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# The Effectiveness of Transdiagnostic Applications of Competitive Memory Training (COMET) on Low Self-Esteem and Comorbid Depression: A Meta-analysis of Randomized Controlled Trials

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## Abstract

**Background** Low self-esteem is a relevant transdiagnostic condition in the etiology, manifestation, and aggravation of different types of psychopathology. While low self-esteem is expected to ameliorate automatically after successful treatment of the principal emotional disorder the patient is suffering from, this does not always happen. Therefore, several specific interventions for enhancing low self-esteem have been developed, amongst them competitive memory training or COMET. The current meta-analysis investigated the efficacy of COMET in a variety of patient populations.

**Methods** Several databases were simultaneously examined after which 11 randomized COMET studies were identified. They encompassed a total of 662 patients with a diversity of emotional disorders of whom 344 had been treated in the experimental COMET conditions. Effects of COMET were expressed as Hedges'  $g$  and were assessed on self-esteem and comorbid depression. When heterogeneity or publication bias were detected, original outcomes were corrected.

**Results** Low self-esteem was enhanced ( $g = 0.50$ ; after correction  $g = 0.61$ ), while comorbid depression was reduced ( $g = 0.68$ ; after correction  $g = 0.54$ ).

**Conclusions** COMET is a promising transdiagnostic intervention producing moderate enhancements in low self-esteem and moderate reductions in comorbid depression compared to control conditions in a variety of emotional disorders.

**Study Registration** Prospero ID: CRD42021237905.

**Keywords** Meta-analysis · Competitive memory training · COMET · Transdiagnostic · Self-esteem · Depression

## Introduction

Over the years self-esteem, and low self-esteem in particular has been a much debated topic in the academic discourse by psychologists at scholarly conferences and in scientific journals, as well as in the public discourse by journalists, politicians and writers. During the 1970s and 1980s an influential 'self-esteem movement' developed in the public area, mainly in parts of the United States. Propagators of this movement considered low self-esteem to be at the root of many personal, relational and social problems, such as addiction, violence, academic underachievement and teenage pregnancy (Mecca et al., 1989). Boosting self-esteem in the general population with the aid of school programs, child rearing practices and psychological therapies were advocated as ways to solve these problems. Governmental funding to develop and facilitate such interventions was requested and sometimes made available. Gradually however, many claims about the supposed detrimental role of

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low self-esteem in society and personal life appeared to be nothing more than popular opinions lacking any solid empirical support. In fact, contrary to the expectations of adherents of the ‘self-esteem movement’ most claims could not withstand rigorous scientific inquiry. The expected associations between self-esteem and outcome appeared to be either non-existent or weak or difficult to interpret. Different methods of measuring the variables of interest led to different results and often, high self-esteem seems to be a consequence of success in different areas of functioning instead of a causal factor (Baumeister et al., 2005; Sowislo & Orth, 2013; Swann et al., 2007). The more objective the outcome measures were that self-esteem was supposed to predict, the weaker the associations appeared to be. The very subjective criterion of ‘happiness’ was one of the few correlates of self-esteem that regularly yielded satisfying effect sizes (Baumeister et al., 2003; Scheff & Fearon, 2004).

Apart from the initial overselling of self-esteem in the public discourse and its subsequent debunking, the academic self-esteem discourse knew its own controversies. Should self-esteem be conceptualized as a global self-evaluation or better as the self-evaluation of different relevant personal characteristics, strengths and weaknesses (Sowislo & Orth, 2013)? Is self-esteem a rather unchangeable trait, or is it a state with relatively malleable features (Crocker & Wolfe, 2001)? Can self-esteem be assessed meaningfully without resorting mainly to self-report measures (Sowislo & Orth, 2013)? Is high self-esteem an asset worthwhile pursuing in order to facilitate a satisfying life (DuBois & Flay, 2004), or is it a myth stimulating people to chase unremittingly the approval of others (Ellis, 2005)? Many of these questions are still not fully answered.

Nevertheless, while the importance attributed to self-esteem as a cause of and a possible solution for all sorts of social adversities has diminished substantially, its role as an influential transdiagnostic factor in clinical psychology and psychopathology still remains and has become even stronger. Nowadays, most clinical psychologists in the field consider self-esteem to represent the affective and evaluative aspect of the self-concept (Sowislo & Orth, 2013), pertaining to the extent to which someone appreciates him (her) self subjectively as a person (Zeigler-Hill, 2011) and which generally is associated with desirable outcomes since it motivates to initiate adaptive behaviours (Pyszczynski et al., 2004). High self-esteem is equated mostly with the realization that one is ‘good enough’ and not necessarily with the sense of being ‘superior to others’.

In clinical psychology and treatment the focus is primarily on low self-esteem. Not being a formal mental disorder on its own, low self-esteem is a problematic transdiagnostic mental condition manifest in the symptomatology of several of such disorders. Variants of negative self-evaluations such as low self-esteem are among the formal criteria of DSM-5

mood disorders, posttraumatic stress disorder, eating disorders, and avoidant and borderline personality disorders (American Psychiatric Association, 2013). Moreover, negative self-evaluations are recognized as associated features in the clinical presentation of many other mental conditions such as social anxiety disorder, schizophrenia, addiction, and paranoia, without being part of their formal diagnostic criteria (Silverstone & Salsali, 2003; Zeigler-Hill, 2011). Not only does low self-esteem play a role in the manifestation of several mental disorders, it is also a determinant in the etiology and course of some of them (Sowislo & Orth, 2013; Stice, 2002). Negative self-evaluation, and low self-esteem in particular is associated with relapse after initial recovery (Brown et al., 1990; Fairburn et al., 1993), while high self-esteem seems to buffer against the development and aggravation of emotional problems (Mancini et al., 2011; Sedikides et al., 2004).

Several types of self-esteem can be distinguished. These are often, but not always highly correlated and their impact on psychopathology is thought to vary. Apart from explicit self-esteem, implicit self-esteem, discrepant self-esteem (the incongruence between implicit and explicit self-esteem), self-esteem stability, contingent self-esteem and still other forms have been described (Bos et al., 2010; Kernis et al., 1993). However, within the context of psychopathology and psychological treatment explicit self-esteem and, to a lesser extent, implicit self-esteem and the (lack of) congruence between them have been studied most. While some have attributed a prominent role to low implicit self-esteem (Franck et al., 2007), some recent studies suggest explicit low self-esteem probably to be the most relevant for the prediction and treatment of psychopathology in clinical practice (van Tuijl, 2017, pp. 197–198; de Jong et al., submitted; Creemers et al., 2012).

Moreover, low self-esteem maintains strong associations with depression (Sowislo & Orth, 2013). Not only are negative self-opinions, among which reduced self-esteem part of the formal symptoms of major depressive disorder, according to some researchers self-esteem and depression are both even part of the same ‘cognitive-emotional dimension’, with (high) self-esteem at one pole and depression at the other (Watson et al., 2002). Moreover, low self-esteem is predictive for the development of depression later in life, suggesting low self-esteem to be a vulnerability factor for depression (Orth et al., 2009; van Tuijl et al., 2014). To a lesser extent a reversed relationship also seems to exist where depression predicts low self-esteem, supporting the scar model of self-esteem (Zeigler-Hill, 2011). In line with this, indications are that enhancing self-esteem might reduce the level of depression (Hilbert et al., 2019; Morton et al., 2012; Steel et al., 2015).

Even though low self-esteem is recognized as a transdiagnostic problem of many emotional disorders, most treatment

guidelines recommend treatment of the principal disorder exclusively without suggesting additional elective interventions to address low self-esteem. After all, low self-esteem is expected to ameliorate automatically after successful treatment of the main disorder. Indeed, quite often this is the case (de Jong et al., 2020), but not always (Fennell & Jenkins, 2004). Therefore, several specific interventions have been developed to address low self-esteem directly. The most well-known are Fennell's procedure of low self-esteem treatment (Fennell, 1998) and Competitive Memory Training (COMET: Korrelboom et al., 2011). Of these two, Fennell's approach probably has been mostly applied in clinical practice, while COMET seems to have been examined most in clinical research. While both are cognitive-behavioural approaches, Fennell's model has a more traditional CBT flavour because of its emphasis on identifying, challenging and modifying the patient's dysfunctional automatic thoughts and cognitive schema's directly. COMET on the other hand, employs a more indirect strategy to enhance low self-esteem by enhancing the retrievability of the patient's ('available but hidden') positive self-knowledge.

COMET for low self-esteem is a manualized intervention and can be conducted in an individual or in a group format. COMET is considered a transdiagnostic intervention and can be applied irrespective of the principal psychiatric diagnosis of the patient. It addresses low self-esteem by strengthening the retrievability of memories and self-knowledge related to positive self-evaluations. Fundamental to the practice of COMET is Brewin's theory of competitive memory retrieval hierarchies (Brewin, 2006). According to this theory all concepts have different meanings and emotional connotations. Such meanings and connotations are hierarchically arranged in longterm memory where they compete to be retrieved. Once retrieved these meanings and connotations determine the actual feelings and behavioural tendencies of the person, at the same time inhibiting the retrievability of other, incompatible meanings and connotations. Depending on the context in which activation takes place and the person's idiosyncratic biases, the retrieval hierarchy determines which meanings are more easily retrieved and which are not. In psychopathology retrieval biases are problematic, dominant, and pervasive. Memories connected with dysfunctional meanings and connotations prevail at the cost of functional ones. While most traditional CBT procedures focus on the direct challenging, disabling, and modification of maladaptive self-opinions, instead, COMET's focus is on strengthening of the competitiveness of the patient's functional self-beliefs and attitudes. By doing so, functional meanings are thought to move up in the retrieval hierarchy at the cost of dysfunctional self-opinions.

COMET for low self-esteem usually takes 6 to 12 sessions, lasting 45–60 min each in individual settings or 90–120 min in a group format. The most distinctive steps

are: (1) identification of positive characteristics of the patient that are incompatible with their dominant negative self-evaluations and selection of specific examples from daily life where these positive characteristics are or have been at work; (2) enhancing the emotional saliency of these positive memories; and (3) associating strengthened positive self-evaluations with triggers that normally activate negative connotations. Enhanced emotional saliency of positive memories is effectuated by repetitively recalling them during therapy sessions and in daily homework assignments. Recall is accomplished with the aid of writing assignments and imagery. In this process, formulating positive self-verbalizations, adopting a self-confident posture and facial expression and listening to personalized 'empowering music' are practiced as auxiliaries to enhance emotional saliency even further (see: Korrelboom et al., 2011).

Since low self-esteem is an important transdiagnostic aspect of psychopathology and a promising target for curative and preventive intervention, it is important to present an overview of the efficacy of interventions addressing self-esteem problems. Such a review already exists for Fennell's method. In a recent meta-analysis consisting of 3 RCT's and 4 cohort studies of Fennell's model for the specific treatment of low self-esteem small (0.34 for one-day workshops) to high (1.12 for treatments consisting of weekly sessions) pre-post effect sizes for self-esteem were found, as were comparable results for depressive symptoms (Kolubinski et al., 2018). Until now a similar review for COMET was lacking. In the current study we meta-analysed the efficacy of COMET for low self-esteem and (comorbid) depression.

## Methods

This study will be reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). Details of the protocol for the current meta-analysis were registered in PROSPERO the International prospective register of systematic reviews (PROSPERO (york.ac.uk) under ID number CRD42021237905 (Korrelboom et al., 2021)).

## Identification and Selection of Studies

### Search Procedure

To identify eligible studies pertaining to randomised controlled trials into the efficacy of competitive memory training in enhancing low self-esteem and reducing comorbid depression, a search procedure consisting of three stages was conducted. Since an intervention in line with the general aspects of the COMET procedure described above was

called Positive Memory Training or POMET (Steel et al., 2015), these terms were also included into the search terms.

First, database searches were run in Embase, OVID Medline and PsycINFO simultaneously. Keywords were: *Competitive Memory Training* OR *COMET* OR *Positive Memory Training* OR *POMET*. Secondly, results of these searches were combined (AND) with the keywords: *randomised controlled trial* OR *randomized controlled trial* OR *RCT*. All searches were restricted to papers published between January 2007 (date of the first COMET publication) and April 2 2021 (start of the current study). Thirdly, the titles and abstracts of the papers selected in the automatized search process just described were manually inspected globally (titles and, if necessary, abstracts) by the first author (KK) for eligibility.

### In- and Exclusion Criteria

Then, full texts of the eligible papers identified by the aforementioned procedure were completely inspected by the first (KK) and fourth author (MvdG) independently, in order to control for all in- and exclusion criteria. We included studies that (1) mentioned COMET/POMET, (2) were an RCT, (3), had self-esteem and/or depression as outcome measures, (4) pertained to help-seeking patients exclusively, (5) were written in English or Dutch, and (6) were published between January 2007 and April 2 2021.

Since identifying core negative as well as finding incompatible positive self-evaluations is a rather complicated procedure, a collaborative dialogue with a therapist was considered to be required. For that reason, treatments lasting less than four sessions, self-help procedures and online interventions without substantial blending with therapist contacts, were excluded from this meta-analysis.

### Data Collection Process

We collected data on authors, training format (individual or group), year of publication, relevant outcome measures, number of participants, age and gender distribution, and country where the study was conducted.

Since most studies had no data on follow-up all analyses were based on end-of-treatment mean and standard-deviation and the number of participants that were randomized to the condition (intention to treat).

When information on any of these topics was missing, we contacted the authors to request for additional information.

### Risk of Bias

Low methodological quality of intervention studies may cause bias in meta-analytic results. Therefore, the Clinical Trial Assessment Measure (CTAM: Tarrier & Wykes, 2004)

was used to rate the risk of bias. The CTAM measures methodological rigor in six areas of trial design: sample size and recruitment method, allocation to treatment, assessment of outcome, control group, analysis and description of treatments. It has demonstrated good inter-rater agreement and excellent concurrent validity (Wykes et al., 2008). The CTAM has a maximum total score of 100, with scores below 65 indicating poorer trial quality.

The CTAM was slightly adapted to make it more appropriate for this specific meta-analysis. More specifically, the CTAM assumes outcome measures to be assessed by independent raters. However, the outcomes of the studies in the current meta-analysis were generally measured by self-report instruments. Therefore, we considered validated and widely used self-report instruments as equivalent to ratings by independent raters.

The CTAM was filled in by two raters (TIJ and AK) independently. Discrepancies between raters were discussed until agreement was reached. Whenever TIJ and AK could not reach agreement on a subject both other authors were involved in the discussion.

### Data Synthesis and Analysis

We conducted a random-effects meta-analysis using Comprehensive Meta-Analysis version 2.2 ([www.meta-analysis.com](http://www.meta-analysis.com)). All outcomes were continuous variables and effect sizes were expressed as Hedges'  $g$  (Hedges & Olkin, 1985). Heterogeneity of effect sizes across studies was tested with a  $\chi^2$  distributed  $Q$ -test.  $I^2$  values of 0%, 25%, 50% or 75% indicated no, low, moderate and high heterogeneity, respectively (Higgins et al., 2003). We conducted Egger's regression test to quantify any publication bias and to test whether this was statistically significant. The Egger's test is apt to type 2 error in small samples. Where missing publications were detected in the funnel plot, the effect was corrected using Duval and Tweedie's trim and fill (Duval & Tweedie, 2000).

The following sensitivity and subgroup analyses were performed: (1) exclusion of studies with inadequate methodology (CTAM score  $\leq 65$ ), (2) exclusion of unblinded studies, (3) removal of one study at a time to detect a single source of heterogeneity, (4) studies with individual sessions and group sessions. We considered the total number of participants and different comparison conditions too small and the diversity of diagnoses too large to justify yet more subgroup analyses.

## Results

### Study Selection

The automatized search procedure yielded 466 papers, while two papers (Balci et al., 2020; Farahimanesh et al., 2021)



were identified through other sources. After deduplication 355 records remained. After the first global manual inspection of titles and abstracts 337 papers were excluded for not being investigations into the efficacy of COMET, leading to 18 remaining studies. Of these, the full texts were assessed for inclusion by the first (KK) and last (MvdG) authors of which 7 were removed after assessment. One was excluded because it was a self-help treatment (Schneider et al., 2014); two were excluded because they were reviews (Churchill et al., 2013; Hitchcock et al., 2017); two other studies were excluded because they did not measure self-esteem or depression as outcome measures (Korrelboom et al., 2014; Tajikzade et al., 2019); one paper was a study protocol and was excluded for this reason (Steel et al., 2015). Finally, one last paper was excluded (Farahimanesh et al., 2021) because it pertained to the same study and data that already had been selected (Farahimanesh et al., 2020).

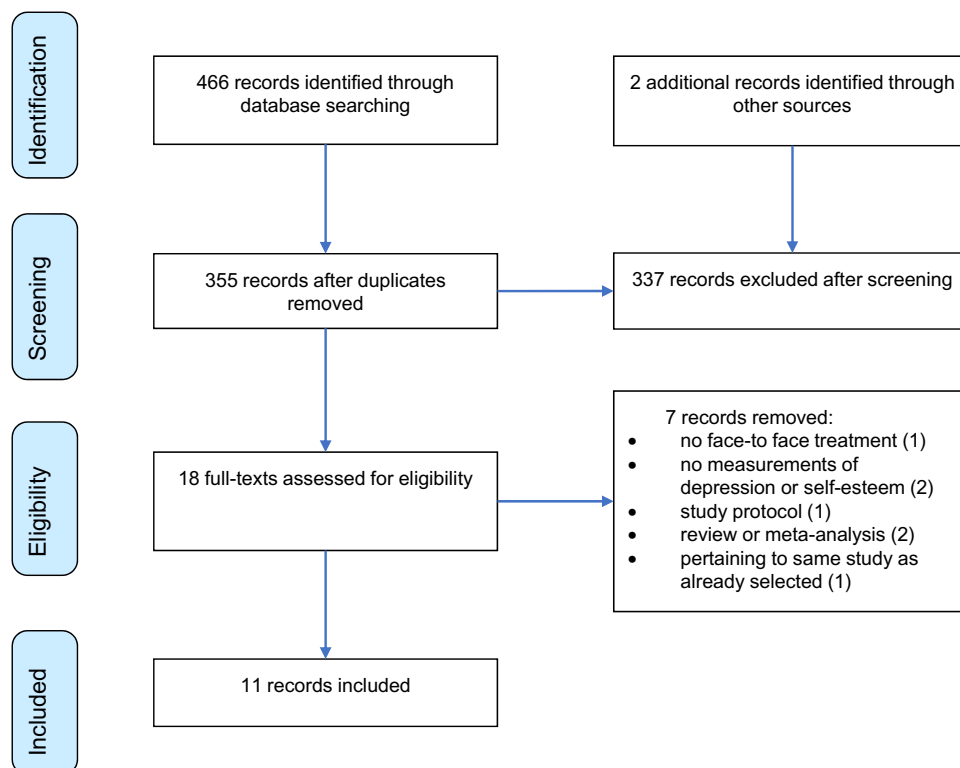
Thus, in the end 11 studies were included (Balci et al., 2020; Bloemers & de Vogel, 2020; Ekkers et al., 2011; Farahimanesh, et al., 2020; Korrelboom et al., 2009, 2011, 2012; Staring et al., 2016; Steel et al., 2020; van der Gaag et al., 2012; van Vreeswijk et al., 2020). See Fig. 1 for a flow chart of the search and inclusion process.

Additional data were requested from and delivered by van Vreeswijk and colleagues and Farahimanesh and colleagues (Farahimanesh et al., 2020; van Vreeswijk et al., 2020).

## Study Characteristics

The eleven included studies encompassed a total of 662 patients, 344 in the experimental (COMET) conditions and 318 in the control groups. Six studies employed a group format while five were conducted in an individual setting. Most studies (10) assessed an adult population, while one was conducted in a youth and adolescent population (Balci et al., 2020). Studies were conducted in patient populations with different principal diagnoses: anxiety disorders (1), mood disorders (2), psychosis-related disorders: paranoia; schizophrenia and auditory hallucinations (3), autism-spectrum disorders (1), eating disorders (1), personality disorders (2), and recently diagnosed cancer patients with trauma-related symptomatology associated with this diagnosis (1). Eight studies used therapy as usual (TAU) as comparison condition while three other studies compared COMET with other specific interventions targeting low self-esteem and/or depression: Eye Movement Desensitization and Reprocessing (EMDR), Memory Specificity Training (MEST) and Schema Mindfulness Based Cognitive Therapy (SMBCT). One study was executed in the UK and one in Iran. The 9 other studies were conducted in the Netherlands. Nine studies assessed self-esteem as outcome measure and nine depression. Seven studies assessed both self-esteem and depression simultaneously. Self-esteem was measured with the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1979) in

**Fig. 1** Flow chart of search and inclusion process



eight studies, while the Self-Esteem Rating Scale (SERS: Lecomte et al., 2006) was used in one. Seven studies made use of the Beck Depression Inventory-II (BDI-II: Beck et al., 1996) to assess depression, one of the Quick Inventory of Depressive Symptomatology-Self Report (QIDS-SR: Rush et al., 2003) and one of the Child Depression Inventory (CDI: Sitarenios & Kovacs, 1999). One study (Ekkers et al., 2011) made use of two different instruments simultaneously to assess depression, the QIDS-SR and the Geriatric Depression Scale (GDS: Brink et al., 1982) without defining which one should be considered as the primary outcome measure. Since the GDS is primarily a screener and the authors themselves used the QIDS-SR as the single index for one of their main analyses (clinical significant change at depression), we choose the QIDS-SR as the primary outcome measure for depression to be used in the meta-analysis (Table 1).

### Risk of Bias Within Studies

Only two studies scored below the cutoff of 65 on the CTAM. These were the studies by Bloemers and de Vogel (2020) and Balci et al. (2020). However, as already mentioned before, it should be remembered that outcomes in most studies were self-reported and that these were considered to be blind in our adjusted version of the CTAM. The study by Bloemers and de Vogel was the only study with unblinded ratings performed by therapists (see Table 2).

### Results of Individual Studies

Eleven studies were included in the meta-analyses. The results of the analyses are shown in Table 3. Overall there were statistically significant effect sizes for COMET on self-esteem and depression. However, heterogeneity was high. Although Egger's regression test never reached significance, the more sensitive Duval and Tweedie procedure found some evidence for publication bias. We decided to apply Duval and Tweedie's Trim and Fill since this procedure can give a more accurate estimate of the effect sizes. This procedure imputes estimated values for missing studies and corrects the effect size accordingly. The estimates must be interpreted with caution as all analyses showed high between-study heterogeneity. Duval and Tweedie does not just correct for publication bias, but can also determine the between-study heterogeneity. In that case the corrected estimate underestimates the effect size. This could be the case in the corrected estimates for self-esteem. In the depression estimates the corrected effect sizes are actually larger than the unadjusted estimates: see Table 3, last column.

### Self-Esteem

Nine studies examined the effects on self-esteem as a primary or secondary outcome. The effect size of  $g = 0.50$  was statistically significant, however heterogeneity was not only significant but also moderate to large (see Fig. 2). Although the Egger's regression test showed no statistically significant publication bias, the funnel plot found three missing studies and Duval and Tweedie's procedure corrected the effects downward to  $g = 0.28$ .

The subgroup analyses did not indicate significant changes in these effect sizes, and heterogeneity stayed high when only low risk of bias studies, or only blinded studies or either individual or groups format therapies were included. Only the subgroup analysis with one outlier removed resulted in low heterogeneity and no publication bias. This was due to the negative outlier study by Steel et al. (2020) that found reduced self-esteem in the COMET condition. Excluding this outlier consolidated the moderate effect size on self-esteem to  $g = 0.61$  with no publication bias and low heterogeneity, reflecting a relatively robust finding (see Table 3).

### Depression

Nine studies examined the effects on depression as a primary or secondary outcome. The effect size was  $g = 0.68$ , but here too heterogeneity was high while the funnel plot showed two missing studies and correction raised the effect size to  $g = 0.77$  (see Table 3 and Fig. 3). Again, heterogeneity did not change much when calculations were restricted to only low risk of bias or blinded studies. However, removal of one outlier did. The exclusion of the outlying extremely positive study by Farahimanesh et al. (2020) resulted in an effect size of  $g = 0.54$  with no publication bias and no heterogeneity.

### Discussion

The current study meta-analysed the benefits of the transdiagnostic COMET intervention. All analyses demonstrated statistically significant positive effects favouring COMET on the two outcome measures self-esteem and comorbid depression. However, both analyses revealed high heterogeneity and some indications of publication bias. Both analyses stayed statistically significant after the removal of one outlier, rendering heterogeneity to small or none and showing no evidence of publication bias, while effect sizes for self-esteem and depression remained moderate. Therefore, the latter effect sizes seem to us a better representation of the overall effects of COMET as a transdiagnostic training module to enhance self-esteem ( $g = 0.61$ ) and reduce feelings of depression ( $g = 0.54$ ).

**Table 1** Characteristics of the included studies

Authors	Year	Format	Duration of intervention	Country	Study population	Comet		Control		Outcome measures			
						Subjects	Age: years Mean (SD)	Male sex (%)	Subjects		Age: years Mean (SD)	Male sex (%)	
Korrelboom et al.	2009	Group	8 weekly sessions 90 min	Netherlands	Eating disorders	26	25.5 (5.3)	n.a	TAU	26	25.4 (5.7)	n.a	RSES; BDI-II
Korrelboom et al.	2011	Group	7 weekly sessions 90 min	Netherlands	Personality disorders	45	36.0 (8.3)	20	TAU	31	36.2 (9.4)	10	RSES; BDI-II
Ekkers et al.	2011	Group	7 weekly sessions 90 min	Netherlands	Depression in the elderly	53	65+	n.a	TAU	40	65+	n.a	QIDS-SR
Korrelboom et al.	2012	Group	8 weekly sessions 90 min	Netherlands	Depression	31	39.0 (10.7)	23	TAU	30	42.9 (9.5)	17	RSES; BDI-II
Van der Gaag et al.	2012	Indiv	8 weekly sessions 45 min	Netherlands	Depression in psychotic auditory hallucinations	39	40.4 (12.0)	54	TAU	38	40.6 (12.1)	50	BDI-II; SERS
Staring et al.	2016	indiv	6 weekly sessions	Netherlands	Anxiety disorders	23	38.4	17.4	EMDR	24	35.5	12.5	RSES; BDI-II
Steel et al.	2020	indiv	12 weekly sessions	United Kingdom	Depression in schizophrenia	49	42.5 (9.9)	69	TAU	51	43.4 (11.2)	80	BDI-II; RSES
Bloemers & de Vogel	2020	indiv	10 weekly sessions 90 min	Netherlands	Forensic psychosis and paranoia	7	43.1 (2.5)	86	TAU	7	40.2 (7.5)	71	RSES
Farahimanes et al.	2020	indiv	7 weekly sessions	Iran	Trauma-related stress in cancer	30	49.1 (10.9)	23	MEST	30	49.7 (10.4)	40%	BDI-II
Balci et al.	2020 <sup>a</sup>	indiv	7 weekly sessions	Netherlands	Autism spectrum disorders in youth	11	12.2 (2.4)	73	TAU	13	11.8 (2.5)	85	RSES; CDI
Van Vreeswijk et al.	2020	group	8 weekly sessions	Netherlands	Personality disorders	30	25–40	23	SMBCT	28	25–40	25	RSES

Indiv individual, SE self-esteem, n.a. not applicable, TAU treatment as usual, EMDR eye movement desensitization and reprocessing, SMBCT schema mindfulness-based cognitive therapy, MEST memory specific training, RSES rosenberg self-esteem scale, BDI-II Beck Depression Inventory II, QIDS-SR quick inventory of depressive symptomatology-self report, SERS self-esteem rating scale, CDI child depression inventory

<sup>a</sup>Preprint



**Table 2** Quality ratings of the studies using the Clinical Trials Assessment Measure (CTAM)

Study	Total (100)	Sample (10)	Allocation (16)	Assessment (32)	Control group (16)	Analysis (15)	Treatment description (11)
Korrelboom et al. (2009)	74	7	13	26	6	11	11
Korrelboom et al. (2011)	73	7	16	26	6	15	11
Ekkers et al. (2011)	81	7	16	26	6	15	11
Korrelboom et al. (2012)	81	7	16	26	6	15	11
Van der Gaag et al. (2012)	79	7	16	29	6	15	6
Staring et al. (2016)	92	2	16	32	16	15	11
Steel et al. (2020)	77	7	16	32	6	5	11
Bloemers and de Vogel (2020)	48	2	13	6	16	5	6
Farahimanesh et al. (2020)	89	10	13	29	16	15	6
Balci et al. (2020) <sup>a</sup>	63	2	13	26	6	5	11
Van Vreeswijk et al. (2020)	73	7	13	26	16	5	6

The upper line indicates (between brackets) the maximum achievable score for each category. The line after each specific study indicates which scores were actually achieved. The maximum total score is 100. Total scores below 65 indicate poorer methodological quality

<sup>a</sup>Preprint

**Table 3** The effects of transdiagnostic competitive memory training on self-esteem and depression

Analysis	Random effects				Heterogeneity			Publication bias	
	Number of contrasts	Hedges' g	Z	p-Value of Z	Q (df)	p-Value of Q	I <sup>2</sup>	Egger's regression test p-value	Duval & Tweedie (missing) corrected effect-size
<b>Self-esteem</b>									
Main analysis	9	0.50**	2.994	0.003	24.891 (8)	0.002	68	0.174	(3) 0.28
Low ROB <sup>a</sup>	7	0.47*	2.426	0.015	24.123 (6)	0.000	75	0.059	–
Blinded studies	8	0.49**	2.748	0.006	24.620 (7)	0.001	72	0.122	(2) 0.32
Outlier removed	8	0.61**	4.887	0.000	10.010 (7)	0.188	30	0.683	–
Group format	4	0.57	2.546	0.011	8.955 (3)	0.030	66	0.945	–
Individual format	5	0.44	1.737	0.082	13.378 (4)	0.010	70	0.170	(1) 0.32
<b>Depression</b>									
Main analysis	9	0.68***	4.765	0.000	21.185 (8)	0.007	62	0.308	(2) 0.77
Low ROB <sup>a</sup>	7	0.71***	4.652	0.000	20.496 (7)	0.005	65	0.071	(3) 0.90
Blinded studies	9	0.68***	4.765	0.000	21.185 (8)	0.007	62	0.308	(2) 0.77
Outlier removed	8	0.54***	6.032	0.000	3.435 (7)	0.842	0	0.679	–
Group format	4	0.60***	4.983	0.000	0.954 (3)	0.812	0	0.853	–
Individual format	5	0.76**	2.709	0.007	20.062 (4)	0.000	80	0.474	(1) 0.88

Group and individuals studies: see Table 1 in column 'Format'. Outlier removed is Steel et al. removed in self-esteem analysis and Farahimanesh et al. removed in depression analysis

Q value for heterogeneity tested by Chi-square, df degrees of freedom, I<sup>2</sup> degree of heterogeneity, low ROB low risk of bias with studies by Bloemers & de Vogel and Balci removed, Blinded studies studies with Bloemers & de Vogel removed

\*p < .05, \*\*p < 0.01, \*\*\*p < 0.005

The current study adds to the literature by showing that, similarly to Fennel's method (Kolubinski et al., 2018), COMET is effective in enhancing low self-esteem and reducing depressive symptoms. However, a straight comparison between both methods cannot be based on these two separate meta-analyses for two reasons. Firstly, Kolubinski

et al. (2018) reported within-group effect sizes based on a mixture of RCT and cohort data while the current meta-analysis calculated between-group effect sizes, exclusively based on data retrieved from RCTs. Secondly, it is plausible that our sample is more afflicted and impaired than the one included by Kolubinski. Generally, studies in our

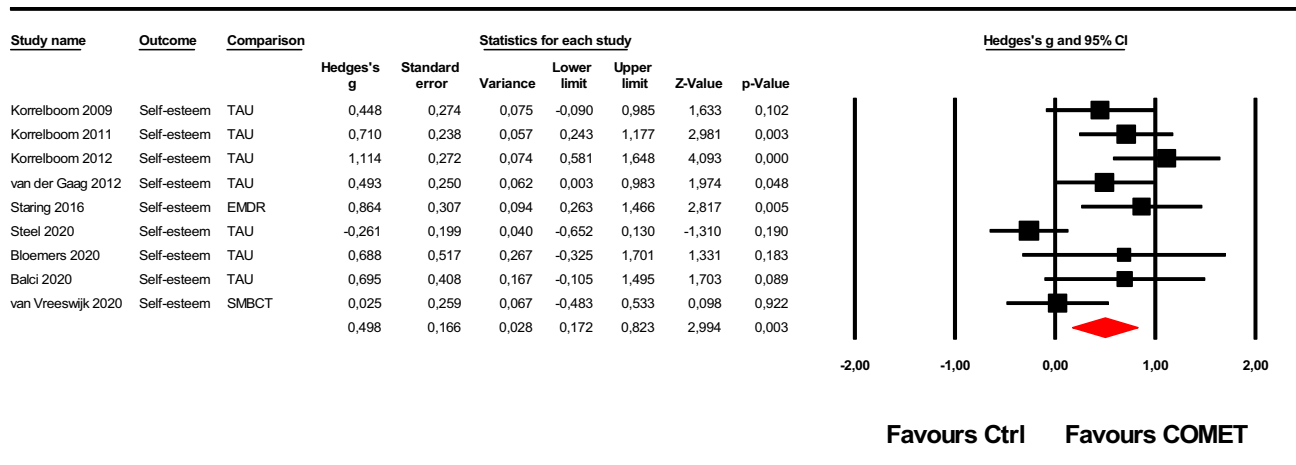


Fig. 2 Effects of COMET on self-esteem

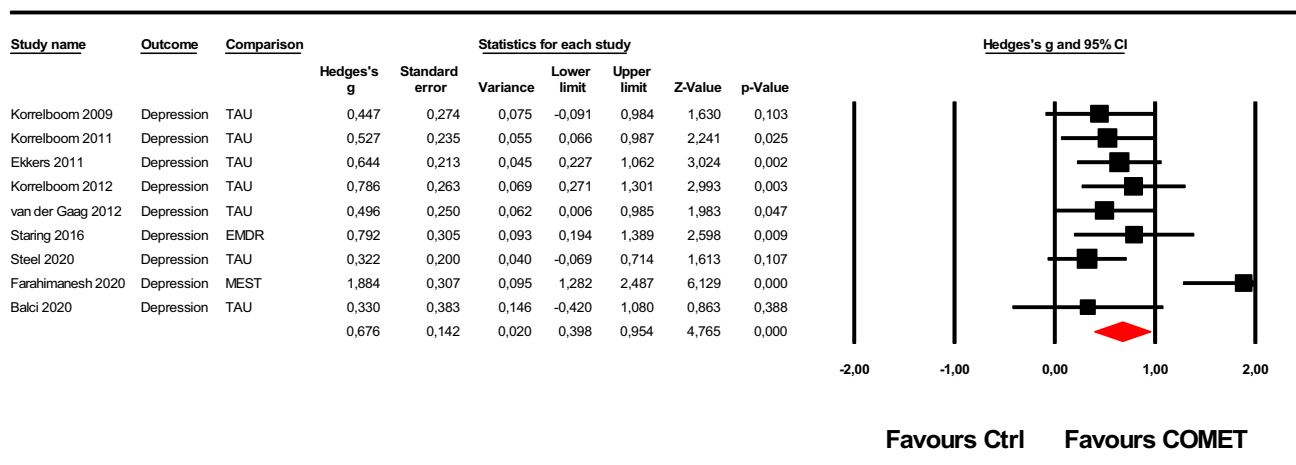


Fig. 3 Effects of COMET on depression

meta-analyses recruited patients that were enrolled in clinical practice for their problems, while Kolubinski et al. (2018, p. 297) formulated their inclusion criteria as ‘adults with low self-esteem, who do not exhibit a severe and enduring mental health condition or cognitive deficit’.

The current meta-analysis confirms what most separate COMET studies already suggested: in a broad range of help-seeking psychiatric patients COMET seems to boost low self-esteem and reduce depression better or faster than several other interventions do. Therefore, when low self-esteem is still an issue after successful guideline treatment for the principal diagnosis, COMET would be an obvious additional intervention to apply.

Finally, results of this meta-analysis as well as Kolubinski et al.’s (2018) might inspire the setup of studies into the possibility to prevent the development of serious mental disorders by enhancing the self-esteem of persons at risk

for such developments by employing specific self-esteem interventions. Having said this, it should be kept in mind that COMET is probably not the optimal intervention for all sorts of problematic low self-esteem (Korrelboom, 2016). For example, when self-esteem promoting behaviours are completely absent, interventions that encourage explicitly the execution of positive behaviours might suit better (Hall & Tarrier, 2003). Furthermore, when insufficiently processed intrusive memories of negative experiences with rejection and ridicule seem to be responsible for preserving low self-esteem, a particular version of Eye Movement Desensitization and Reprocessing (EMDR) might be a better choice for intervention (Griffioen et al., 2017).

Our meta-analysis should be interpreted within several limitations. Firstly, although eleven COMET studies justify a meta-analysis, it is a limitation that generally speaking the studies were small. Only 662 patients were in the

meta-analysis, of which 344 were treated in the COMET conditions. Secondly, as COMET is a transdiagnostic procedure, the patients were heterogeneous because they were stemming from different primary diagnostic groups that varied from anxiety disorders to chronically psychotic patients. This will have had influence on the variation in effect sizes. However, despite these sources of heterogeneity, the removal of just one outlier in the different subgroup analyses resulted in moderate effect sizes on self-esteem and comorbid depression with low to no heterogeneity and no publication bias. Another limitation is that nine studies came from the Netherlands while only one was from the United Kingdom and one from Iran. The COMET intervention needs more research from other research groups in other nations. Additionally and connected to this, yet another limitation should be mentioned: the first (KK) and/or the fourth author (MvdG) were involved as researchers in 7 out of 11 of the meta-analyzed studies. On the one hand this was difficult to avoid since COMET is a new intervention, so far only investigated in a limited number of studies by a limited number of researchers. On the other hand, of course, this could have introduced bias in the selection and evaluation of included studies. We have tried to mitigate this threat of bias by adhering carefully to existing protocols for executing proper meta-analyses and by having two independent researchers, not involved in any of the included RCT's (TIJ and AK) performing the risk of bias evaluations. That most studies did not use independent raters to assess treatment outcome but relied on validated self-referent questionnaires instead, might be considered another limitation. Outcome assessment in these studies was considered to be equivalent to studies with blinded assessors. This might have influenced the high number of low risk of bias studies. Subgroup analyses with only blinded studies yielded to the removal of only one study and subgroup analyses with only low risk of bias yielded to the removal of only two studies. These removals had only a minor influence on the results: they remained about equal to the main analysis. On the other hand, that removal of just one study can have an impact was demonstrated by the removal of one outlier that reduced heterogeneity and publication bias in both outcome measures considerably.

While our procedures allowed for the inclusion of unpublished studies, it could be considered a limitation that we did not define a strategy to actively identify unpublished studies. Therefore we might have missed studies that would have been eligible for our meta-analysis. Two final limitations to be mentioned here pertain to the individual studies themselves: in all instances only explicit self-esteem was measured, ignoring other aspects of self-esteem. Moreover, the included studies provided insufficient data to assess long-term COMET effects. Those aspects warrant closer investigation in future research.

## Conclusions

The current study showed positive effects favouring COMET over TAU and a couple of control interventions on the outcome measures self-esteem and comorbid depression. Therefore, COMET is considered a promising transdiagnostic intervention to target the enhancement of positive self-esteem and comorbid depression. Because of its emphasis on strengthening the retrievability of positive self-opinions, the procedure differs from challenging and modifying dysfunctional opinions as is practiced in most traditional cognitive behavioral interventions. Therefore, and for its moderate effects on low self-esteem and depression, COMET seems a valuable addition to or an alternative for verbal therapy techniques.

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## Declarations

**Conflict of interest** The first author (Kees Korrelboom) has presented workshops on the subject of Competitive Memory Training for which he received a fee. He has also published 2 books on the subject of COMET for which he received royalties. The other three authors (Tom IJdema, Annemiek Karreman, and Mark van der Gaag) do not have possible conflicting interests.

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