
A META-ANALYSIS ON THE EFFICACY OF EXPOSURE-BASED TREATMENT IN ANXIETY DISORDERS: IMPLICATIONS FOR DISGUST

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Abstract

Despite of several meta-analyses indicating that exposure-based treatments (EBT) are successful in addressing anxiety and fear symptoms, less is known whether this is also the case for disgust, which also accompanies anxiety disorders. Therefore, the aim of the current meta-analysis was to compare the efficacy of EBT on disgust and anxiety (emotional distress), against control condition. This meta-analysis included a total of eight studies. Overall, there was a medium effect size ($g = .57$, 95% CI: .26 to .88, $p < .001$) for emotional distress; a medium effect size for anxiety ($g = .79$, 95% CI: .24 to 1.34, $p = .005$), yet a small effect size for disgust ($g = .36$, 95% CI: .05 to .68, $p = .024$). These findings prompt that current EBT are not tailored to address disgust symptoms accompanying many forms of anxiety disorders, although literature points more and more to a need in this respect. We also examined potential moderator variables (the year of publication, the number of exposure sessions, age of the sample, and gender composition). Additionally, we discussed several strengths and limitations, one of the most important being the small number of studies regarding the subject and their heterogeneity.

Keywords: emotional distress, disgust, anxiety disorders, exposure treatment, meta-analysis

Introduction

Recent research emphasizes that, compared to fear and anxiety, disgust is a rare, understudied, but a complex emotion, seemingly involved in the presence and

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maintenance of anxiety symptoms (Olatunji et al., 2017). Specifically, disgust is considered a negative emotion that has been viewed as the ground for developing an avoidance response. In this direction, experiencing disgust may have evolved specifically to protect humans from the risk of disease (Curtis et al., 2011). Olatunji and Sawchuk (2005) found that people reporting high levels of disgust also present avoidance behaviors, one potential reason why disgust is currently pinpointed as the reason for anxiety relapse. Although the literature describes several types of anxiety disorder, including generalized anxiety disorder, panic disorders, social anxiety disorders, and phobias, the authors conclude that disgust is positively correlated only with the fear of small animals and it represents a strong predictor of arachnophobia and blood-injury-injection phobia (BII phobia); this finding is also emphasized in the review made by Olatunji, Cisler, et al. (2010).

As research in the field started to expand, other associations to posttraumatic stress disorder (PTSD; Badour et al., 2012), and obsessive-compulsive disorder (OCD) were noticed (Brady et al., 2010; Ludvik et al., 2015). In fact, there are suggestions that disgust contributes significantly to OCD due, being highly associated with OCD characteristic intrusive thoughts regarding contamination (Olatunji et al., 2010). Recurrent intrusive thoughts of contamination are present in 50% of the persons diagnosed with OCD, especially at those people with cleaning and washing compulsive rituals (Olatunji & Sawchuk, 2005). Hence, understanding and studying disgust might be useful in improving treatment for anxiety disorders related to contamination, especially since 50% of patients with anxiety symptoms do not respond, give up or refuse interventions (Foa et al., 2002) and up to 75% of patients show residual symptoms after treatment is completed (Fisher & Wells, 2005).

Although disgust is believed to be an important element in anxiety disorders, little is known about how well are currently available treatments ready to address it (Mason & Richardson, 2012). Conventionally, exposure-based treatment is the first line in addressing anxiety and associated symptoms, such as disgust. Precisely, the exposure technique is originally designed to reduce emotions related to fear and is based on the extinction process that underlies Pavlovian conditioning-based learning. Disgust is usually investigated as a secondary outcome, after fear or anxiety, and there are currently little to no interventions tailored to specifically address it as a main symptom in anxiety disorders. As a consequence, there is currently no available meta-analysis to provide an overview of the efficacy of exposure-based treatment in addressing disgust alongside anxiety symptoms. It is important to have specific interventions for the disgust, because the exposure therapy focused on anxiety is not always efficient in reducing it, and, if the exposure is effective, these effects are temporary, because it becomes a habitude to a lesser extent and slower, compared to fear (Ludvik et al. 2015).

Overview of the present meta-analysis

All in all, previous arguments emphasized the need for a systematic review and meta-analysis on the relative efficacy of exposure-based treatments (EBT) for

disgust in anxiety disorders, also encompassing OCD and PTSD. Given that there are no interventions specifically targeting disgust, we also investigated inherently anxiety outcomes as part of the current meta-analysis, both separately and pooled together with disgust (i.e., emotional distress), with the purpose of a comprehensive review of the existing literature. As such, we included all treatment outcome efficacy studies focused on the efficacy of exposure-based treatments in comparison to the control group (i.e., waitlist, placebo, or other interventions) which also included in outcome list disgust measurements.

Both meta-regression and subgroup analyses accompanied the central goal of the meta-analysis in an endeavor to identify potential effect size moderators. Also, we assessed the quality of the research design through the risk of bias to emphasize the effectiveness or safety of the intervention. This meta-analysis included the following moderators: the year of publication, the number of exposure sessions, age of the sample, and gender composition. These moderators were chosen because we are interested in investigating if there is a differential efficacy of EBT in patients who present the clinical symptoms, in relation to the moderators.

Publication year. To highlight the role of disgust and anxiety in the selected mental disorders, we included the year of publication as a relevant moderator. Because articles on this topic were published between 1993 – 2013, this analysis was carried out to understand the reasons why the outcomes are heterogeneous according to year, and also to understand if the effect of the exposure therapy, as an intervention method, change over time. Moreover, given the fact that recent studies could have higher quality in reporting the results, this may have an impact on comparing the older studies with the newer ones.

The number of exposure sessions. Given the fact that the number of exposure sessions is well investigated in terms of efficacy, we assessed whether single or multiple exposure sessions had an influence on the outcome of the treatment. This potential moderator, chosen because it can have an important role regarding the treatment of anxiety disorders, precisely refers to whether the number of sessions was matched or not across treatment conditions. For some anxiety disorders, like specific phobia, multiple sessions are not necessarily superior to one session exposure with respect to the fear outcome (Öst et al., 2001). In this case, the moderator was analyzed according to the number of sessions used in each study.

Age of the sample and gender differences. To illustrate the relevance of emotional distress in the clinical domain, it is necessary to determine whether socio-demographic moderators such as age and gender could make a difference in the exposure intervention. The first argument in favor of their use is that the literature showed that women described themselves as more anxious than men (Barrett et al. 1998). Another argument is based on the idea that women tend to assess stressors as more severe and are predisposed to use different coping strategies to face stressors, compared to men. Regarding the moderator related to the age of the sample (extracted from studies as mean age), disgust can contribute to the development and maintenance of both anxiety and related disorders, even from the first years of life (Muris, 2006), therefore it is important to include it in the analysis.

Methods

Literature Search

To identify potentially relevant studies, a systematic search of the literature was deployed on online databases like: PsycInfo, PubMed, Web of Science, and Google Scholar, in September 2019. We searched for articles that were referenced in the most recent and relevant systematic reviews and meta-analysis on disgust and mental disorders (Ludvik et al., 2015; Olatunji et al., 2017). We used the following search string-based on the Pico criteria: (expos* OR treat*) AND (ocd OR obsess* OR compulsi* OR ptsd OR posttraumatic OR phobi* and anxi* AND fear) AND (disgust OR disgust*).

Studies that compared two groups (low and high levels of disgust and anxiety) were excluded because this aim was beyond the purpose of the current meta-analysis. More precisely, studies that did not include persons diagnosed with these disorders or clinical or subclinical samples were excluded. Thus, articles that are not full-text or did not report data for any outcomes related to the post-treatment for disgust or anxiety were excluded.

Inclusion and Exclusion Criteria

The following inclusion criteria were used to select the studies for this meta-analysis: (a) a measurement of the levels of disgust and anxiety in anxiety disorders, including OCD, and PTSD; (b) an experimental and a control group; (c) a measurement of the levels of disgust and anxiety after treatment; (d) a treatment which consisted in one of the forms of exposure therapy; and (e) the studies provided data to calculate the effect sizes.

In contrast, the exclusion criteria are the following: (a) studies which included anxiety but not a measure of disgust in the assessment; (b) included only the experimental group; (c) did not measure disgust and anxiety in anxiety disorders, OCD or PTSD; (d) measured disgust and anxiety only before treatment; (e) did not include EBT; and (f) there were no available data for calculating the effect sizes.

Selection of Studies

The initial search procedure identified 7777 references through databases searching and screening of other sources. After 356 duplicates were removed, we screened 7421 records and excluded 7315 studies based on title or abstract analysis. The studies were excluded if they were theoretical reviews, or meta-analyses or did not measure disgust, or they examined the facial expression of emotions like disgust but did not measure the disgust itself, or if they only had an experimental group without a control condition. Then, we inspected 106 full-text articles for eligibility. Only eight articles fully met the inclusion criteria and were included in the current

meta-analysis. Out of the selected papers, seven studies had a clinical sample and one had an analog sample. The PRISMA flow-diagram summarizes the selection procedure of the studies included in this meta-analysis (see Figure 1).

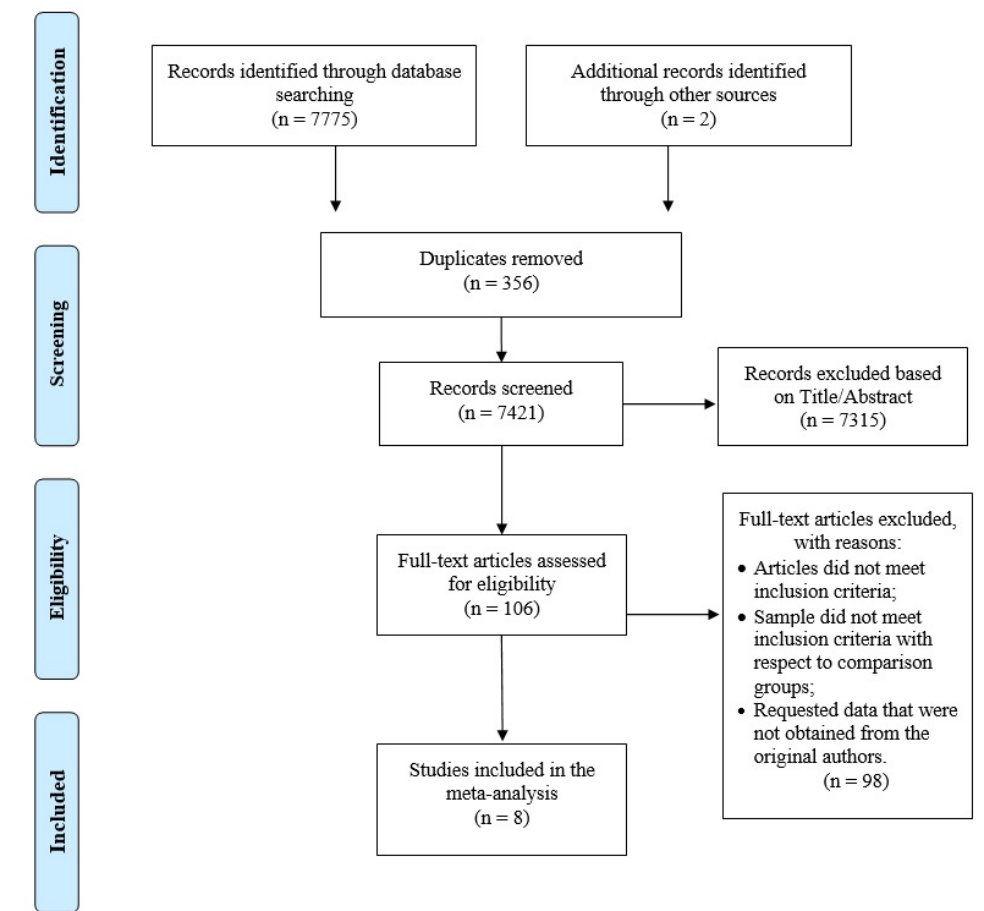


Figure 1. PRISMA flow-diagram depicting the study selection process

Procedure

Data coding system

We used a data coding system, that appears in Table 1, and describes the characteristics of the studies included in the meta-analysis. This standardized coding form was used for every study. For each article, we coded the following characteristics: author information, year of publication, total sample size, gender composition, age of the sample, type of population (children or adults), types of clinical disorders (types of anxiety disorders, OCD or PTSD), clinical status (clinical

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or analog sample), type of exposure treatment and type of modification (disgust or anxiety modification). Moreover, the following moderators were coded for this meta-analysis: year of publication, the number of exposure sessions, age of the sample, and gender composition (% of female). First, the year of publication was selected as a relevant moderator to highlight the role of disgust and anxiety in the selected mental disorders, but also to emphasize the reasons why the outcomes are heterogeneous over time. Second, we assessed whether single or multiple exposure sessions had an influence on the outcome of the treatment. In this case, the potential moderator was coded according to the number of sessions. Third, socio-demographic moderators such as age (extracted as mean age) and gender (male and female genders) were chosen to see if they could make a difference in the exposure intervention. Finally, subgroup analyses were performed on the type of the outcome or the more precisely emotional distress that represents disgust and anxiety.

Table 1. Characteristics of the studies included

Author	Sample size	Mean age	% female (full sample)	Type of population	Clinical disorder	Clinical status	Type of exposure	Type of modification
Badour et al. (2013)	40	28.18	100	adults	PTSD	clinic	imagery	disgust
de Jong et al. (1997)	43	11.60	100	children	SP	clinic	IVE + ANT	disgust
Huijding & de Jong (2007)	60	33.95	63.50	adults	SP	clinic	IVE	anxiety
Leutgeb et al. (2009)	45	27.40	100	adults	SP	clinic	IVE	anxiety
Merckelbach et al. (1993)	56	28.90	100	adults	SP	clinic	IVE	disgust
Olatunji et al. (2011)	51	39.39	50	adults	OCD	clinic	IVE	disgust
Olatunji et al. (2009)	46	18.86	62.20	adults	SP	analogue	IVE	disgust and anxiety
Schienle et al. (2005)	43	24.75	81.40	adults	BII	clinic	IVE	disgust

Note. SP = spider phobia; OCD = obsessive-compulsive disorder; BII = blood-injection-injury phobia; PTSD = posttraumatic stress disorder; IVE = *in vivo* exposure; IVE + ANT = *in vivo* exposure + another type of exposure or treatment.

Risk of bias assessment

For the selected studies, we assessed the quality of the research design using the Risk of Bias in Non-randomized Studies of Interventions (ROBINS-I) rating scale developed by Sterne et al. (2016). This tool is based on the Cochrane risk-of-bias criteria and evaluates the risk of bias regarding the effectiveness or safety (benefit or harm) of intervention as opposed to studies that did not use randomization to allocate interventions. ROBINS-I assesses the following seven bias domains:

confounders, selection of participants, classification of interventions, deviations from intended interventions, missing data, measurement of outcomes, and selection of the reported result. The response options are the following: “Yes”, “Probably yes”, “Probably not”, “No” and “No information”. The interpretation of the risk of bias judgments is “Low risk”, “Moderate risk”, “Serious risk”, and “Critical risk”. Two of the authors conducted the ratings. Disagreements were solved by discussion and reaching consensus.

Statistical analysis

For the statistical analysis, we used Comprehensive Meta-Analysis (CMA) version 2. For effect size estimates we chose Hedges’s g , which is similar to Cohen’s d but is considered a more accurate version than Cohen’s d because, when the sample size is below 20, Hedges’s g outperforms Cohen’s d (Grissom & Kim, 2005). A value between 0.2 – 0.5 indicates a small effect size, a value between 0.5 – 0.8 indicates a medium effect size and a value of a minimum 0.8 indicates a large effect size (Cohen, 1988). To investigate the efficacy of EBT on emotional distress, in contrast to control condition, we ran the analyses following the exclusion of the studies that are considered outliers. According to Viechtbauer & Cheung (2010), an outlying study presents a standardized residual greater than 3. For each study, we entered available data (mean and standard deviation or mean and t -value, respectively the number of participants for every study) based on the control and experimental group.

Heterogeneity was assessed using the statistical indicator I^2 . It is presented as a percentage and reflects the proportion of variability in effect size due to true differences among the studies. The values of the I^2 statistic can be interpreted in the following manner: a value of 0% indicates no observed heterogeneity; a value $\leq 25\%$ indicates low heterogeneity; a value $\leq 50\%$ indicates moderate heterogeneity, and 75% and above indicates high heterogeneity (Higgins & Thompson, 2002).

We used moderation analyses testing the following variables: year of publication, the number of exposure sessions, age of the sample, and gender composition. We also examined publication bias in three ways. First, we visually inspected funnel plots, precisely the standard error for each article against the effect size of the study. Second, we used the Duval & Tweedie trim-and-fill procedure (Higgins & Green, 2011) to provide corrected effect sizes and confidence intervals; more precisely, this method removes the smaller studies that cause asymmetry, uses the trimmed funnel plot to estimate the true center of the funnel, and then replaces the missing studies and their missing pair around the filling (Borenstein et al., 2009). Finally, we used the Egger’s test (Higgins & Green, 2011) of the intercept to identify the significance of the asymmetry of the funnel plot.

Results

Characteristics of the Studies

The characteristics of the included studies are presented in Table 1. Analyzing the eight selected studies, we identified that the sample sizes ranged from 40 to 60, resulting in a total of 384 participants. The mean age ranged from 11.60 to 39.39 years. Also, the rate of female participants ranged from 50% to 100%. All studies measured disgust and anxiety using self-report measures.

As far as age group is concerned, seven of the studies included adults, and one study (de Jong et al., 1997) included children. Examining the variable named clinical disorder, five of the studies diagnosed participants with spider phobia while one study (Schienle et al., 2005) diagnosed participants with BII phobia; another study (Olatunji et al., 2011) diagnosed participants with OCD. Additionally, one study diagnosed people with PTSD (Badour et al., 2013).

Out of the studies included in this meta-analysis, seven included a clinical sample and only one (Olatunji et al. 2009) presented data from an analog sample. Also, six studies have chosen *in vivo* exposure, while one study (de Jong et al., 1997) presented two types of exposure: *in vivo* exposure and eye movement desensitization; only one study used imagery technique (Badour et al., 2013). Moreover, two studies (Huijding & de Jong, 2007; Leutgeb et al., 2009) had chosen to decrease only the level of anxiety, while five studies (Badour et al., 2013; de Jong et al., 1997; Merckelbach et al., 1993; Olatunji et al., 2011; Schienle et al., 2005) chose to decrease only the level of disgust; even more, only one study had the aim to decrease both the levels of disgust and anxiety.

Risk of Bias

A 73.33% inter-rater agreement was found, with ratings ranging from 100% to 50%. This means that 26.67% of the data collected in the study is erroneous. Evaluating the quality of interrater reliability based on consensus estimates, this should be at least 70% (Stemler & Tsai, 2008). Analyzing each domain of the quality rating scale ROBINS-I, we obtained the following data: (1) for bias due to confounding, the eight selected articles ranged between the low risk of bias (three studies), moderate risk (four studies) to serious risk of bias (one study); (2) for bias in the selection of participants into the studies, the articles ranged between low and moderate risks of bias; (3) for bias in classification of interventions, the studies ranged between low and moderate risk, and only one article with serious risks of bias; (4) for bias due to deviations from intended interventions, the majority of

studies presented a low risk of bias; (5) for bias due to missing data, the articles ranged between low, moderate and serious risks of bias; (6) for bias in the measurement of outcomes, the studies also ranged between low, moderate and serious risks of bias; (7) for bias in the selection of the reported result, the articles ranged between low and moderate risks of bias.

The overall bias for the eight studies revealed four articles with low risk of bias, another three with a moderate risk of bias, and one article with serious risk of bias. Also, the risk of bias presents a medium effect size ($g = .52$, 95% CI: .28 to .76, $p < .001$). The four studies with low risk of bias present a medium effect size ($g = .48$, 95% CI: .21 to .74, $p < .001$), while the other three studies with moderate risk of bias present a high effect size ($g = .80$, 95% CI: .17 to 1.44, $p = .013$); one study with serious risk of bias presents a non-significant effect size ($g = .21$, 95% CI: -1.53 to 1.95, $p = .813$).

Regarding publication bias, The Duval & Tweedie trim and fill procedure estimated four studies with an effect size higher than the mean ($g = .80$, 95% CI: .47 to 1.13, $Q = 128.80$), so the effect size would grow and stay significant. Egger's intercept test was significant (intercept = 8.22; 95% CI: -1.80 to 18.25), indicating that the funnel plot is asymmetric. In other words, a small number of studies showed larger effect size and publication bias has occurred. This is visible from the funnel plot in Figure 3 (black dots indicate inputted missing studies).

Main Results and Moderator Analyses

Using a random-effects model, the overall pooled effect size for emotional distress in post-treatment was medium ($g = .57$, 95% CI: .26 to .89, $p < .001$; $Q = 72.80$, $I^2 = 79.40\%$) and favors exposure relative to control. Figure 2 depicts the forest plot of effect sizes. Heterogeneity was assessed using the statistical indicator I^2 . It is presented as a percentage and reflects the proportion of variability in effect size due to true differences among the studies. The values of the I^2 statistic indicate high heterogeneity, meaning that there is variability in the data and, implicitly, differences found in the studies effect.

Using a mixed-effects model for subgroup analyses, the emotional distress presents a small effect size ($g = .47$, 95% CI: .20 to .74, $p = .001$). Moreover, the results seem to favor the EBT: there was a small effect size for EBT interventions with regard to disgust ($g = .36$, 95% CI: .05 to .68, $p = .024$) and a medium pooled effect size for EBT interventions with regard to anxiety ($g = .79$, 95% CI: .24 to 1.35, $p = .005$). These results highlight the significant difference between the two emotions in the exposure therapy post-treatment.

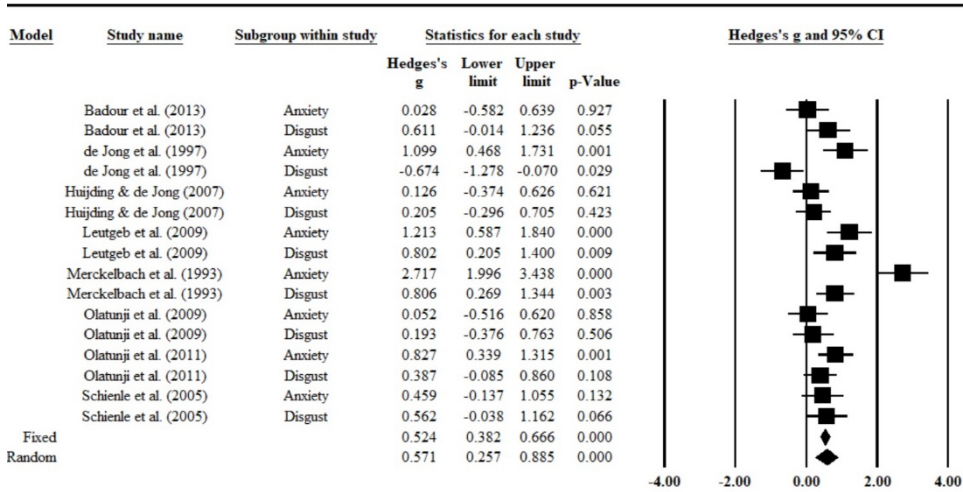


Figure 2. Forest plot

In the case of moderators, the meta-regression results revealed a significant association related to the year of publication (slope = $-.03$, 95% CI: $-.05$ to $.007$; $p = .010$) and the gender composition – percent of the female participants (slope = $.01$, 95% CI: $.00$ to $.02$, $p = .003$). Regarding the age of the sample, results revealed a non-significant association (slope = $-.006$, 95% CI: $-.02$ to $.01$, $p = .534$). For the moderator consisting in the number of exposure sessions, using a mixed effects model, the results show a small overall effect size ($g = .34$, 95% CI: $.14$ to $.54$, $p = .001$).

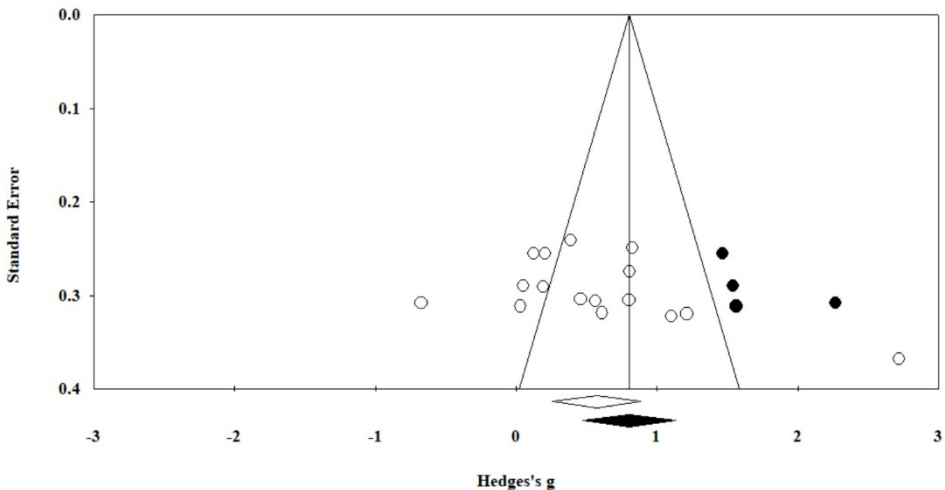


Figure 3. Funnel plot of publication bias

Discussion

This study aimed to provide the first comprehensive meta-analysis to assess the current state of research regarding the efficacy of the EBT on disgust, anxiety, and overall emotional distress in anxiety disorders, especially specific phobia. In contrast with the prior meta-analysis (Olatunji et al., 2017), the focus was on studies that included experimental and control groups formed prior to the assessment and, also to analyze the efficiency the exposure-based therapy as a form of treatment. The main findings are discussed below.

Main Analyses

The random-effects analysis revealed a medium, but significant overall effect size, supporting the idea that the EBT can reduce the level of emotional distress in specific phobia, especially for spider phobia. Moreover, the subgroup emotional distress presents a lower but significant effect size of disgust compared to anxiety. A possible explanation for this result could be the fact that the exposure interventions investigated were tailored for decreasing the level of anxiety, but not especially for decreasing disgust (Ludvik et al., 2015). Similar results were found by Olatunji et al. (2017), but their meta-analysis focused on the comparisons made on disgust proneness for the anxiety disorders between high and low anxiety outcomes. However, a high percentage of heterogeneity was found in the present meta-analysis, meaning that there may still be variability due to differences in population, measurement methods, or possible cultural differences. More precisely, there could be other variables which have an influence on the relation studied and have not been included in this meta-analysis. Also, this result needs to be interpreted cautiously because this meta-analysis included a small number of studies (von Hippel, 2015).

The results are in line with prior reviews that emphasized the involvement of disgust in various psychopathologies, especially anxiety-related disorders and the observed robust role of disgust in many disorders (Knowles et al., 2018; Olatunji, Cisler, et al., 2010). In this direction, empirical research tested the efficacy of exposure-based treatment to decrease both the level of disgust and anxiety symptoms in specific phobia (de Jong et al., 1997; de Jong et al., 2000; Leutgeb et al., 2009; Olatunji, 2006; Olatunji et al., 2012), but they also include this intervention to obsessive-compulsive symptoms (Olatunji et al., 2011; Merckelbach et al., 1993). In the case of OCD, disgust is present especially in contamination-related OCD and the treatment of choice is exposure, evaluative conditioning, counterconditioning, and US revaluation (Ludvik et al., 2015).

All the exposure-based interventions used to decrease the level of disgust are originally designed to reduce fear-associated emotions. Henceforth, the empirical investigation has supported the idea that disgust is more resilient than fear and

anxiety responses to exposure therapy or it is more likely that the disgust responses return (Olatunji et al., 2009; Rachman et al., 2011). The most relevant and accepted explanation so far is that habituation to disgust stimuli may occur more slowly in individuals with contaminated-related OCD, suggesting that extinction-resistant disgust responses could contribute to the persistence of the symptoms, and, as a consequence, may serve to reduce the effectiveness of exposure-based treatment (McKay, 2006).

Moderators

Overall, the results demonstrated that gender composition and year of publication present effects on the relationship between emotional distress (disgust and anxiety) and anxiety disorders after the exposure-based treatment. Moreover, the number of exposure sessions presents a small effect size on this relation. However, the age of the sample presents no effect.

Regarding the moderator gender composition, our results show a positive association; more precisely, the percent of female participants can moderate the effect in terms of outcomes after the intervention. A potential explanation for this result could be that the majority of the intervention studies include rather female participants, than males. Also, the number of exposure sessions represents a moderator on the relationship between emotional distress and anxiety disorders after the EBT. This result can be focused on the importance of how many exposure sessions can be useful so that the treatment is active.

The year of publication represents another variable that moderates the relationship between emotional distress and specific phobia. A potential explanation for this result could be that the studies meet higher methodological restrictions and bring more extensive proofs on their validity than previously published studies. Thus, arguments could be based on the large period the articles were published in (from 1993 – 2013), and, implicitly, the fact that the rigor of publishing raised in the last years, compared to the '90s.

Regarding the age of the sample, this meta-analysis found that this variable does not moderate the relation between outcomes (disgust and anxiety) and specific phobia. In addition, the fact that this moderation model was not supported could be interpreted as: (a) inadequate power due to the relatively small samples per condition in some studies; and (b) the studies selected for this meta-analysis included not only adults, but also children and adolescents as participants, which could emphasize differences in the manifestation of the symptoms and the efficacy of the intervention received. However, given the fact that the majority of the selected studies present adults as participants, we could conclude that adults may develop more skills in assessing their disgust and anxiety symptoms, in contrast to children and adolescents (Podina et al., 2016).

Risk of Bias

The average quality of the studies uncovered some biased results. Out of the seven domains of ROBINS-I (Sterne et al., 2016), only one revealed a low risk of bias, precisely due to deviations from intended interventions. So, the articles did not present significant systematic differences between the groups regarding the intended interventions, as Sterne et al. (2016) explain in the guide. Another two domains (bias in the selection of participants into the studies and the bias in the selection of the reported results) revealing that the articles present a risk range from low to moderate. Thus, these studies present some issues regarding the participant's selection and reporting results in a selective manner (Sterne et al., 2016).

The other four domains (bias due to confounding, the bias in classification of interventions, bias due to missing data, and bias in the measurement of outcomes) revealed a risk range from low/moderate to serious. So, the studies selected for this meta-analysis present some important problems such as bias introduced by differential or non-differential misclassification of intervention status, bias due to exclusion of participants with missing data about intervention or other variables, measurements errors related to intervention; the outcome assessors are aware of intervention status, as Sterne et al. (2016) explain in their guide.

Theoretical and Clinical Implications

From a theoretical point of view, the results of this meta-analysis could represent a scientific challenge for the traditional theories that explain anxiety disorders, considering the reality that anxiety is the main concept assessed in this type of disorder. One of the surprising findings of this research is that, along with anxiety, the concept of disgust is predominantly present in anxiety disorders, especially in spider phobia. Thus, it seems that disgust was somehow understudied in the context of anxiety disorders and should be reconsidered as well in the clinical practice (Olatunji et al., 2017).

From a clinical point of view, the results of this meta-analysis emphasize that both disgust and anxiety are active emotional responses in anxiety disorders, especially in spider phobia. One of the mechanisms that may underlie psychopathology is represented by irrational cognitions (Podina et al., 2015). Thus, similarly to anxiety, assessment of disgust could be useful not only in the diagnostic of these disorders, but also for planning psychological interventions that encompass both disgust and anxiety as the main outcomes. Our findings could be useful in the assessment or development of treatment plans especially for specific phobia, which supports the inclusion of the clinical assessment of the presence of disgust in clinical practice (Knowles et al., 2018) and the development of new measurement instruments for this concept. Measuring the level of disgust in these disorders may increase the precision of the assessment and lead to a better clinical understanding. Moreover, results show that exposure-based interventions could be useful in decreasing levels of disgust and anxiety in spider phobia (Olatunji et al., 2009), BII phobia (Olatunji et al., 2007),

OCD (Armstrong & Olatunji, 2017) and PTSD (Badour & Feldner, 2016). Despite the medium-size effect, the results suggest that there are some benefits associated with this intervention. The results of this meta-analysis may provide insights to help advance in this field. Finally, one specific result is very important for our approach, namely, that the level of disgust decreased after the exposure-based therapy, as has the level of anxiety. These results are similar to the arguments presented by Cisler et al. (2009) that emphasize both anxiety and disgust symptoms are present in these types of disorders, with different magnitude and response domain.

From a clinical point of view, the results of this meta-analysis emphasize that disgust is an emotional response active in these two clinical disorders. Thus, these aspects could be useful especially in diagnosing those two disorders but also planning a psychological intervention that implies both disgust and anxiety as the main outcomes. This data could be useful in the development of diagnosing techniques, of a treatment plan for the specific phobia, including a clinical assessment of the presence of anxiety and disgust and measurement instruments for this concept.

Limitations

Several limitations should be acknowledged for this meta-analysis. *First*, we found only a limited number of studies analyzing the level of disgust in anxiety disorders after the EBT. For the limited number of studies, the heterogeneity was high and significant for the overall pooled effect size, so the results need to be interpreted cautiously. Moreover, considering the number of studies and their unbalanced characteristic, the conclusions and the generalizability of the results are limited.

Second, we could not find a significant number of randomized studies that analyze the effect of EBT on emotional distress. As a solution, we chose to include also non-randomized studies that assess disgust and anxiety from a clinical point of view. So, upcoming studies should attempt to balance the use of randomized and non-randomized studies in the research of disgust in some mental disorders and measure the outcomes also at follow-up.

Third, we found a reduced number of articles that study OCD, PTSD, and BII phobia in exposure-related therapy for disgust. Because of this, we could not generalize the results in the case of these disorders. Consequently, studying emotional distress, especially disgust, in these clinical disorders should be an objective for further research.

Fourth, we selected articles that studied both adults and children, because there are only a few available studies that assess disgust from a clinical view, then form a control group, and an experimental group from the same sample. For this reason, we could not do the analysis separately for the two categories of participants. In this respect, future research should investigate separately adults and children, with regard to the presence of disgust in mental disorders, given the approximately equal number of studies for both groups.

Finally, the results obtained in this meta-analysis show that the moderators included here are not conclusive enough, so upcoming research should focus on searching other variables that could moderate the presence of disgust and anxiety in mental disorders after the exposure therapy. Due to the high heterogeneity, some moderators did not explain the results. This issue suggests that there could be other variables that have an influence on the relation studied, which have not been examined in this meta-analysis.

Conclusions

The main finding of this meta-analysis is that, besides anxiety, disgust plays a key role in specific phobia, even after the exposure-based treatment. There is evidence that exposure therapy is associated with decreased levels of emotional distress, especially in spider phobia, but these findings need to be interpreted with caution, because there are only a few studies that follow this line of inquiry in the clinical area. Given the relevance of disgust in anxiety and other related disorders, it becomes a promising line of research for the clinical practice to develop psychological instruments that could target the assessment of disgust. However, since this meta-analysis is a preliminary one, it is too premature to speak of a treatment for specific phobia, with the aim to reduce disgust.

Conflict of Interest

The authors declare that there are no potential conflicts of interest associated with this publication.

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