sensitivity analyses were not conducted for secondary outcome variables because the number of included studies was low ($k < 10$), so removing papers could have disproportionately impacted the results.

Results

Included studies

Academic database searches identified 4032 studies, and grey literature searches identified 4829 studies (Figure 1). Following de-duplication and screening by title and abstract, 219 articles from the academic databases and 43 from the grey literature were sought for retrieval. At full-text screening, of the 218 academic database articles retrieved, 192 were excluded, and of the 30 grey literature articles retrieved, all were excluded, resulting in a total of 26 studies for inclusion in this review (Appendix C).

Study characteristics

Table 2 reports the characteristics of the 26 included studies and their quality ratings. Sample sizes of outpatients with anorexia nervosa allocated to receive

CBT ranged from 13 to 120 participants, with completer sample sizes ranging from nine to 105 participants. There were 24 (92.31%) journal articles, one (3.85%) PhD thesis, and one (3.85%) letter. Twenty-five (96.15%) studies (except the 1998 thesis) were peer-reviewed and published between 1999 and 2024. There were nine (34.62%) case series, eight (30.77%) cohort studies, seven (26.92%) RCTs, one (3.85%) case-control study, and one (3.85%) quasi-experimental study. Nine (34.62%) studies were from Italy, four (15.38%) from the UK, three (11.54%) each from Australia and Norway, three (11.54%) from multiple countries (UK and Italy; Australia, UK, and USA; Australia and UK), and one (3.85%) each from China, Germany, Japan, and Sweden. Participants were adolescents and adults (92–100% female), with a mean age range of 15.5–34.6 years and mean illness duration of 0.5–9.39 years.

Quality assessment

The included studies were rated as medium-to-high quality (Table 2), with scores ranging from 50%-83.33% (Appendix B). Seventeen (65.38%) papers rated using the cohort studies form scored from 50–83.33%, two (7.69%) papers rated using the case-control studies form scored from 63.64–80.00%, and seven (26.92%) papers rated using the RCT form scored from 53.85–76.92%. Lack of clarity in identifying and accounting for confounding variables and insufficient follow-up were common reasons for lower quality scores for studies assessed using the cohort or case-control CASP forms. For RCTs, a lack of novel interventions and clarity in the appropriacy of blinding procedures were common reasons for lower quality scores.

Risk of bias assessments

Appendix D contains the risk of bias assessment results. Seven (26.92%) RCTs were assessed using the RoB 2 tool for the primary outcomes of pre- to post-treatment weight and eating disorder symptoms. Four (15.38%) RCTs were also assessed for the secondary outcomes of pre-to-post-treatment depression, and two (7.69%) for anxiety and quality of life. Across all outcomes, two (7.69%) RCTs were rated as raising "some concerns", and the other five (19.25%) were "low risk". Two (7.69%) were assessed using the NOS case-control tool and scored seven and eight out of nine stars, suggesting low risk of bias. Seven (26.92%) were assessed using the NOS cohort tool. Three (11.54%) scored seven and four (15.38%) scored eight out of nine stars, suggesting low risk of bias. Nine (34.62%) studies were assessed using the JBI Critical Appraisal Checklist for Case Series. Out of a total score of ten, five (19.25%) studies scored nine, two (7.69%) scored eight, one (3.85%) scored seven, and one (3.85%) scored four. While studies scoring seven and higher suggest a low risk of bias, the score of four was a potential concern. The reason for two studies having "some concerns" in the RoB 2 assessments was due to incomplete reporting on allocation sequence concealment until after participants' enrolment. The low-scoring study in the JBI assessment was an older one, which reported limited details.

Meta-analyses

To address this review's first research question, meta-analyses were conducted for the pre- to post-treatment primary outcome variables of weight and eating disorder symptoms. Pre- to post-treatment meta-analyses were then conducted for secondary outcome variables of depression, anxiety, and quality of life. Exploratory analyses of the primary outcome variables were also conducted—pre-treatment to early change, and pre-treatment to follow-up.

Sensitivity analyses

Appendix E shows the results of sensitivity analyses for the pre- to post-treatment meta-analyses of the primary outcome variables. Five studies were identified for removal from the dataset and rerunning of the meta-analyses. Gu et al. (2021) was removed to test the impact of converted data (non-parametric to parametric data) on outcomes, Cassioli et al. (2022) was removed to test the impact of their large sample size on outcomes, and Ball (1998), Leung et al. (1999), and Touyz et al. (2013) were removed to test the impact of their higher risk of bias scores on outcomes. There were no significant differences between the meta-analyses using the complete dataset and the meta-analyses with the above papers removed. Therefore, this paper reports the results of meta-analyses using the complete dataset.

Primary outcome variables

Figure 2 shows the meta-analytic results for pre- to post-CBT change in weight for 24 studies across 30 comparisons ($N = 1280$). Higher scores indicate greater increase in patients' weight. Post-CBT increases in weight were large and statistically significant (g = 0.87; 95% CI 0.67–1.08; Z = 8.63, $p < .001$). Between-study heterogeneity was statistically significant (Q = 182.62, $p < .001$).

Figure 3 shows the meta-analytic results of pre- to post-CBT change in eating disorder symptoms for 21 studies across 26 comparisons ($N = 1101$). Negative scores indicate a decrease in patients' reported eating disorder symptoms (i.e. better outcomes). Post-CBT decreases in eating disorder symptoms were medium-large and statistically significant (g = −0.74; 95% CI −0.93 - −0.54; Z = −7.83, $p < .001$). Between-study heterogeneity was statistically significant (Q = 192.87, $p < .001$).

Figure 4 shows funnel plots for the meta-analyses of pre-to-post-CBT changes in weight and eating disorder symptoms. Both plots suggest evidence of skew. Egger's regression was statistically significant for weight (B = −2.11; 95% CI −3.57 - −0.64; $t = 4.19$, $p < .001$), suggesting potential systematic bias in the available literature. However, Egger's regression was not statistically significant for eating disorder symptoms.

Secondary outcome variables

Figures 5–7 show the meta-analytic results of pre- to post-CBT changes in the secondary outcome variables of depression, anxiety, and quality of life, respectively. For all three

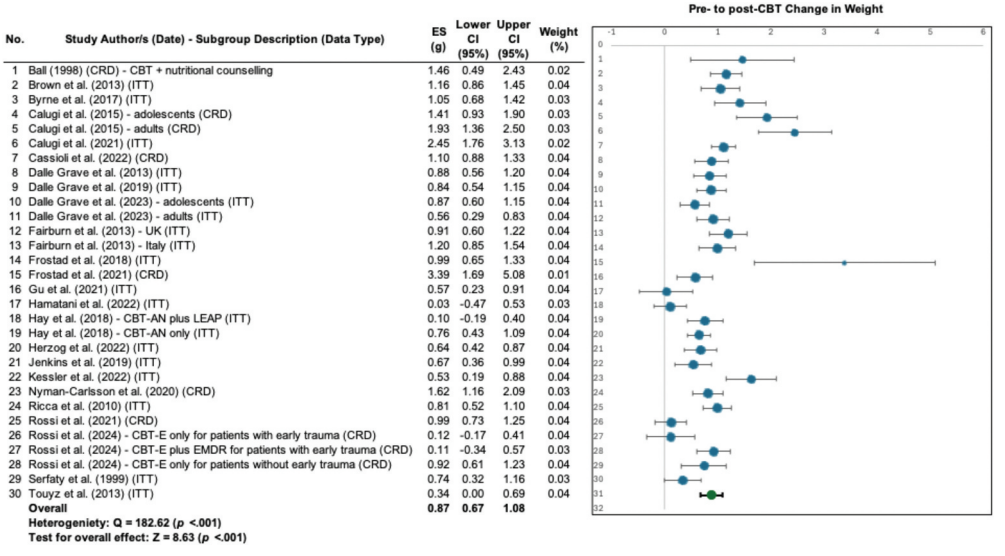


Figure 2. Forest plot of pre- to post-CBT effect sizes for the primary outcome variable of weight. CRD = completer data, CDS = complete dataset (i.e. all participants allocated to CBT completed treatment), ITT = intention to treat data.

secondary outcome variables, there were insufficient studies ($k < 10$) to test for publication bias.

Figure 5 shows the meta-analytic results of pre- to post-CBT change in depression for six studies across six comparisons ($N = 216$). Lower scores indicate a decrease in patients' reported depressive symptoms. Post-CBT decreases in depression were medium and statistically significant (g = −0.62; 95% CI −0.88 –

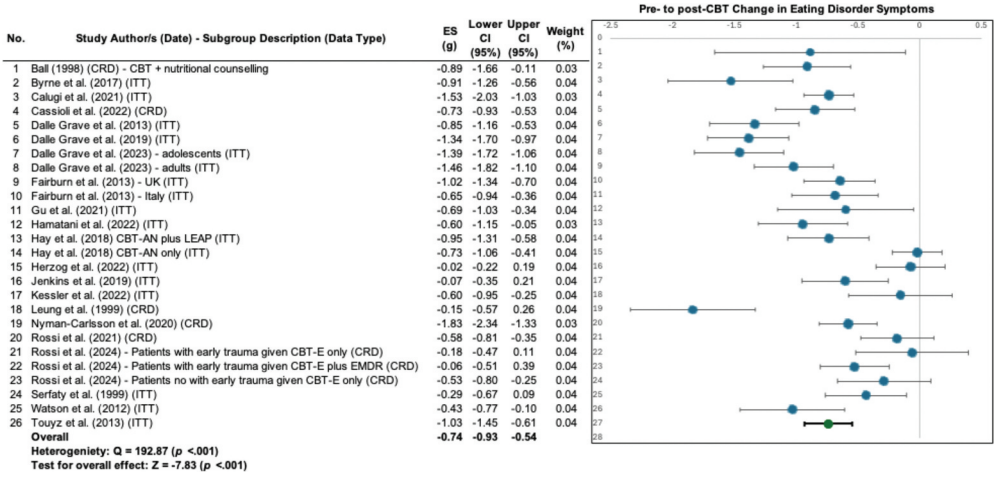


Figure 3. Forest plot of pre- to post-CBT effect sizes for the primary outcome variable of eating disorder symptoms. CRD = completer data, CDS = complete dataset (i.e. all participants allocated to CBT completed treatment), ITT = intention to treat data.

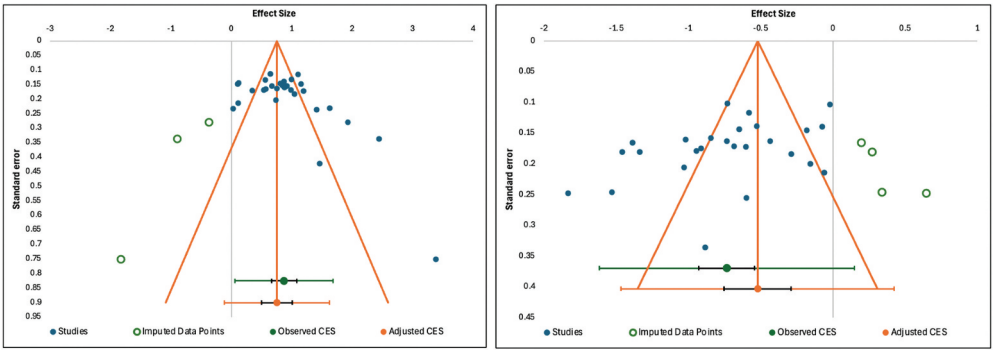
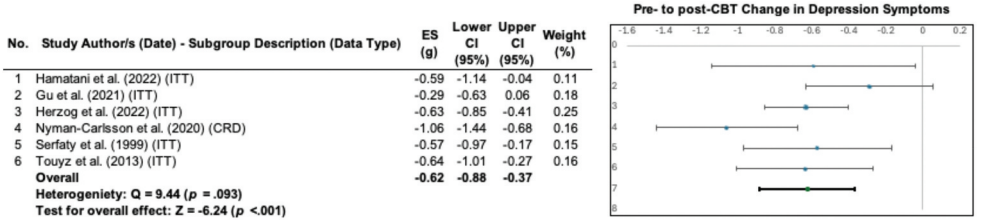


Figure 4. Funnel plots for the pre to post-CBT effect sizes for the primary outcome variables of weight and eating disorder symptoms.



No.	Study Author/s (Date) - Subgroup Description (Data Type)	ES (g)	Lower CI (95%)	Upper CI (95%)	Weight (%)
1	Hamatani et al. (2022) (ITT)	-0.59	-1.14	-0.04	0.11
2	Gu et al. (2021) (ITT)	-0.29	-0.63	0.06	0.18
3	Herzog et al. (2022) (ITT)	-0.63	-0.85	-0.41	0.25
4	Nyman-Carlsson et al. (2020) (CRD)	-1.06	-1.44	-0.68	0.16
5	Serfaty et al. (1999) (ITT)	-0.57	-0.97	-0.17	0.15
6	Touyz et al. (2013) (ITT)	-0.64	-1.01	-0.27	0.16
	Overall	**-0.62**	**-0.88**	**-0.37**	
	Heterogeneity: Q = 9.44 (p = .093)				
	Test for overall effect: Z = -6.24 (p <.001)				

Figure 5. Forest plot of pre- to post-CBT effect sizes for the secondary outcome variable of depression. CRD = completer data, CDS = complete dataset (i.e. all participants allocated to CBT completed treatment), ITT = intention to treat data.

No.	Study Author/s (Date) - Subgroup Description (Data Type)	ES (g)	Lower CI (95%)	Upper CI (95%)	Weight (%)
1	Ball (1998) (CRD) - CBT + nutritional counselling	-0.86	-1.63	-0.09	0.25
2	Gu et al. (2021) (ITT)	-0.33	-0.65	-0.01	0.46
3	Hamatani et al. (2022) (ITT)	-0.90	-1.51	-0.30	0.30
	Overall	**-0.63**	**-1.48**	**0.22**	
	Heterogeneity: Q = 4.42 (p = .110)				
	Test for overall effect: Z = -3.20 (p = .001)				

Figure 6. Forest plot of pre- to post-CBT effect sizes for the secondary outcome variable of anxiety. CRD = completer data, CDS = complete dataset (i.e. all participants allocated to CBT completed treatment), ITT = intention to treat data.

−0.37; Z = −6.24, $p < .001$). Between-study heterogeneity was not statistically significant.

Figure 6 shows the meta-analytic results of pre- to post-CBT change in anxiety for three studies across three comparisons ($N = 58$). Lower scores indicate a decrease in patients' reported anxiety symptoms. Post-CBT decreases in anxiety were medium and statistically significant (g = −0.63; 95% CI −1.48 – 0.22; Z = −3.20, $p < .001$). Between-study heterogeneity was not statistically significant.

Figure 7 shows the meta-analytic results of pre- to post-CBT change in quality of life for eight studies across 10 comparisons ($N = 389$). Higher scores indicate an increase in patients' reported quality of life. Post-CBT increases in quality of life were large and

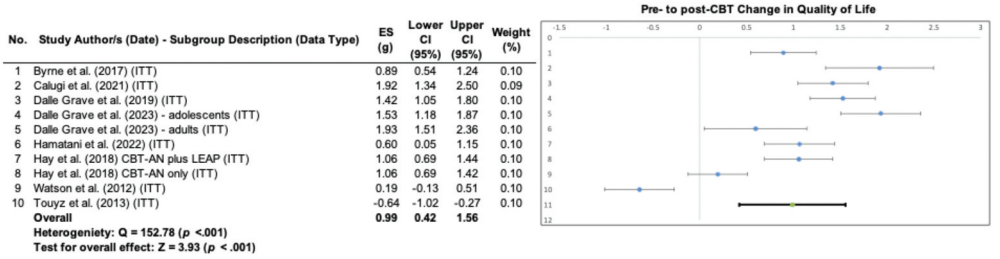


Figure 7. Forest plot of pre- to post-CBT effect sizes for the secondary outcome variable of quality of life. CRD = completer data, CDS = complete dataset (i.e. all participants allocated to CBT completed treatment), ITT = intention to treat data.

Table 3. Summary of pre- to post-CBT meta-analyses for the primary and secondary outcome variables.

Outcome Variable	K[a]	n[b]	N	ES (g)	SE	Lower CI (95%)	Upper CI (95%)	Z	p^c
Weight	24	30	1280	0.87	0.10	0.67	1.08	8.63	<.001
Eating Disorder Symptoms	21	26	1101	−0.74	0.09	−0.93	−0.54	−7.83	<.001
Depression	6	6	216	−0.62	0.10	−0.88	−0.37	−6.24	<.001
Anxiety	3	3	58	−0.63	0.20	−1.48	0.22	−3.20	<.001
Quality of Life	8	10	389	0.99	0.25	0.42	1.56	3.93	<.001

Two-tailed *p*-values are reported.
[a]k = Number of included studies.
[b]n= Number of comparisons (i.e. individual studies and subgroups within studies included in the meta-analysis).
[c]$p < .05$ following Holm-Bonferroni (Holm, 1979) correction for multiple comparisons.

statistically significant (g = 0.99; 95% CI 0.42–1.56; Z = 3.93, $p < .001$). Between-study heterogeneity was statistically significant (Q = 152.78, $p < .001$).

Table 3 summarises the outcomes of the pre- to post-CBT meta-analyses for the primary and secondary outcome variables. It shows that outpatient CBT works well for patients with anorexia nervosa, with medium-to-large effect size estimates for all five outcome measures.

Impact of CBT at different measurement points

Table 4 shows the results of further exploration of the primary outcome variables of weight and eating disorder symptoms, comparing scores at baseline with scores across three time points: early change (as defined in the papers, ranging from one to four months into treatment), immediately post-treatment, and at follow-up (as defined in the papers, ranging from six months to 60 weeks after treatment end).

Effect sizes increased at each time point for both variables. Early change showed small, significant effects for weight (g = 0.34; 95% CI −0.25 – 0.93; Z = 2.47, $p = .013$) and medium, significant effects for eating disorder symptoms (g = −0.51; 95% CI −1.10-0.07; Z = 11.17, $p < .001$). However, caution must be taken when interpreting these results given small sample sizes (k = 3 and 2 respectively). Between-study heterogeneity was not statistically significant (Supplementary Materials Figures D.1 and D.4).

At follow-up, there were large, significant effect sizes (weight: g = 0.90; 95% CI 0.68–1.13; Z = 8.50, $p < .001$; eating disorder symptoms: g = −0.99; 95% CI −1.22 -

Table 4. Summary of meta-analyses for early change, treatment end, and follow-up changes in the primary outcome variables.

Outcome Variable	Time 2[a]	k[b]	n[c]	N	ES (g)	SE	Lower CI (95%)	Upper CI (95%)	Z	p[d]
Weight	Early change	3	3	172	0.34	0.14	−0.25	0.93	2.47	.013
	Treatment end	24	30	1280	0.87	0.10	0.67	1.08	10.22	<.001
	Follow up	13	16	709	0.90	0.11	0.68	1.13	8.50	<.001
Eating Disorder Symptoms	Early change	2	2	74	−0.51	0.05	−1.10	0.07	−11.17	<.001
	Treatment end	21	26	1101	−0.74	0.09	−0.93	−0.54	−7.83	<.001
	Follow up	11	15	685	−0.99	0.11	−1.22	−0.76	−9.20	<.001

Two-tailed *p*-values are reported.
[a]Time 2 comparator with pre-treatment (baseline) scores as Time 1 for all meta-analyses.
[b]k = Number of included studies.
[c]n= Number of comparisons (i.e. individual studies and subgroups within studies included in the meta-analysis).
[d]$p < .05$ following Holm-Bonferroni (Holm, 1979) correction for multiple comparisons.

−0.76; Z = −9.20, $p < .001$). Between-study heterogeneity was statistically significant (weight: Q = 65.43, $p < .001$; eating disorder symptoms: Q = 97.60, $p < .001$) (Supplementary Materials Figures D.2 and D.5).

Funnel plots (Supplementary Materials Figures D.3 and D.6) showed limited evidence of skew at early change and follow-up for both variables. For early change, Egger's regression was not statistically significant for weight and not calculable in Meta-Essentials for eating disorder symptoms (fewer than three studies). However, Egger's regression was significant for weight at follow-up (B = −1.02; 95% CI −2.08 to 0.04; t = 3.91, $p < .05$) and eating disorder symptoms (B = 2.90; 95% CI −0.79 to 6.59; t = −2.26, $p < .05$), implying potential systematic bias in the available literature.

In sum, cumulative improvements were found in weight and eating disorder symptoms across the three time periods of early change, post-treatment, and follow-up for outpatients with anorexia nervosa treated with CBT.

Moderator analyses

To address the second research question, moderator analyses were conducted for the pre- to post-CBT primary outcome variables (weight; eating disorder symptoms). As k < 10, moderator analyses were not conducted for the secondary outcome variables of depression, anxiety, and quality of life. Also, the planned subgroup analyses (ASD diagnosis, manual use, order of interventions) were not feasible, as no included papers reported ASD diagnoses, all but two papers (Hamatani et al., 2022; Leung et al., 1999) followed a manual, and only one paper (Brown et al., 2013) reported using a manual where the order of interventions was behavioural first.

Table 5 shows the results of separate meta-regression analyses for mean age, mean illness duration, mean baseline BMI, protocol number of sessions, and dropout rates. For the outcome variable of weight, mean baseline BMI (B = −0.48, 95% CI −0.83 - −0.13, Z = −2.83, $p < .05$) was a significant moderator. Post-treatment, patients starting CBT at a lower BMI gained more weight by the end of treatment than those starting out at a higher weight. Age, illness duration, protocol number of sessions, and dropout rates were not statistically significant moderators of weight. None of the moderator variables were statistically significant for eating disorder symptoms.

Table 5. Meta-regression analyses for pre-to post-CBT changes in the primary outcome variables.

Outcome Variable	Moderator Variable	n[a]	B-coefficient	SE	Lower CI (95%)	Upper CI (95%)	Z	p^b	R^2 (%)
Weight	Mean age (years)	28	−0.03	0.02	−0.06	0.01	−1.61	.107	5.46
	Mean illness duration (years)	18	−0.05	0.02	−0.10	0.00	−2.11	.035	12.71
	Mean baseline BMI	26	−0.48	0.17	−0.83	−0.13	−2.83	.005	10.46
	Protocol No. Sessions	30	0.02	0.01	0.00	0.04	2.57	.010	12.72
	Dropout Rate	29	0.01	0.00	0.00	0.02	1.29	.199	3.64
Eating Disorder Symptoms	Mean age (years)	25	0.04	0.02	0.00	0.08	2.28	.023	16.05
	Mean illness duration (years)	16	0.03	0.02	−0.02	0.07	1.38	.167	10.73
	Mean baseline BMI	22	0.32	0.17	−0.04	0.67	1.85	.064	12.17
	Protocol No. Sessions	26	−0.01	0.01	−0.03	0.00	−1.60	.109	9.33
	Dropout Rate	25	0.00	0.01	−0.01	0.01	−0.46	.645	0.84

Two-tailed *p*-values are reported.
[a]n = Number of comparisons (i.e. individual studies and subgroups within studies included in the meta-analysis).
[b]$p < .05$ following Holm-Bonferroni (Holm, 1979) correction for multiple comparisons.

Discussion

This systematic review and meta-analysis aimed to determine how well CBT works for outpatients with anorexia nervosa, and whether therapy factors and patient characteristics affect outcomes. Meta-analyses examined CBT's effectiveness and potential moderators of weight and eating disorder symptoms. Systematic searches found 26 medium- to high-quality studies of adolescent and adult outpatients with anorexia nervosa allocated to receive CBT. Meta-analyses showed that CBT worked well for outpatients with anorexia nervosa. Weight and eating disorder symptoms improved to follow-up. Baseline BMI moderated weight gain. To the authors' knowledge, this is the first in-depth review of outpatient CBT for anorexia nervosa that explores potential moderators.

Primary outcomes

This review extends and supports previous research, demonstrating that outpatient CBT is an effective treatment for anorexia nervosa. Medium-large post-treatment effect sizes were identified for the primary outcomes of weight (g = 0.87; 95% CI 0.67–1.08) and eating disorder symptoms (g = −0.74; 95% CI −0.93 - −0.54), and for the secondary outcomes of depression, anxiety, and quality of life. Weight and eating disorder symptoms significantly improved across three time points: early change, post-treatment, and follow-up.

These effect sizes are broadly similar to those reported in previous research on outpatients with anorexia nervosa (Hay et al., 2015; Linardon, Piedad Garcia, et al., 2017; NICE, 2017; Öst et al., 2024; Solmi et al., 2021). Previous reviews also found CBT of equivalent effectiveness to other evidence-based psychotherapies (Linardon, Piedad Garcia, et al., 2017; NICE, 2017) or treatment as usual (TAU) (Hay et al., 2015; Solmi et al., 2021), referring to a combination of medical monitoring, including regular weighing, and nutritional and psychotherapeutic interventions. The ubiquitous use of TAU interventions in psychotherapy potentially accounts for a large proportion of effects and might explain the lack of differentiation between CBT and other psychotherapies (Solmi et al., 2021). Hence, CBT's effectiveness as a stand-alone component of the overall treatment might be lower than the current

findings. Öst et al.'s (2024) very large post-CBT effect sizes for patients with anorexia nervosa (BMI: g = 2.30, 95% CI 1.87–2.73; eating disorder symptoms: g = 1.46, 95% CI 1.12–1.79) are also likely to be overinflated because they included so few studies. Compared with this review's 24 included studies for the meta-analysis of weight and 21 for eating disorder symptoms, Öst et al.'s (2024) meta-analyses had just 11 and 10 studies, respectively. This review's larger sample sizes were likely due to its broader inclusion criteria (i.e., any age, study design, first- or second-wave CBT interventions), despite specifying only outpatients. It also used a different academic database (SCOPUS rather than Embase) and included grey literature searches. Hence, the more conservative effect sizes in the present review might have greater reliability, and it is recommended that future reviews keep inclusion criteria broad to capture the wider literature.

To summarise, the current review contributes to the field of eating disorder research by providing empirical evidence that outpatient CBT not only works well for anorexia nervosa but that outcomes are maintained and improve over time. While unable to distinguish the contribution of TAU elements in CBT, the medium-large effect sizes reported in this review can be considered a reliable indicator of outpatient CBT's effectiveness, suggesting that clinicians can expect good outcomes for their patients if applying the therapy appropriately.

Potential moderators

This review also explored potential moderators (mean age, mean illness duration, mean baseline BMI, protocol number of sessions, dropout rates) for the primary outcome variables of weight and eating disorder symptoms. Only baseline BMI was a statistically significant moderator of weight gain. None were statistically significant moderators of eating disorder symptoms.

These findings contribute new insights into whether therapy factors and patient characteristics affect how well CBT works for outpatients with anorexia nervosa. Regarding patient characteristics, CBT works well for patients regardless of starting weight, age, or illness duration. Lower starting weight actually predicted better levels of weight gain, and did not impair improvement in eating disorder symptoms (Dalle Grave et al., 2018). Furthermore, illness duration was not relevant to levels of improvement, as shown previously (Craig et al., 2019; Radunz et al., 2020; Raykos et al., 2018), adding to the evidence that terms like chronic, persistent, or severe and enduring eating disorders are irrelevant when considering treatment effectiveness.

The lack of effect of protocol-based duration of therapy supports evidence that longer therapies might not be more effective than briefer ones, even for underweight patients (Bell et al., 2017; Pellizzer et al., 2019; Rose et al., 2021; Tatham et al., 2020). However, this result must be interpreted cautiously, given the limited number of studies with shorter protocol durations. The non-significance of dropout rates lends weight to the reliability of this review's reported effect sizes, as it implies that dropout was handled appropriately in the included studies' analyses.

Limitations of included studies

To summarise, the results of moderator analyses demonstrate that outpatient CBT works well for patients with anorexia nervosa, irrespective of baseline BMI, age, illness duration, protocol duration of therapy, and dropout rates. However, results must be interpreted in the context of the included studies' limitations. First, relatively few reported the necessary minimum data (pre- to post-CBT weight and/or eating disorder symptoms), resulting in excluding 36 studies. For anorexia nervosa, the importance of these outcome measures is well established (Bulik et al., 2007), making the lack of consistent reporting in the literature problematic and potentially indicative of reporting bias. Second, the included studies were predominantly conducted by a small group of Western researchers applying a broadly similar model of CBT (Fairburn, 2008), limiting the cultural generalisability of the findings. Third, patients were mostly female, and reporting of ethnicity was rare (where it was reported, patients were mostly white). Fourth, despite its purported comorbidity (Leppanen et al., 2022), none of the included studies reported ASD diagnoses, meaning that this potential moderator could not be explored within the existing literature.

Limitations of current review

Studies were only included when reported in English because of the reviewers' language limitations. This might have introduced English-language bias to the review (Egger, Zellweger-Zähner, et al., 1997; Rosenthal, 1979). It is therefore recommended that future reviews include non-English language studies wherever possible.

Additionally, this review was mostly conducted by a single reviewer due to limited resources. While a second reviewer independently completed data extraction and quality assessment for a sample of the included studies, and inter-rater reliability was broadly high overall, agreement in scoring the quality of individual studies varied considerably. Future researchers should consider having at least two reviewers wherever possible to augment the reliability and validity of their results.

There are limitations of pre- to post-treatment effect sizes as a measure of treatment effect, such as: inability to control all other factors that might influence intervention effects; non-independence leading to potential errors in standardised mean difference calculations; lack of reporting of pre-post correlations; and high heterogeneity of included studies. These can all negatively affect the reliability and validity of reported effect sizes (Cuijpers et al., 2017).

Meta-Essentials does not allow for multiple simultaneous moderator analyses. Therefore, results do not account for potential intercorrelations and might overestimate the effects of moderator analyses. Holm-Bonferroni corrections (Holm, 1979) have been applied to address this limitation. However, future reviewers might use meta-analytic software that supports multiple simultaneous moderator analyses.

Finally, the levels of heterogeneity identified in this review's meta-analyses were to be expected (Higgins, 2008), particularly given the broad inclusion criteria. However, such heterogeneity might limit the precision of effect size estimates, which must be interpreted cautiously.

Implications for research

Several recommendations can be made for researchers, all of which apply regardless of the therapy involved. First, when conducting intervention studies for anorexia nervosa, researchers should report weight and eating disorder outcomes as standard practice, and journals should make this a requirement of publication. Reporting these crucial patient outcomes would allow researchers and clinicians to assess treatment effectiveness more accurately. It would also be valuable to set remission/recovery criteria that were consistent across studies, to allow clear comparability.

Second, to avoid confusion, authors should publish outcomes and characteristics separately for patients diagnosed with anorexia nervosa and those diagnosed with atypical or subclinical anorexia nervosa, and criteria for diagnosis should also be clearly stated. This would allow researchers to conduct more nuanced outcome analyses, which is important given these patients' different baseline presentations and treatment needs (e.g., for weight gain).

Third, therapy factors and patient characteristics should be reported in as much detail as possible. That will allow future reviewers to conduct moderator and mediator analyses that improve understanding of how and for whom therapy works.

Fourth, papers rarely noted manual adherence. Researchers are advised to report on manual adherence to allow for a more accurate assessment of the extent to which clinicians follow protocol.

Finally, authors are encouraged to seek publication of weak and non-significant results to present an accurate picture of treatment effectiveness, and journals are encouraged to consider such papers regardless of outcome if the quality is adequate. That way, future reviews can be more certain of summarising the literature on the treatment of anorexia nervosa accurately.

Implications for clinical practice

If clinicians can engage patients with anorexia nervosa in a full course of outpatient CBT, results suggest good outcomes for adolescents and adults, regardless of issues such as age, severity or treatment duration. It is also important to aim for early change, but to push for sustained improvements across therapy and into the follow-up period. This strategy can lead to clinically meaningful benefits in terms of weight gain, eating disorder symptoms, quality of life, depression and anxiety. Finally, the lack of a link between suggested duration of treatment in the protocol and outcomes supports the focus on early change and briefer therapies recommended in the wider literature (e.g., NICE, 2017; Vall & Wade, 2015).

Conclusion

This systematic review and meta-analysis has established the effectiveness of outpatient CBT for anorexia nervosa, and is the first to explore potential moderators of its effectiveness. Results suggest an optimistic picture for outpatients with anorexia nervosa treated with CBT, with good outcomes regardless of starting weight, age, or illness duration. Clinicians are advised to start treatment early, monitor outcomes throughout,

and not stretch out therapy if improvements are not being made for the best patient outcomes. Researchers should aim to publish accurate and complete data to improve the evidence base for future reviews.

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Data availability statement

The data that support the findings of this study (full review dataset, reviewer guidelines for data extraction and quality assessments, and full risk of bias assessments) are openly available in ORDA (the University of Sheffield's research data repository provided by Figshare), at: https://doi.org/10.15131/shef.data.25673379.v3.

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Appendices

Appendix A

Table of Search Terms, Keywords, and Combinations.

Table A1. Full Details of Conducted Searches, including Search terms, Keywords, and Combinations.

Source Type	Source Name	Date of Last Search	Keywords & Combinations	Additional Details
Academic databases	SCOPUS	23/02/2024	CBT OR "cognitive behavio* therap*" OR "behavio* therap*" OR "cognitive therap*" AND anorexi*	• English language only. • Each term entered on separate lines of basic search function. • Title, abstract, and keyword search.
	APA PsycINFO via Ovid (1806 to February Week 3 2024)	23/02/2024	Cognitive behavior therapy OR behavior therapy OR cognitive therapy AND anorexia nervosa	• English language only. • Advanced keyword search. • Map term to subject heading box automatically ticked. • Used matched terms function and combined the subject headings as indicated in the keywords.
	MEDLINE via Ovid (Ovid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations, Daily and Versions 1946 to February 22, 2024)	23/02/2024	Cognitive behavior therapy OR behavior therapy OR cognitive therapy AND anorexia nervosa	• English language only. • Advanced keyword search. • Map term to subject heading box automatically ticked. • Used matched terms function and combined the subject headings as indicated in the keywords.
Hand searches of review papers	Galsworthy-Francis & Allan (2014)	30/01/2024	Cognitive behavior therapy OR behavior therapy OR cognitive therapy AND anorexia nervosa	• Read review papers and looked up studies of potential relevance. • Searched titles and abstracts in the references for keywords. • Checked potential papers against academic results to exclude if previously included or excluded. • Otherwise, full papers sought out for screening.
	Hay et al. (2015)	30/01/2024		
	National Institute for Health and Care Excellence (2017)	01/02/2024		
	Zeeck et al. (2018)	30/01/2024		
	Murray et al. (2019)	30/01/2024		
	Solmi et al. (2021)	30/01/2024		

(*Continued*)

Table A1. (Continued).

Source Type	Source Name	Date of Last Search	Keywords & Combinations	Additional Details
Grey literature databases	ProQuest Dissertations and Theses (via Web of Science)	30/01/2024	anorexi*	• Simple search within the Abstract field • "ProQuest Dissertations and Theses" selected from the "search in" drop-down menu. • When searches retrieved, selected "English language only". • Search retrieved better results with as few terms as possible.
	Conference Proceedings Citation Index (via Web of Science)	30/01/2024	anorexi* AND "cognitive behavio* therap*" OR "behavio* therap*" OR "cognitive therap*" OR CBT	• Simple search, adding each search term on a new line and searching within the Abstract field. • "Web of Science Core Collection" selected from the "search in" list. • "Conference Proceedings Citation Index – Science (CPCI-S)" and "Conference Proceedings Citation Index – Social Science & Humanities (CPCI-SSH)" selected from the drop down "editions" list. • When searches retrieved, selected "English language only".
	OSF Preprints	29/01/2024	anorexia	• Simple search (no advanced options) of the preprints only. • Required whole terms (not Boolean terms). • Search retrieved better results with as few terms as possible.
	OSF Registries	29/01/2024	anorexia	• Simple search (no advanced options). • Required whole terms (not Boolean terms). • Search retrieved better results with as few terms as possible.
	ISRCTN Registry	29/01/2024	CBT OR "cognitive behavio* therap*" OR "behavio* therap*" OR "cognitive therap*" AND anorexi*	• Advanced search (text search).
Other	Fingertip searches	01/02/2024	Cognitive behavior therapy OR behavior therapy OR cognitive therapy AND anorexia nervosa	• Potentially relevant papers spotted during full paper screening and in previous work were screened for inclusion.

Appendix B

CASP Tables for Quality Assessment of Included Studies.

Table B1. CASP Scores for studies assessed using the CASP cohort studies form.

Author/s (Publication Date)	CASP Question No.[a]												Total Score (No. Yes Responses)	Total Score (%)	Quality Rating[b]
	1	2	3	4	5a	5b	6a	6b	9	10	11	12			
Brown et al. (2013)	Y	Y	Y	Y	CT	CT	N	N	Y	CT	Y	Y	7	58.33	Medium
Calugi et al. (2015)	Y	Y	Y	Y	CT	CT	N	N	Y	Y	Y	Y	8	66.67	High
Calugi et al. (2021)	Y	Y	Y	Y	CT	CT	Y	Y	Y	Y	Y	Y	10	83.33	High
Dalle Grave et al. (2013)	Y	Y	Y	Y	CT	CT	Y	Y	Y	Y	Y	Y	10	83.33	High
Dalle Grave et al. (2019)	Y	Y	Y	Y	CT	CT	Y	CT	Y	CT	Y	Y	8	66.67	High
Dalle Grave et al. (2023)	Y	Y	Y	Y	CT	CT	Y	CT	Y	CT	Y	Y	8	66.67	High
Fairburn et al. (2013)	Y	Y	Y	Y	CT	CT	CT	CT	Y	Y	Y	Y	8	66.67	High
Frostad et al. (2018)	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y	8	66.67	High
Frostad et al. (2021)	Y	Y	CT	Y	CT	N	Y	Y	CT	N	Y	N	6	50.00	Medium
Gu et al. (2021)	Y	Y	Y	Y	CT	CT	CT	N	Y	N	Y	Y	7	58.33	Medium
Hamatani et al. (2022)	Y	Y	Y	Y	CT	CT	Y	Y	Y	CT	Y	Y	9	75.00	High
Jenkins et al. (2019)	Y	Y	Y	Y	CT	Y	N	N	Y	Y	Y	CT	8	66.67	High
Kessler et al. (2022)	Y	Y	Y	Y	CT	CT	N	N	Y	CT	Y	Y	7	58.33	Medium
Leung et al. (1999)	Y	Y	Y	Y	N	CT	N	N	Y	Y	Y	Y	8	66.67	High
Ricca et al. (2010)	Y	Y	Y	Y	CT	CT	Y	Y	Y	CT	Y	Y	9	75.00	High
Rossi et al. (2021)	Y	Y	Y	Y	CT	CT	Y	Y	Y	N	Y	Y	9	75.00	High
Watson et al. (2012)	Y	Y	Y	Y	CT	Y	CT	CT	Y	N	Y	N	7	58.33	Medium

[a]The CASP questions included in this quality assessment were those for which there were answers reported as yes (Y), no (N), and can't tell (CT), and were thus quantifiable. Questions seven and eight in this CASP form were qualitative and therefore excluded.

[b]The quality rating measures how many 'yes' answers were recorded and is scored as follows: High = 66.7% or higher, medium = 33.4% - 66.6%, and low = 33.3% or below.

Table B2. CASP Scores for studies assessed using the CASP case-control studies form.

Author/s (Publication Date)	CASP Question No.[a]										Total Score (No. Yes Responses)	Total Score (%)	Quality Rating[b]
	1	2	3	4	5	6a	6b	9	10	11			
Cassioli et al. (2022)	Y	Y	Y	CT	Y	Y	CT	Y	Y	Y	8	80.00	High
Rossi et al. (2024)	Y	Y	Y	Y	Y	Y	CT	Y	Y	CT	7	63.64	Medium

[a]The CASP questions included in this quality assessment were those for which there were answers reported as yes (Y), no (N), and can't tell (CT), and were thus quantifiable. Questions seven and eight in this CASP form were qualitative and therefore excluded.

[b]The quality rating measures how many 'yes' answers were recorded and is scored as follows: High = 66.7% or higher, medium = 33.4% - 66.6%, and low = 33.3% or below.

Table B3. CASP Scores for studies assessed using the CASP RCT form.

Author/s (Publication Date)	CASP Question No.[a]															
	1	2	3	4a	4b	4c	5	6	7	8	9	10	11	Total Score (No. Yes Responses)	Total Score (%)	Quality Rating[b]
Ball (1998)	Y	Y	Y	N	N	N	Y	CT	Y	N	Y	Y	N	7	53.85	Medium
Byrne et al. (2017)	Y	Y	Y	N	N	Y	Y	Y	CT	Y	Y	Y	N	9	69.23	High
Hay et al. (2018)	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	11	84.62	High
Herzog et al. (2022)	Y	Y	Y	CT	CT	CT	Y	Y	Y	Y	Y	Y	N	9	69.23	High
Nyman-Carlsson et al. (2020)	Y	Y	Y	CT	N	Y	Y	Y	Y	Y	Y	Y	N	10	76.92	High
Serfaty et al. (1999)	Y	Y	Y	N	N	CT	Y	CT	Y	Y	Y	Y	N	8	61.54	Medium
Touyz et al. (2013)	Y	Y	Y	N	Y	CT	Y	CT	Y	N	Y	Y	N	8	61.54	Medium

[a]The CASP questions included in this quality assessment were those for which there were answers reported as yes (Y), no (N), and can't tell (CT), and were thus quantifiable.
[b]The quality rating measures how many 'yes' answers were recorded and is scored as follows: High = 66.7% or higher, medium = 33.4% - 66.6%, and low = 33.3% or below.

Appendix C

References for the included studies.

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Appendix D

Risk of Bias Assessments for the Included Studies.

Table D1. RoB 2 scores for RCTs: pre- to-post-CBT primary outcome measure of weight.

	Domain Rating for Specified Outcome Variable					
	Low risk / Some concerns / High risk					Overall Risk of Bias Rating for Specified Outcome Variable
Author/s (Publication Date)	1	2	3	4	5	Low risk / Some concerns / High risk
Ball (1998)	Some concerns	Low risk	Low risk	Low risk	Some concerns	Some concerns
Byrne et al. (2017)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Hay et al. (2018)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Herzog et al. (2022)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Nyman-Carlsson et al. (2020)	High risk	Some concerns	Low risk	Low risk	Low risk	Low risk
Serfaty et al. (1999)	Some concerns	Low risk	Low risk	Low risk	Some concerns	Some concerns
Touyz et al. (2013)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk

Table D2. RoB 2 scores for RCTs: pre- to-post-CBT primary outcome measure of eating disorder symptoms.

	Domain Rating for Specified Outcome Variable					
	Low risk / Some concerns / High risk					Overall Risk of Bias Rating for Specified Outcome Variable
Author/s (Publication Date)	1	2	3	4	5	Low risk / Some concerns / High risk
Ball (1998)	Some concerns	Low risk	Low risk	Low risk	Some concerns	Some concerns
Byrne et al. (2017)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Hay et al. (2018)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Herzog et al. (2022)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Nyman-Carlsson et al. (2020)	High risk	Some concerns	Low risk	Low risk	Low risk	Low risk
Serfaty et al. (1999)	Some concerns	Low risk	Low risk	Low risk	Some concerns	Some concerns
Touyz et al. (2013)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk

Table D3. RoB 2 scores for RCTs: pre- to-post-CBT secondary outcome measure of depression.

	Domain Rating for Specified Outcome Variable					
	Low risk / Some concerns / High risk					Overall Risk of Bias Rating for Specified Outcome Variable
Author/s (Publication Date)	1	2	3	4	5	Low risk / Some concerns / High risk
Herzog et al. (2022)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk
Nyman-Carlsson et al. (2020)	High risk	Some concerns	Low risk	Low risk	Low risk	Low risk
Serfaty et al. (1999)	Some concerns	Low risk	Low risk	Low risk	Some concerns	Some concerns
Touyz et al. (2013)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk

Table D4. RoB 2 scores for RCTs: pre- to-post-CBT primary outcome measure of anxiety.

	Domain Rating for Specified Outcome Variable					
	Low risk / Some concerns / High risk					Overall Risk of Bias Rating for Specified Outcome Variable
Author/s (Publication Date)	1	2	3	4	5	Low risk / Some concerns / High risk
Ball (1998)	Some concerns	Low risk	Low risk	Low risk	Some concerns	Some concerns
Byrne et al. (2017)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk

Table D5. RoB 2 scores for RCTs: pre- to-post-CBT primary outcome measure of quality of life.

	Domain Rating for Specified Outcome Variable					
	Low risk / Some concerns / High risk					Overall Risk of Bias Rating for Specified Outcome Variable
Author/s (Publication Date)	1	2	3	4	5	Low risk / Some concerns / High risk
Hay et al. (2018)	Low risk	Low risk	Low risk	Low risk	Some concerns	Low risk
Touyz et al. (2013)	Low risk	Low risk	Low risk	Low risk	Low risk	Low risk

Table D6. Newcastle-Ottawa scale scores for case-control studies.

Author/s (Date)	Selection Scores out of 4 stars	Comparability Scores out of 2 stars	Exposure Scores out of 3 stars	Total No. Stars Scores out of 9
Cassioli et al. (2022)	4	2	1	7
Rossi et al. (2024)[a]	4	2	2	8

[a]The NOS Case Control form was used to assess this study because the first part of this study had a case-control design.

Table D7. Newcastle-Ottawa scale scores for cohort studies.

Author/s (Date)	Selection Scores out of 4 stars	Comparability Scores out of 2 stars	Outcome[ab] Scores out of 3 stars	Total No. Stars Scores out of 9
Calugi et al. (2015)	3	2	3	8
Dalle Grave et al. (2023)	3	2	2	7
Fairburn et al. (2013)	2	2	3	7
Jenkins et al. (2009)	3	2	2	7
Ricca et al. (2010)	3	2	3	8
Rossi et al. (2021)	3	2	3	8
Watson et al. (2012)	3	2	2	7

[a]The follow-up period selected for the primary outcomes of interest (weight and/or eating disorder symptoms) in the second question in the 'outcome' section was post-treatment to fit with the overall outcomes of interest in this review.
[b]A maximum 40% dropout rate (Dejong et al., 2012) (or 60% of Ps at follow-up) was decided as adequate for the third question in the 'outcome' section for the purpose of this assessment.

Table D8. Joanna Briggs Institute Critical Appraisal Checklist Scores for Case-Series Studies.

	JBI Question No.[a]										Total No. Responses		
Author/s (Date)	1	2	3	4	5	6	7	8	9	10	Y	N	U
Brown et al. (2013)	Y	Y	Y	U	U	Y	Y	Y	Y	Y	8	0	2
Calugi et al. (2021)	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	9	0	1
Dalle Grave et al. (2013)	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	9	1	0
Dalle Grave et al. (2019)	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	9	1	0
Frostad et al. (2018)	U	Y	Y	Y	N	Y	Y	Y	Y	Y	8	1	1
Frostad et al. (2021)	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	9	1	0
Hamatani et al. (2022)	Y	Y	Y	U	N	Y	Y	Y	U	Y	7	1	2
Kessler et al. (2022)	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	9	1	0
Leung et al. (1999)	U	Y	Y	Y	U	U	U	Y	N	N	4	2	4

[a]Responses to JBI questions were either yes (Y), no (N), or unknown (U). JBI Critical Appraisal Checklist for Case Series is downloadable at: https://jbi.global/critical-appraisal-tools

Appendix E. Sensitivity analyses: pre- to post-CBT meta-analyses for the primary outcome variables.

Outcome Variable	Description of Meta-Analysis	k^a	n^b	N	ES (g)	SE	Lower CI (95%)	Upper CI (95%)	Z	p^c
Weight	Complete dataset	24	30	1280	0.87	0.10	0.67	1.08	10.22	<.001
	Removed Gu et al. (2021)	23	29	1245	0.89	0.10	0.67	1.10	8.47	<.001
	Removed Cassioli et al. (2022)	23	29	1175	0.87	0.10	0.65	1.08	8.24	<.001
	Removed higher risk papers (Ball, 1998; Touyz et al. 2013)	22	28	1241	0.88	0.10	0.67	1.10	8.42	<.001
	Removed all four papers	20	26	1101	0.89	0.11	0.65	1.12	7.84	<.001
Eating Disorder Symptoms	Complete dataset	21	26	1101	−0.74	0.09	−0.93	−0.54	−7.83	<.001
	Removed Gu et al. (2021)	20	25	1066	−0.74	0.10	−0.94	−0.54	−7.54	<.001
	Removed Cassioli et al. (2022)	20	25	996	−0.74	0.10	−0.94	−0.53	−7.51	<.001
	Removed higher risk papers (Ball, 1998; Leung et al., 1999; Touyz et al. (2013)	18	23	1042	−0.74	0.10	−0.95	−0.53	−7.31	<.001
	Removed all five papers	16	21	902	−0.75	0.11	−0.98	−0.51	−6.68	<.001

Two-tailed p-values are reported.
[a]k = Number of included studies.
[b]n = Number of comparisons (i.e., individual studies and subgroups within studies included in the meta-analysis).
[c]$p < .05$