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# Is body dissatisfaction related to an attentional bias towards low weight bodies in non-clinical samples of women? A systematic review and meta-analysis

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A B S T R A C T

Body dissatisfaction is defined as the negative subjective evaluation of one's body and is considered a risk factor for, and symptom of, eating disorders. Some studies show women with high body dissatisfaction display an attentional bias towards low weight bodies; however, this finding is not consistent, and results are yet to be systematically synthesised. We conducted a qualitative and quantitative synthesis of cross-sectional studies investigating the relationship between body dissatisfaction and attentional bias to low weight bodies in non-clinical samples of women. We searched PubMed, Scopus, Web of Science, PsycINFO, ProQuest, and OpenGrey for studies up until September 2022. We identified 34 eligible studies involving a total of 2857 women. A meta-analysis of 26 studies (75 effects) found some evidence from gaze tracking studies for a positive association between body dissatisfaction and attentional bias to low weight bodies. We found no evidence for an association from studies measuring attention using the dot probe task, electroencephalogram (EEG) recording, or the modified spatial cueing task. The results together provide partial support for the positive association between body dissatisfaction and attentional bias to low weight bodies in women. These findings can be used to inform future attentional bias research.


**Contents**



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## 1. Introduction

Body dissatisfaction is defined as the negative subjective evaluation of one's body and is often considered the attitudinal manifestation of body image disturbance (Cash & Deagle, 1997). Large scale studies conducted in multiple countries demonstrate that body dissatisfaction is highly prevalent in women (Al Sabbah et al., 2009; Ejike, 2015; Fiske et al., 2014; Griffiths et al., 2016; Matthiasdottir et al., 2012; Mond et al., 2013), leading some researchers to use the term "normative discontent" to describe the widespread dissatisfaction women feel towards their bodies (Rodin et al., 1984). Body dissatisfaction is associated with multiple negative health outcomes and behaviours. For example, in adolescence it is associated with later depressive episodes (Bornioli et al., 2021), as well as with risky health behaviours such as smoking, drug-use, self-harm, and high-risk alcohol consumption (Bornioli et al., 2019). Body dissatisfaction is also a risk factor for eating disorders, including anorexia nervosa, bulimia nervosa, binge eating disorder, and purging disorder (Stice et al., 2017; Stice & Shaw, 2002) and is a key diagnostic symptom of anorexia nervosa (American Psychiatric Association, 2013).

Cognitive behavioural theories of eating disorders suggest that body dissatisfaction causes people to preferentially attend to disorder-relevant information, such as food or body related stimuli. This attentional bias is thought to exacerbate feelings of body dissatisfaction, resulting in a feedback loop and further body dissatisfaction (Williamson et al., 2004). Support for these theories comes from research showing that people with eating disorders, when compared to non-clinical samples, display attentional biases towards disorder-relevant stimuli, e.g., towards body-related words (Ralph-Nearman et al., 2019; Stott et al., 2021). However, attentional biases are not exclusively displayed by people with eating disorders. In a systematic review of studies on the general population, Rodgers and DuBois (2016) found evidence to suggest that people with high levels of body dissatisfaction also attend to body-related stimuli more than people with low body dissatisfaction. In particular, the authors found initial evidence from eight cross-sectional studies showing that body dissatisfaction is positively associated with attentional biases towards "thin" (hereafter referred to as low weight) stimuli (Cho & Lee, 2013; Gao et al., 2011a, 2012, 2013, 2014, 2011b; Joseph, 2014; Li et al., 2011). However, Rodgers and DuBois (2016) also identified five studies that did not find evidence for this positive association (Glauert et al., 2010; Joseph, 2014).

Rodgers and DuBois (2016) mention a number of different factors that may have contributed to these inconsistent findings. For example, studies varied in their measure of attention (e.g. eye-tracking vs reaction times measures; for a summary of different attentional bias paradigms see Table 1), the presentation time of the low weight stimuli, the type of low weight stimuli (words vs pictures), and the amount of clothing presented on pictures of low weight bodies. Studies also varied in their use of control stimuli (non-body stimuli vs high weight stimuli). Some studies using non-body control stimuli found evidence for a positive association between body dissatisfaction and attentional bias to both low weight and high weight stimuli (e.g. Gao et al., 2013). Therefore, we might expect the association between body dissatisfaction and attentional bias to low weight bodies to differ based on whether non-body or high weight stimuli are used as control stimuli. Given the small number of studies, Rodgers and DuBois (2016) were unable to quantitatively synthesise this data and explore possible moderator variables in depth.

Since Rodgers and DuBois (2016) conducted their literature search in 2015, there have been many cross-sectional studies on non-clinical populations investigating the relationship between body dissatisfaction and attentional bias to body size. Some studies found evidence for a relationship between body dissatisfaction and attentional bias to low weight bodies (e.g. Moussally et al., 2016); however, other studies found no such evidence (e.g. Cass et al., 2020). A recent meta review by Stott et al. (2021) identified some eye-tracking evidence indicating that people with eating disorders may attend to low weight bodies more than non-clinical populations (Blechert et al., 2009; Pinhas et al., 2014). This pattern of results was not found when a dot probe task was used to measure attentional bias (Lee & Shafran, 2008; Shafran et al., 2007). However, the research on clinical populations involved only a small number of studies with very small sample sizes; therefore, these findings may not be robust. Indeed, low statistical power is prevalent in research on attentional biases and eating disorders (Enouy et al., 2022). Stott et al. (2021) also identified a number of limitations of existing systematic reviews and meta-analyses on this topic. For example, most systematic reviews lack a preregistered protocol, quality assessment of included studies, record of reasons for excluding studies, and assessment of small study effects. These limitations prevent strong conclusions from being drawn about the relationship between body dissatisfaction and attentional bias to low weight bodies.

There is a sociocultural theoretical framework to support the suggestion that attentional bias to low weight bodies exacerbates feelings of body dissatisfaction in women. Social comparison theory suggests people evaluate themselves by making social comparisons

**Table 1**
A summary of different paradigms that have been used to measure attentional bias to low weight bodies.

| Attentional bias paradigm | Task description | Operationalisation |
|---|---|---|
| Attentional response to distal vs. proximal emotional information (ARDPEI) task | Participants are presented with an anchor probe, followed by a stimulus pair involving a target stimulus and a neutral stimulus. The anchor probe directs attention either towards or away from the target stimulus. Participants then respond to a probe located on the same or opposite side as the target stimulus. Participants complete trials where the target stimulus is either a low weight body or a control stimulus (e.g.Dondzilo et al., 2021;Grafton & MacLeod, 2014). | Faster reaction times to probes replacing low weight bodies relative to control stimuli are thought to reflect an attentional bias to low weight bodies. Trials that cue participants to attend to the target stimulus specifically measure disengagement bias, whereas trials that direct the participant's attention away from the target stimulus specifically measure engagement bias (e.g.Dondzilo et al., 2021;Grafton & MacLeod, 2014). |
| Body size discrimination task | Participants are presented with a body stimulus and must estimate the stimulus size in comparison to their own body size, e.g. by responding with "thinner", "equal", or "larger" (e.g.Nazareth et al., 2019). | Faster reaction times and greater discrimination accuracies for low weight bodies relative to control stimuli are thought to reflect an attentional bias to low weight body stimuli (e.g.Nazareth et al., 2019). |
| Dot probe task | Participants are presented with a stimulus pair involving a low weight body and a control stimulus. Participants then respond to a probe that appears in the location previously occupied by one of the stimuli (MacLeod et al., 1986). | Faster reaction times to probes replacing low weight bodies relative to control stimuli are thought to reflect an attentional bias to low weight bodies (MacLeod et al., 1986). |
| Electroencephalogram (EEG) recording | Participants are presented with a low weight body or control stimulus and are asked to view the stimuli, sometimes while completing an irrelevant task. Participants have their neural activity measured, typically using either event-related potentials (ERPs; averaged EEG waves produced in response to a stimulus; e.g.Wang et al., 2019) or steady-state visual evoked potentials (SSVEPs; periodic EEG waves elicited by flickering visual stimuli; e.g.Voges et al., 2019). | Greater ERP amplitudes and SSVEP reductions in response to low weight bodies relative to control stimuli are thought to reflect an attentional bias to low weight bodies (e.g.Voges et al., 2019;Wang et al., 2019). Typically, early attentional biases are assessed using ERP components such as the N1, N2, and P2, whereas late attentional biases are assessed using ERP components such as the P3 and LPC (e.g.Uusberg et al., 2018;Wang et al., 2019). |
| Gaze tracking | Participants are presented with a low weight body simultaneously alongside a control stimulus (or stimuli) and are asked to view the stimuli, sometimes while completing an irrelevant task (e.g.Gao et al., 2014). | Greater time spent gazing towards low weight bodies relative to control stimuli is thought to indicate an attentional bias to low weight bodies. Typically, early attentional biases are assessed using first fixation duration and late attentional biases are assessed using total fixation duration (e.g.Gao et al., 2014). |
| Frequency estimation task | Participants are presented with bodies that covary in size and colour. Participants are not told about the covariance and are asked to estimate the frequency of target colours (e.g.Seifert et al., 2008). | Greater frequency estimations for colours that covary with low weight bodies are thought to indicate an attentional bias to low weight bodies (e.g.Seifert et al., 2008). |
| Modified rapid serial visual presentation (RSVP) task | Participants are required to view a rapid stream of visual stimuli and identify a target stimulus that follows either a low weight body or control stimulus (e.g.Berrisford-Thompson et al., 2021). | Reduced accuracy for identifying the target stimulus following low weight bodies relative to control stimuli is thought to indicate greater attentional bias to low weight bodies. This is typically referred to as low weight body induced blindness (e.g.Berrisford-Thompson et al., 2021). |
| Modified spatial cueing task | Participants are presented with either a low weight body or control stimulus. Participants must respond to a subsequently presented probe. Trials are only analysed when the probe appears on the opposite side of the screen to the stimulus (Posner, 1980). | Faster reaction times to probes following control stimuli relative to low weight bodies are thought to indicate greater attentional bias to low weight bodies. This is typically referred to as disengagement bias for low weight bodies (Posner, 1980). |
| Visual search task | Participants are required to identify or detect the presence vs absence of a target stimulus amongst an array of distractor stimuli. For simple visual search tasks, the target stimulus is either a low weight body or control stimulus (e.g.Gaid, 2008). For compound visual search tasks, the target stimulus is paired adjacent to a low weight body or control stimulus (e.g.Cass et al., 2020). | Faster reaction times for low weight body trials relative to control stimulus trials are thought to indicate an attentional bias to low weight bodies (e.g.Cass et al., 2020). For tasks that require presence vs absence detection, signal detection theory can also be used to analyse sensitivity to low weight bodies by calculating the standardised difference between mean hit rates and mean false alarm rates (d′;Green & Swets, 1966). |

with other people. Upward social comparisons involve comparing oneself to "superior" others and are typically thought to result in negative emotions. In contrast, downward social comparisons involve comparing oneself to "inferior" others and are typically thought to result in positive emotions (Festinger, 1954). In the context of body image, low weight bodies are likely to be targets for upward comparisons by women, because low weight bodies have traditionally been promoted as an ideal for women by Western media (Owen & Laurel-Seller, 2000; Sypeck et al., 2004), and a drive for thinness is now common for women across cultures (Swami et al., 2010). Women have been found to be more likely to make upward comparisons and compare themselves to people who have a body size/shape that they consider ideal (Fardouly et al., 2017). Importantly, research supports the suggestion from social comparison theory that upward comparisons can cause negative emotions (Myers & Crowther, 2009). When women are exposed to images of low weight women, they report an increase in body dissatisfaction (Bould et al., 2018; Groesz et al., 2002; Moreno-Domínguez et al., 2019; Tiggemann & McGill, 2004). Therefore, an attentional bias to low weight bodies may be contributing to body dissatisfaction in women, which could make it a useful target for therapeutic intervention.

To target attentional biases, researchers have proposed that computerised attentional bias modification tasks could make a cost-effective adjunct to traditional talking therapies for treating symptoms of eating disorders, such as body dissatisfaction (Renwick et al., 2013). There is preliminary support for the effectiveness of attention modification at reducing eating disorder symptoms; however, only a small number of studies have been conducted, and they have a high degree of heterogeneity (Dondzilo et al., 2018; House et al., 2022; Matheson et al., 2019; Stephen et al., 2018). To inform future research aiming to modify attentional bias to low weight bodies, it would be useful to have a more in depth and up-to-date understanding of whether and how body dissatisfaction relates to an attentional bias towards low weight bodies.

We conducted a systematic review and meta-analysis to investigate the relationship between body dissatisfaction and attentional bias towards low weight female bodies in non-clinical samples of women. As far as we are aware, the only previous systematic review on this topic was conducted by Rodgers and DuBois (2016), who investigated the broad topic of attentional biases displayed by both men and women. Our review provides an update on this earlier review. However, given the number of recent publications, we aimed to solely investigate attentional biases displayed by women towards pictorial stimuli of low weight female bodies. We restricted the review to studies on women because research indicates attentional biases depend on gender differences in body ideals (Cho & Lee, 2013; Talbot & Saleme, 2022) and the majority of studies in this area have been conducted on women. We also limited the review to cross-sectional studies because this is the most commonly used research design on this topic. We further limited the review to pictorial stimuli, rather than word stimuli, because pictorial stimuli of low weight bodies are a more ecologically valid target for social comparisons and have been shown to increase body dissatisfaction (Bould et al., 2018; Groesz et al., 2002; Moreno-Domínguez et al., 2019; Tiggemann & McGill, 2004). By narrowing the scope of the review, we aimed to increase the likelihood of finding enough high quality, homogeneous studies to enable us to conduct a meta-analysis and follow up moderation analyses on the relationship between body dissatisfaction and attentional bias to low weight bodies. We also aimed to follow the recommendations made by Stott et al. (2021) and reduce bias in our review by preregistering our review protocol, conducting a quality assessment of included studies, documenting reasons for excluding studies, and assessing the impact of small study effects on our findings. We hypothesised that body dissatisfaction would be positively related to an attentional bias towards low weight female bodies, i.e., that women with high body dissatisfaction would direct more attention towards low weight female bodies than women with low body dissatisfaction.

## 2. Methods

The systematic review and meta-analysis were preregistered on the Open Science Framework (OSF; https://osf.io/5y9w8/) with deviations from the protocol outlined in the Supplementary Material. The review follows PRISMA reporting guidelines (see Supplementary Material; Page et al., 2021).

### 2.1. Eligibility criteria

Studies were eligible for our review if they met all of the following inclusion criteria: 1) used an analytical cross-sectional design i.e. all data were collected at one time point, 2) recruited female participants who were not recruited specifically on the basis of having a current or previous diagnosis of an eating disorder, 3) included at least one measure of our exposure variable—body dissatisfaction, 4) included at least one assessment of our outcome variable—attentional bias towards pictorial stimuli of low weight female bodies, and 5) explored whether body dissatisfaction was related to attentional bias, using body dissatisfaction as either a grouping or continuous variable. As we did not have resources to translate texts, we also specified that 6) the text of the paper must be written in English. Studies were screened as ineligible for our review if they met any of the following exclusion criteria: 1) review articles, 2) studies comparing people with eating disorders to non-clinical samples without reporting separate results for the non-clinical samples, 3) experimental studies (e.g., intervention studies) that did not report baseline data, and 4) studies that recruited both male and female participants without reporting separate results for the female participants.

### 2.2. Search strategy

One author (TH) completed a database search on the 18th October 2020. TH searched the titles, abstracts, and keywords for terms in the following databases: PubMed, Scopus, Web of Science, PsycINFO, ProQuest, and OpenGrey. No restrictions were made on the publication date or publication status. Where possible, a search filter was applied to limit the search to text written in English. The search terms were the following: (Attention* OR "Dot probe" OR "Visual probe" OR "Visual search" OR "Eye tracking" OR EEG OR ERP OR Hypervigilance) AND (Thin* OR Slim* OR "Low adiposity" OR "Low fat" OR Underweight OR "Body size" OR "Body shape" OR Ideal*) AND ("Body dissatisfaction" OR "Body image" OR "Body satisfaction" OR "Body concern" OR "Body image disturbance" OR "Weight dissatisfaction" OR "Weight satisfaction" OR "Eating disorder").

To find additional studies, author TH 1) hand-searched the references of eligible papers and relevant reviews, 2) emailed the authors of eligible papers, 3) emailed personal contacts of the review authors, 4) posted requests for studies on social media and relevant mailing lists, and 5) emailed the authors of ineligible studies with potentially eligible data. For example, if a study recruited male and female participants but did not report separate results for female participants, then the results for the female participants alone were requested. If the study involved an experimental manipulation, then the baseline results were requested. If the study involved comparing non-clinical samples to people with eating disorders but did not report separate results for the non-clinical samples, then results for the non-clinical samples were requested. We stopped accepting additional content from authors on the 28th of February 2021. To ensure the review findings were up to date, TH repeated the electronic database search on 10th March 2022 and 17th September 2022 to identify eligible studies published after the original database search.

### 2.3. Selection of studies

The total results of the original database search were imported into the reference manager Zotero to remove duplicates and then exported into the screening software Rayyan (Ouzzani et al., 2016). Two authors (TH and KG) independently screened all remaining titles and abstracts. TH then screened all remaining full texts and KG completed an additional independent screening of 10% of the full texts. TH documented the reasons for excluding papers at the full text screening stage (see Supplementary Material). Any text or data received directly from authors or found via hand searching were checked for eligibility by author BE. Disagreements between TH, KG, and BE were resolved by a discussion between these authors and, if required, author IPV. The results of the follow-up database search were screened using the same approach, except that the screening was completed solely by TH.

### 2.4. Data extraction

Data were extracted from each study using a standardised data extraction form. For studies identified from the original database search, TH extracted data from all eligible studies and KG independently extracted data from 10 % of eligible studies. Data from remaining eligible studies were extracted by TH and checked by BE. Disagreements between authors were resolved by discussion between TH, KG, BE, and if required, IPV. The majority of studies quantified the relationship between body dissatisfaction and attentional bias using the effect size Pearson's $r$; therefore, we aimed to extract this effect size with the 95 % confidence intervals from each study. If Pearson's $r$ was not reported, then it was calculated from publicly available data or estimated by converting an alternatively reported or calculated effect size. Effect size calculations were conducted using the R package "esc" to convert Cohen's $d$ (Lüdecke, 2019; R Core Team, 2020), the online calculator Psychometrica to convert standardised β coefficients (Lenhard & Lenhard, 2016; Peterson & Brown, 2005), and the R package "psychometric" to estimate 95% confidence intervals (Fletcher, 2022). If no information was available to extract an effect size, then we emailed the authors for this information. Effect sizes were extracted so positive effect sizes indicated women with high body dissatisfaction, when compared to women with low body dissatisfaction, had a greater attentional bias to low weight bodies.

### 2.5. Quality assessment

The authors TH and BE each independently assessed all of the included studies for risk of bias using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Analytical Cross-Sectional Studies (see Supplementary Material; Moola et al., 2020), which was specifically designed to assess the quality of analytical cross-sectional studies. Disagreements between authors were resolved by discussion between TH, BE, and if required, IPV. A risk of bias score was calculated for each study by summing the number of "Yes" responses on the checklist. Possible scores ranged from 0 to 7 and high scores indicated low risk of bias.

### 2.6. Data analyses

The results were reported in a data extraction table and a narrative synthesis (see Table 2 and Supplementary Material). Evidence for a positive (negative) association between body dissatisfaction and attentional bias was indicated by a positive (negative) effect size with 95 % confidence intervals that did not overlap with zero. We interpreted there being no evidence for an association if the effect size 95 % confidence intervals included zero. When authors did not respond to our requests for effect size data, we noted this in the full data extraction form (see Supplementary Material) and inferred evidence for an association based on the author's text summary of the results and, if reported, a $p$-value of $< .05$.

We identified enough similar studies to conduct one meta-analysis pooling effect sizes from studies measuring attentional bias using the dot probe task, gaze tracking, EEG recording, and the modified spatial cueing task. We excluded effect sizes from the meta-analysis if we could not extract the effect size data and authors did not respond to our data requests. We also excluded studies from the meta-analysis if they used a measure of attentional bias not used by any other study in the meta-analysis e.g. the frequency estimation task (Seifert et al., 2008). These studies were instead summarised via narrative synthesis. For the meta-analysis, we initially converted effect sizes from Pearson's $r$ to Fisher's $Z$. We then conducted a three-level random effects model using the restricted maximum likelihood method and the "meta" and "metafor" packages in R (Assink & Wibbelink, 2016; Balduzzi et al., 2019; R Core Team, 2020; Viechtbauer, 2010). The results of the meta-analysis were reported in a forest plot. To assess statistical heterogeneity, we calculated $\tau^2$, $I^2$, and Cochran's $Q$ and visually inspected the forest plot for non-overlapping 95% confidence intervals.

We explored statistical heterogeneity by conducting moderation analyses on continuous variables and dummy coded categorical variables. Moderator variables were evaluated separately and included measure of attentional bias (categorical: dot probe vs EEG vs gaze tracking vs modified spatial cueing), measure of body dissatisfaction (categorical: BAS vs BPSS-R vs BSQ vs BSSS vs EDE vs EDI vs NPS, vs single item measure), publication status (categorical: published vs non-published), risk of bias score (continuous), method of effect size calculation (categorical: converted effect size vs non-converted effect size), mean participant age (continuous), mean participant body mass index (BMI; continuous), method of low weight body stimuli acquisition (categorical: photographs vs digitally altered photographs vs computer generated images), amount of skin exposed on the low weight body stimuli (categorical: nude vs clothed with torso exposed vs clothed with torso concealed), and the type of control stimuli (categorical: higher weight body stimuli vs non-body stimuli vs both higher weight body stimuli and non-body stimuli).

We conducted attention measure specific moderation analyses separately for dot probe and gaze tracking studies. For dot probe studies, moderators included the body stimulus layout (categorical: top-bottom vs left-right) and the stimulus onset asynchrony (SOA)—the time period from the onset of the body stimulus pair to the onset of the probe (continuous). For gaze tracking studies, moderators included the gaze tracking index (categorical: gaze duration—the total sum time spent gazing at the low weight body, vs fixation frequency—the total count of fixations directed at the low weight body, vs first run dwell time—the sum time spent initially gazing at the low weight body prior to diverting gaze) and the presentation time of the body stimuli (continuous). Effect sizes were excluded from moderation analyses if we were unable to extract the relevant moderator data or, for categorical moderation analyses, if the effect size was too dissimilar from other effect sizes to form a category of $>$ 1 effect size.

Lastly, to investigate potential publication bias we plotted effect sizes on sunset (power-enhanced) funnel plots using the metaviz R package (Kossmeier et al., 2020). Funnel plots were presented separately for each measure of attentional bias and we used the moderation analysis estimates for plotting population effect sizes. We visually inspected the funnel plots for evidence of nominally statistically significant effects ($0.01 < p \leq 0.05$) from small studies which could be driving the meta-analysis results. We interpreted the funnel plots in conjunction with power-based statistics, including the median statistical power of the effects, the test of excess significance, and the replicability index.

## 3. Results

The results of the search and screening stages are presented in Fig. 1. From the original database search, authors TH and KG independently screened 980 titles and abstracts (95 % agreement; Cohen's κ = 0.67), followed by 8 full texts (88 % agreement; Cohen's κ = 0.71). Remaining full texts and results identified from follow-up database searches were screened solely by author TH. For initial data extraction, TH and KG independently extracted data from two studies (91 % overall agreement with 100 % agreement specifically for effect size extraction). Once TH finished extracting data from the remaining studies, the full data extraction form (34 studies) was checked by author BE (98 % overall agreement with 94 % agreement specifically for effect size extraction). The results of the systematic review are presented in a pared-down data extraction table (Table 2), with additionally extracted details including demographics and effect sizes documented in Supplementary Materials.

The search found 34 eligible studies, involving a total number of 2857 female participants. The largest number of studies were conducted in Australia (10 studies), followed by Canada (4 studies), United Kingdom (4 studies), United States (4 studies), China (3 studies), and Brazil (2 studies). Studies were also conducted in Estonia (1 study), Germany (1 study), Malaysia (1 study), South Korea (1 study), Switzerland (1 study), and in an online setting with no country restrictions (2 studies). Participants had a weighted mean age of 21.12 years and a weighted mean BMI of 22.62 kg/m$^2$,

**Table 2**
Characteristics and main findings for the included studies. A full data extraction table with additionally extracted details including demographics and effect sizes is provided in the Supplementary Materials.

| Author/Year | *N* | Paradigm | Stimuli | Body dissatisfaction assessment | Main findings |
|---|---|---|---|---|---|
| Berrisford-Thompson et al. (2021) | 114 | Modified RSVP task | Low weight vs scrambled bodies. | BSQ | + Women with high (compared to low) BD demonstrated reduced accuracy for identifying target stimuli following low weight bodies (vs scrambled bodies), indicating low weight body induced blindness. |
| Cass et al. (2020) | 71 | Visual search task | Low weight vs high weight vs average weight bodies. | BSQ; Actual–ideal body discrepancy on a novel figure rating scale (NFRS); EDE-S; EDE-W | ○ No associations between BD and RTs for low weight bodies (vs average weight bodies).<br>○ No associations between BD (BSQ; EDE-S; EDE-W) and RTs for low weight bodies (vs high weight bodies).<br>− Women with high (compared to low) BD (NFRS) had slower RTs for low weight bodies (vs high weight bodies). |
| Cho and Lee (2013) | 41 | Eye-tracking during a free-viewing task | Low weight vs high weight vs muscular vs average weight bodies. | EDI-2-BD | + Women with high (compared to low) BD gazed for longer and fixated more frequently at low weight bodies. |
| Dondzilo et al. (2021) | 63 | ARDPEI task | Low weight vs high weight bodies vs abstract art. | BSQ | ○ No direct associations between BD and RTs for low weight bodies (vs high weight bodies) on engagement or disengagement bias trials.<br>+ Women with high (compared to low) BD had faster RTs for low weight bodies (vs high weight bodies) on engagement bias trials, but only via the mediators appearance comparisons and eating disorder-specific rumination. |
| Dondzilo et al. (2017) | 70 | Dot probe task | Low weight bodies vs abstract art. | BSQ | + Women with high (compared to low) BD had faster RTs for probes replacing low weight bodies (vs abstract art). |
| Gaid (2008) | 40 | Visual search task | Low weight vs high weight vs average weight bodies. | BISS | ○ No associations between BD and RTs for low, average, or high weight bodies.<br>+ Women with high (compared to low) BD had a greater difference between present vs absent trials for low weight and average weight bodies, but not high weight bodies. |
| Gao et al. (2014) | 68 | Eye-tracking during a free-viewing task | Low weight body vs body where shape/weight information was not salient vs household items vs gardening items. | NPS-F | ○ No association between BD and the percentage of first fixations to low weight bodies.<br>− Women with high (compared to low) BD were slower to fixate on low weight bodies.<br>+ Women with high (compared to low) BD had longer first fixations and overall gaze durations during the 15 s presentation time towards low weight bodies. |
| Gao et al. (2013) | 204 | Modified spatial cueing paradigm | Low weight bodies vs household items. | NPS-F | + For SOA 760 ms trials, women with high (compared to low) BD had slower reaction times to probes following low weight body stimuli (vs household items).<br>○ For SOA 1160 ms trials, there was no association between BD and RTs to probes following low weight bodies (vs household items). |
| Glauert et al. (2010) study 1 | 49 | Dot probe task | Low weight vs high weight bodies. | BSQ | ○ No association between BD and RTs for probes replacing low weight bodies (vs high weight bodies). |
| Glauert et al. (2010) study 2 | 50 | Dot probe task | Low weight vs high weight bodies. | BSQ | ○ No association between BD and RTs for probes replacing low weight bodies (vs high weight bodies). |
| Glauert et al. (2010) study 3 | 50 | Dot probe task | Low weight vs high weight bodies. | BSQ | − Women with high (compared to low) BD had slower RTs for probes replacing low weight bodies (vs high weight bodies).<br>○ This negative relationship was eliminated after controlling for BMI. |
| House, Stephen, et al. (2022) study 1 | 150 | Dot probe task | Low weight vs high weight bodies. | BSSS | ○ No association between BD and RTs for probes replacing low weight bodies (vs high weight bodies). |
| House, Stephen, et al. (2022) study 2 | 70 | Dot probe task | Low weight vs high weight bodies. | BSSS | ○ No association between BD and RTs for probes replacing low weight bodies (vs high weight bodies). |
| House, Stephen, et al. (2022) study 3 | 150 | Dot probe task | Low weight vs high weight bodies. | BSSS | ○ No association between BD and RTs for probes replacing low weight bodies (vs high weight bodies). |
| House, Wong, et al. (2022) | 300 | Dot probe task | Low weight vs high weight bodies. | BSSS | ○ No association between BD and RTs for probes replacing low weight bodies (vs high weight bodies). |

(*continued on next page*)

**Table 2** (*continued*)

| Author/Year | *N* | Paradigm | Stimuli | Body dissatisfaction assessment | Main findings |
|---|---|---|---|---|---|
| Joseph (2014) study 1 | 89 | Dot probe task | Low weight vs high weight bodies. | BSQ | + Women with high (compared to low) BD had faster RTs for probes replacing low weight bodies (vs high weight bodies). |
| Joseph (2014) study 2 | 25 | Dot probe task | Low weight vs high weight bodies. | BSQ | ○ No association between BD and RTs for probes replacing low weight bodies (vs high weight bodies). |
| Karlinsky et al. (2021) | 87 | Covert eye-tracking during a free-viewing rest period | Low weight vs average weight bodies. | BAS | ○ No association between BD and likelihood of directing first fixation to low weight bodies.<br>○ No association between BD and gaze count or gaze duration to low weight bodies. |
| Lee and Shafran (2008) | 75 | Dot probe task | Low weight bodies vs animals. | EDE-S | ○ No association between BD and RTs for probes replacing low weight bodies (vs animals). |
| Misener and Libben (2020) | 197 | Modified spatial cueing paradigm with eye-tracking | Low weight vs high weight bodies vs control bodies where shape/weight information was not salient. | BSQ | − Women with high (compared to low) BD had faster RTs to probes following low weight bodies (vs control bodies and vs high weight bodies).<br>○ For SOA 760 ms trials, there was no association between BD and first run dwell times (initial fixation durations) to low weight bodies (vs control bodies and vs high weight bodies).<br>+ For SOA 1160 ms trials, women with high (compared to low) BD had longer first run dwell times for low weight bodies (vs control bodies).<br>○ For SOA 1160 ms trials, there was no association between BD and first run dwell times to low weight bodies (vs high weight bodies). |
| Moussally et al. (2016) | 163 | Dot probe task | Low weight vs average weight bodies. | BSQ | + For SOA 500 ms trials, women with high (compared to low) BD had faster RTs for probes replacing low weight bodies (vs average weight bodies).<br>○ For SOA 100 ms and 1500 ms trials, there was no association between BD and RTs for probes replacing low weight bodies (vs average weight bodies). |
| Nazareth et al. (2019) | 19 | Body size discrimination task | Low weight vs high weight bodies | Brazilian BSQ; Actual–ideal body discrepancy (Brazilian FRS) | ○ No associations between BD and accuracy or RTs to low weight bodies (vs high weight bodies). |
| Purvis et al. (2015) | 77 | Visual gaze tracking during a virtual reality free viewing task | Low weight vs high weight vs average weight bodies. | BPSS-R at baseline | + In the beach environment, women with high (compared to low) BD gazed for longer at low weight bodies.<br>○ In the party environment, there was no association between BD and gaze duration to low weight bodies. |
| Scott et al. (2023) | 60 | Eye-tracking during a free-viewing task | Low weight vs high weight vs average weight bodies and faces | BSS | ○ No association between BD and fixation duration or fixation count to low weight bodies and faces.<br>− Women with high (compared to low) BD made less unique visits to low weight bodies and faces. |
| Seifert et al. (2008) | 32 | Frequency estimation task | Low weight vs high weight vs average weight bodies. | Actual–ideal body discrepancy (FRS) | ○ No association between BD and frequency estimations for low weight bodies. |
| Shafran et al. (2007) | 75 | Dot probe task | Low weight bodies/body parts vs animals. | EDE-S | ○ No association between BD and RTs for probes replacing low weight bodies (vs animals). |
| Stephen, Sturman, et al. (2018) | 35 | Eye-tracking during a free-viewing task | Low weight vs high weight bodies. | Single-item measure of BD rating | + Women with high (compared to low) BD gazed for longer and fixated more frequently at low weight bodies. |
| Szostak (2018) | 80 | Dot probe task | Low weight vs average weight bodies. | BSQ; EDI-3-BD | ○ No associations between BD and RTs for probes replacing low weight bodies (vs average weight bodies). |
| Tobin et al. (2019) | 167 | Eye-tracking during a free-viewing task | Low weight bodies vs average weight bodies where shape/weight information was not salient vs household items vs gardening items. | BSQ | + Women with high (compared to low) BD spent more time fixating at low weight bodies. |

(*continued on next page*)

**Table 2** (*continued*)

| Author/Year | *N* | Paradigm | Stimuli | Body dissatisfaction assessment | Main findings |
|---|---|---|---|---|---|
| Uusberg et al. (2018) | 36 | EEGs measured during a body size comparison and working memory task | Low weight vs high weight bodies. | EDI-2-BD | ○ No associations between BD and amplitudes to low weight bodies (vs high weight bodies), as indexed by the P3 and LPP components.<br>○ For the N170 component, there were no associations between BD and amplitudes to low weight bodies (vs high weight bodies) for self-identity trials or other-identity low working memory trials.<br>− For the N170 component, women with high (compared to low) BD demonstrated reduced amplitudes for low weight bodies (vs high weight bodies), but only for other-identity high working memory trials.<br>○ For the P2 component, there were no associations between BD and amplitudes to low weight bodies (vs high weight bodies) for other-identity trials or self-identity high working memory trials.<br>− For the P2 component, women with high (compared to low) BD demonstrated reduced amplitudes for low weight bodies (vs high weight bodies), but only for self-identity low working memory trials. |
| Voges et al. (2019) | 44 | SSVEP measured with EEG during a dot detection task | Low weight vs high weight bodies. | Combined scores on the EDE-S and EDE-W | ○ No associations between BD and SSVEP amplitudes to low weight bodies (vs high weight bodies). |
| Volkmann and de Castro (2021) | 42 | Modified spatial cueing paradigm | Low weight bodies vs cylinders. | Brazilian BSQ | ○ No association between BD and RTs to probes following low weight bodies (vs cylinders) for SOA 760 ms or 1160 ms trials. |
| Wang et al. (2019) | 31 | EEGs measured during a body size comparison task | Low weight vs high weight bodies. | NPS-F | ○ No associations between BD and RTs for low weight bodies.<br>− Women with high (compared to low) BD showed reduced N2 amplitudes to low weight bodies (vs high weight bodies).<br>− Women with high (compared to low) BD showed reduced LPC amplitudes during the 730–1000 ms interval to low weight bodies (vs high weight bodies). |
| Withnell et al. (2019) | 108 | Eye-tracking during a free-viewing task | Low weight bodies vs average weight bodies where shape/weight information was not salient vs household items vs gardening items. | BSQ | + Women with high (compared to low) BD fixated for longer at low weight bodies. |

*Note.* ARDPEI = Attentional response to distal vs. proximal emotional information; BD = body dissatisfaction; EEG = electroencephalogram; RSVP = Rapid serial visual presentation; RT = reaction time; SOA = stimulus onset asynchrony; SSVEP = steady state visually evoked potentials. Body Appreciation Scale (BAS; Avalos et al., 2005); Body Image States Scale (BISS; Cash et al., 2002); Body Parts Satisfaction Scale-Revised (BPSS-R; Petrie et al., 2002); Body Satisfaction Scale (BSS; Slade et al., 1990); Body Shape Questionnaire 34 (BSQ; Cooper et al., 1987); Body Shape Satisfaction Scale (BSSS; Pingitore et al., 1997); Brazilian Body Shape Questionnaire 34 (BSQ; Di Pietro & Silveira, 2009); Brazilian Figure Rating Scale (FRS; Kakeshita et al., 2009); Eating Disorder Examination Shape Subscale (EDE-S; Fairburn & Cooper, 1993); Eating Disorder Examination Weight Subscale (EDE-W; Fairburn & Cooper, 1993); Eating Disorder Inventory 2 Body Dissatisfaction Subscale (EDI-2-BD; Garner, 1991); Eating Disorder Inventory 3 Body Dissatisfaction Subscale (EDI-3-BD; Garner, 2004); Figure Rating Scale (FRS; Stunkard et al., 1983); Negative Physical Self Fatness Concern Subscale (NPS-F; Chen et al., 2006). In the main findings column, + indicates the finding is in our hypothesised direction, – indicates the finding is in the opposite direction, and O indicates there was no association. If a study calculated a difference score for their measure of attention (e.g. a RT difference score), we have reported the stimulus compared to the low weight body in brackets e.g. "faster RTs for probes replacing low weight bodies (vs high weight bodies)" indicates a RT difference score was calculated for low weight vs high weight bodies.

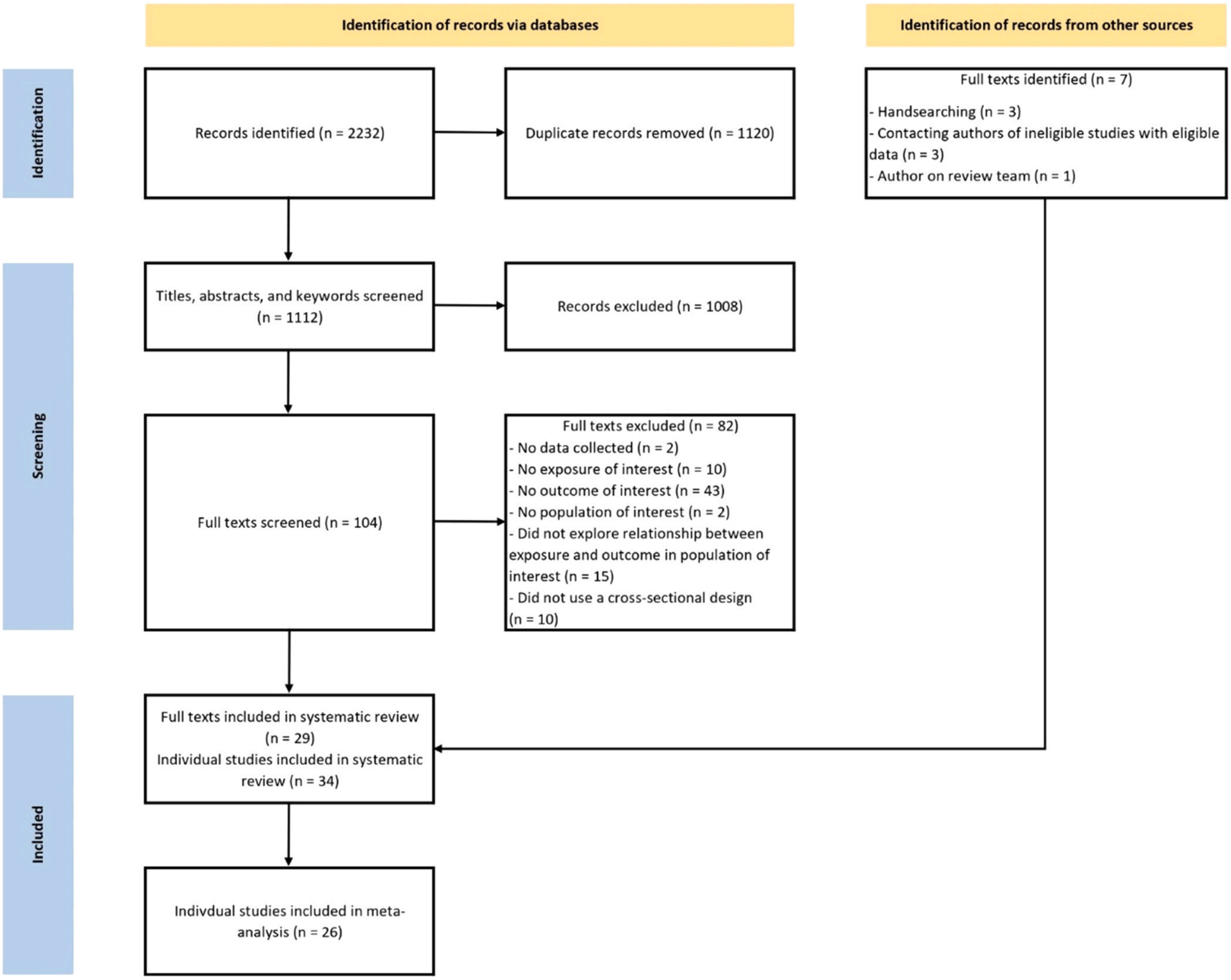


**Fig. 1.** Flow diagram of search results. Some included full texts reported multiple studies, therefore we have distinguished between the number of full texts and individual studies included in the systematic review and meta-analysis.

which is in the healthy weight range (NHS, 2019). Participants were typically university students recruited from undergraduate courses. The most common method of measuring attentional bias was the dot probe task (14 studies), followed by gaze tracking (9 studies), electroencephalogram (EEG) recording (3 studies), a modified spatial cueing paradigm (3 studies), and a visual search task (2 studies). Remaining studies used an attentional response to distal vs. proximal emotional information (ARDPEI) task (1 study), a body size discrimination task (1 study), a frequency estimation task (1 study), and a modified rapid serial visual presentation (RSVP) task (1 study).

### 3.1. Meta-analysis

The meta-analysis pooled 75 effect sizes from 26 studies (Fig. 2). The studies measured attentional bias using either the dot probe task, gaze tracking, EEG recording, or the modified spatial cueing task. The multilevel random effects model did not provide evidence for a relationship between body dissatisfaction and attentional bias to low weight bodies, $Z(74) = 0.06$, $p = .165$, 95 % confidence intervals [− 0.03, 0.14], 95 % prediction interval [− 0.37, 0.49]. We converted the pooled Fisher's Z to Pearson's $r$, which indicated the pooled effect size was very small in size, $r = .06$ (Cohen, 1988). A visual inspection of the forest plot (Fig. 2) revealed statistical heterogeneity, because there were multiple effects with non-overlapping 95 % confidence intervals. The distribution of variance across levels indicated substantial effect size heterogeneity within and between studies, $I^2_{\text{Level 2}} = 27.70\%$, $I^2_{\text{Level 3}} = 48.78\%$; $\tau^2_{\text{Level 2}} = 0.016$, $\tau^2_{\text{Level 3}} = 0.028$, and Cochran's Q test of heterogeneity was significant, $Q(74) = 237.40$, $p < .001$.

#### 3.1.1. Moderation analyses

Almost all of the moderation analyses provided no evidence for moderating effects (all $p$-values > .05; see Supplementary Materials for more details). The only exception was for measure of attentional bias, $F(3, 71) = 2.84$, $p = .044$. The pooled effects for each measure of attentional bias are reported in Table 3. We found evidence indicating gaze tracking effects were larger (more positive) than EEG effects ($t(71) = -2.58$, $p = .012$, but no evidence indicating gaze tracking effects differed from dot probe effects ($t(71) = -1.36$, $p = .178$) or modified spatial cueing effects ($t(71) = -1.72$, $p = .089$. There was no evidence for differences between dot probe, EEG, and modified spatial cueing effects (all $p$-values > .05; see Supplementary Materials for more details). There was evidence indicating that gaze tracking effects were larger (more positive) than zero, whereas there was no evidence indicating that dot probe, EEG, and modified spatial

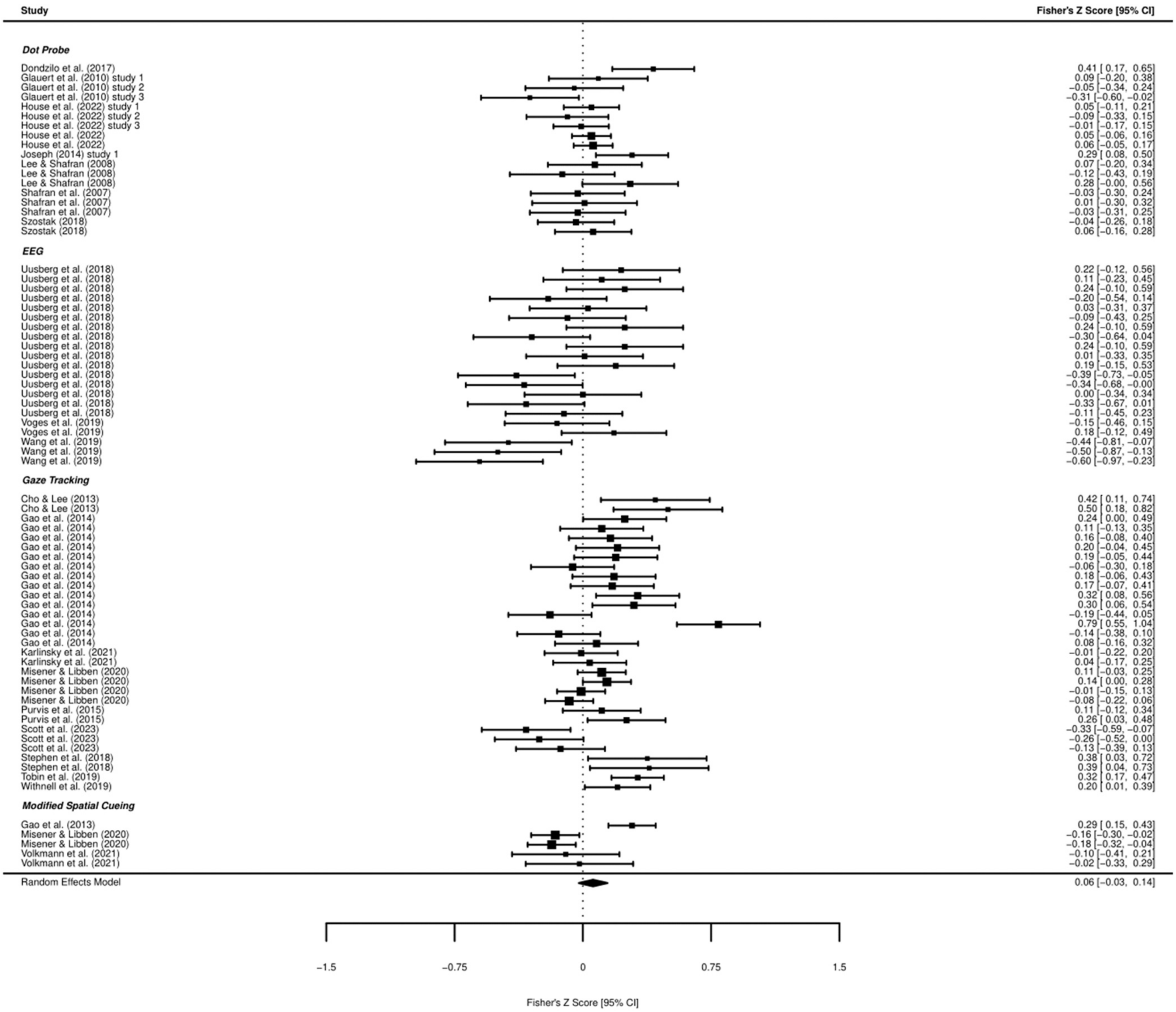


**Fig. 2.** Forest plot of Fisher's Z for body dissatisfaction and attentional bias to low weight bodies, grouped by measure of attentional bias (k = 75). Positive effects indicate women with high body dissatisfaction, when compared to women with low body dissatisfaction, directed more attention to low weight bodies. A three-level random effects model was used for pooling effects. Study weight is indicated by square size. CI = 95% confidence interval.

**Table 3**
The pooled effects reported separately for each measure of attentional bias.

| Attention measure | *k* | *Z* [95% CI] | *r* | *t* | *p* |
|---|---|---|---|---|---|
| Dot Probe | 18 | 0.05 [− 0.08, 0.18] | 0.05 | 0.71 | .478 |
| EEG | 21 | -0.16 [− 0.38, 0.06] | -0.16 | -1.43 | .157 |
| Gaze Tracking | 31 | 0.17 [0.04, 0.29] | 0.17 | 2.70 | .009 |
| Modified Spatial Cueing | 5 | 0.00 [− 0.19, 0.20] | 0.00 | 0.04 | .970 |

*Note.* CI = 95 % confidence interval.

cueing effects differed from zero (see Table 3). In summary, gaze tracking studies found evidence suggesting that women with high body dissatisfaction, when compared to women with low body dissatisfaction, had a greater attentional bias to low weight bodies. Dot probe, EEG, and modified spatial cueing studies did not provide evidence for this relationship. The moderation analyses for dot probe and gaze tracking studies found no evidence for moderating effects of body stimuli layout, SOA, gaze tracking index, or body stimuli presentation time (all $p$-values > .05; see Supplementary Materials for more details).

### 3.1.2. Missing effects

We identified 11 effects from five studies that would have been eligible for the meta-analysis; however, we were unable to extract effect size data and authors were unable to provide the data. For dot probe studies, the missing effects included one positive association effect (Moussally et al., 2016) and three no-association effects (Joseph, 2014, study 2; Moussally et al., 2016). For EEG studies, the missing effects included five no-association effects for N1, P2, and early LPC components (Wang et al., 2019). For gaze tracking studies, the missing effects included one no-association effect for first gaze behaviour (Karlinsky et al., 2021). For modified spatial cueing studies, the missing effects included one no-association effect for SOA 1160 ms trials (Gao et al., 2013). Given the number of no-association effects and the relatively small sample sizes for these effects, we think it is unlikely they would have influenced our interpretations of the pooled effect estimates (either overall or separated by measure of attentional bias) if effect size data had been available. However, it is possible that a marginal decrease in the pooled gaze tracking effect combined with a marginal increase in the pooled EEG effect may have reduced the evidence for a difference between these effects.

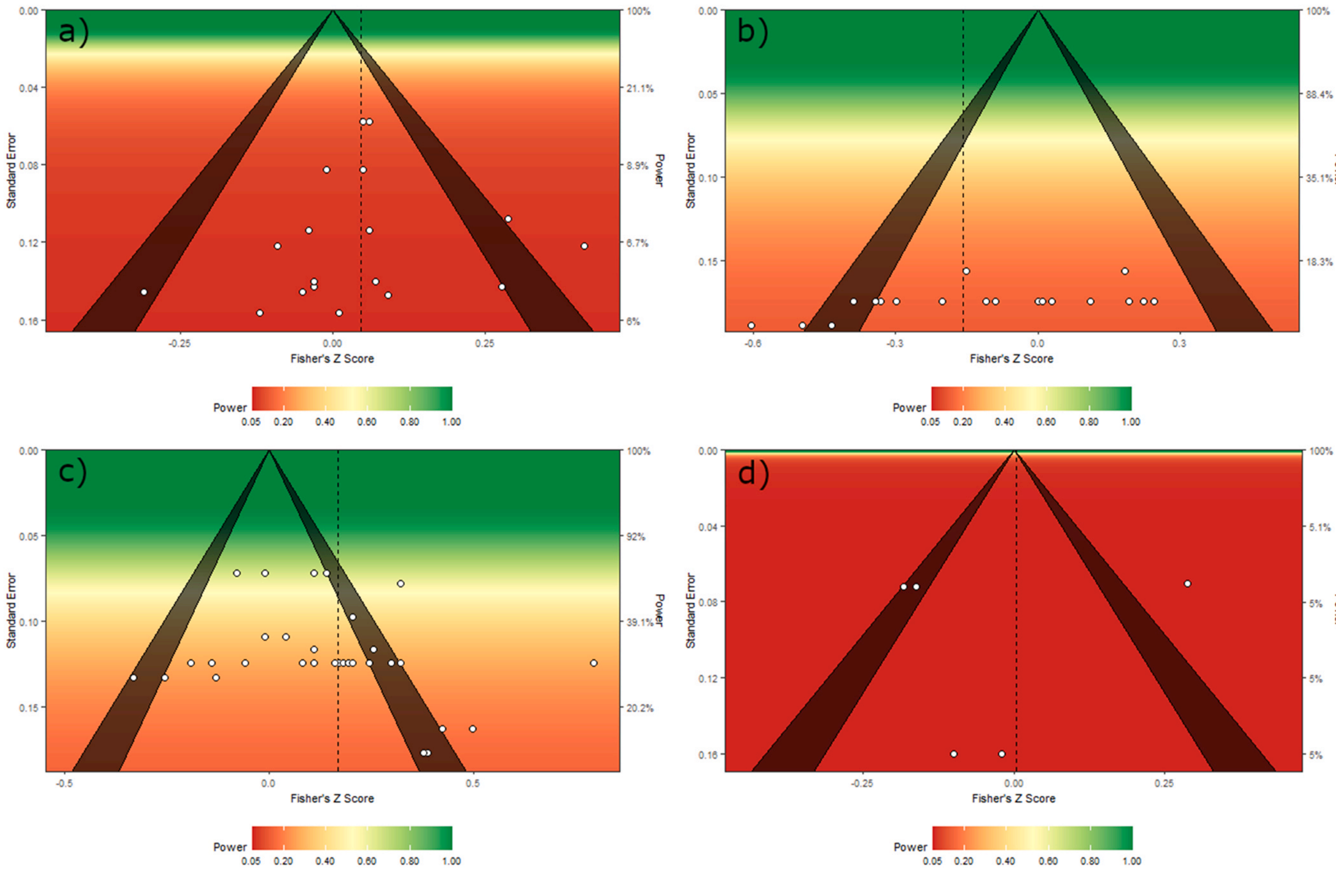


**Fig. 3.** Four sunset (power-enhanced) funnel plots presenting correlation coefficients (Fisher's Z; k = 75) for body dissatisfaction and attentional bias to low weight bodies. Plot a (top left) presents effects from dot probe studies, plot b (top right) presents effects from EEG studies, plot c (bottom left) presents effects from gaze tracking studies, and plot d (bottom right) presents effects from modified spatial cueing studies. Positive correlations indicate women with high body dissatisfaction, when compared to women with low body dissatisfaction, directed more attention to low weight bodies. Moderation analysis estimates (Table 3) were used for plotting population effect sizes, depicted by the dashed lines. Significance contours (0.01 < p ≤ 0.05) are depicted by the dark shaded areas. Study-level statistical power for detecting population effect sizes is colour-coded from red (underpowered) to green (appropriately powered; Kossmeier et al., 2020).

### *3.1.3. Publication bias*

The sunset (power-enhanced) funnel plots are presented separately by measure of attentional bias in Fig. 3. For dot probe studies, we did not identify obvious asymmetry, although a small number of small study effects clustered in the significance contours (Fig. 3a) which could suggest publication bias. The median statistical power for dot probe tests was very low (6.5 %), but a test of excess significance did not indicate we observed more statistically significant dot probe effects than expected (observed = 3.00; expected 1.32; $p = .129$). This does not provide clear evidence of publication bias. The expected replicability of the dot probe findings was very low (R-index = 0.0 %). Similarly, for EEG studies we did not identify obvious asymmetry, although a small number of small study effects clustered in the negative significance contour (Fig. 3b), which could suggest publication bias. The median statistical power for EEG tests was very low (14.8 %), but a test of excess significance did not indicate we observed more statistically significant EEG effects than expected (observed = 5.00; expected 3.11; $p = .246$). This does not provide clear evidence of publication bias. The expected replicability of the EEG findings was very low (R-index = 5.8 %).

For modified spatial cueing studies, we did not identify obvious asymmetry, although the number of effects was very low ($k = 5$), making asymmetry difficult to detect. There were two effects clustered in the negative significance contour, which could suggest publication bias (Fig. 3d). These effects were from relatively higher powered studies; however, the median statistical power of all modified spatial cueing tests was very low (5.0 %). A test of excess significance indicated we observed more statistically significant modified spatial cueing effects than expected (observed = 3.00; expected 0.25; $p < .001$), which could provide evidence for publication bias. The expected replicability of the modified spatial cueing findings was very low (R-index = 0.0 %). Overall, for dot probe, EEG, and modified spatial cueing effects, we think it is possible that publication bias may have contributed to some of the nominally significant effects from studies with low statistical power. However, we do not think publication bias will have affected our overall interpretations of the dot probe, EEG, or modified spatial cueing data, given we did not interpret there being evidence for a relationship between body dissatisfaction and attentional bias based on these measures.

For gaze tracking studies, visual inspection of the funnel plot did reveal a slight asymmetry and a number of small study effects clustering in the positive significance contour (Fig. 3c). This could suggest the gaze tracking estimated effect was inflated due to publication bias. The median statistical power of all gaze tracking tests was higher than other measures of attentional bias, but still low (27.4 %). A test of excess significance did not provide evidence indicating that we observed more statistically significant gaze tracking effects than expected (observed = 13.00; expected 10.12; $p = .271$). The expected replicability of the findings was higher than other measures of attentional bias, but still low (R-index = 12.9 %). Overall, these findings call for a cautious interpretation of the gaze tracking data. The estimated effect provided evidence for a positive relationship between body dissatisfaction and attentional bias to low weight bodies; however, this effect may be inflated due to publication bias.

## 3.2. Narrative synthesis

### 3.2.1. Visual search

Two studies used a visual search task to explore the relationship between body dissatisfaction and attentional bias to low weight bodies (Cass et al., 2020; Gaid, 2008). Cass et al. (2020) conducted a compound visual search task which involved young adult women searching for a horizontal or vertical target bar amongst an array of tilted distractor bars. Each bar was paired adjacent to a female body stimulus. For neutral trials, all body stimuli were average weight. For low and high weight body trials, body stimuli adjacent to the distractors were average weight, while the body adjacent to the target bar was either low or high weight respectively. Attentional bias was measured using the difference in mean reaction times for low weight vs high weight body trials and for low weight body trials vs neutral trials. The results did not provide evidence for associations between the measures of attentional bias and any of the body dissatisfaction measures (BSQ; Cooper et al., 1987; EDE-S; EDE-W; Fairburn & Cooper, 1993). The only exception was when body dissatisfaction was measured using actual–ideal body discrepancy on a novel figure rating scale (NFRS). There was weak evidence that women with high (compared to low) body dissatisfaction were slower to locate low weight bodies. This result was only significant relative to high weight bodies, and not to average weight bodies.

Gaid (2008) found similar results for their simple visual search task. Participants were required to detect the presence or absence of a low, average, or high weight body stimulus amongst an array of distractor body stimuli presented at various orientations. The results provided no evidence to suggest reaction times for any of the three body sizes were related to body dissatisfaction. Gaid (2008) also used signal detection theory (Green & Swets, 1966) to analyse participants' sensitivity to the target bodies. There was weak evidence demonstrating that women with high body dissatisfaction exhibited greater sensitivity to low weight and average weight bodies than to high weight bodies, unlike women with low body dissatisfaction who showed no significant variation of sensitivity across body size. For both visual search studies, a majority of the reaction time results provided no evidence for an association between body dissatisfaction and attentional bias to low weight bodies. The only exception was some weak evidence for a negative relationship when body dissatisfaction was measured using actual–ideal body discrepancy on a novel figure rating scale (NFRS; Cass et al., 2020). Therefore, low weight female bodies seem unlikely to facilitate visual search performance in women with high body dissatisfaction. However, there was some weak evidence demonstrating that body dissatisfaction is positively related with increased sensitivity to low and average weight bodies, compared to high weight bodies (Gaid, 2008). Further research is needed to confirm this finding.

### 3.2.2. Attentional response to distal vs. proximal emotional information (ARDPEI) task

Dondzilo et al. (2021) used the attentional response to distal vs. proximal emotional information (ARDPEI) task to measure attentional bias to low weight bodies in young adult women. The target stimulus depicted either a low weight or high weight body and the neutral stimulus depicted abstract art. Mean reaction time differences between low and high weight trials were used to calculate engagement and disengagement bias scores. The results did not provide evidence for a direct association between body dissatisfaction and engagement or disengagement bias to low weight bodies. However, engagement bias was indirectly positively related to body dissatisfaction via two mediating variables: appearance comparisons and eating disorder-specific rumination. Dondzilo et al. (2021) proposed a pathway where engagement with low weight female bodies increases feelings of body dissatisfaction via these mediators. However, it should be noted that this study only provided correlational and not causal evidence for this pathway.

### 3.2.3. Modified rapid serial visual presentation (RSVP) task

Berrisford-Thompson et al. (2021) conducted a modified rapid serial visual presentation (RSVP) task with female undergraduate students. The target stimulus followed either a low weight body or a control version of the body in which the pixels were scrambled. Low weight body induced blindness was measured by calculating the difference in mean accuracy scores for target stimuli following low weight vs scrambled bodies. Body dissatisfaction was positively correlated with low weight body induced blindness, so women with high (compared to low) body dissatisfaction directed more attention to low weight bodies. Consistent with Dondzilo et al. (2021), this positive relationship was mediated by eating disorder-specific rumination. Berrisford-Thompson et al. (2021) proposed a similar pathway where attention to low weight bodies increases eating disorder-specific rumination, which in turn increases body dissatisfaction, although the study provided only correlational and not causal evidence for this pathway.

### 3.2.4. Body size discrimination

Nazareth et al. (2019) presented young adult women with body silhouettes and measured the participants' ability to discriminate between the size of the silhouette and their own body size. Compared to the other studies included in this review, this study used a very short presentation time for the body stimuli (17 ms), which allowed for the measurement of attentional bias during the very initial stages of visual processing. The researchers measured discrimination accuracy and reaction time, and we calculated difference in mean accuracy scores and reaction times for the low vs high weight body trials. The results did not show evidence of an association between body dissatisfaction and discrimination accuracy or reaction time to low weight bodies, relative to high weight bodies. This would suggest any bias in attentional processing for women with high body dissatisfaction is unlikely to occur for such fast body size judgements.

### 3.2.5. Frequency estimation task

The final task used to measure attentional bias to body size was the frequency estimation task. Based on the availability heuristic (Tversky & Kahneman, 1973), Seifert et al. (2008) proposed that if women with high (compared to low) body dissatisfaction direct more attention to low and average weight bodies, then this should lead them to overestimate their frequency. They presented participants with body silhouettes that covaried in size and colour and asked them to estimate the frequency of target colours. Contrary to their hypothesis, Seifert et al. (2008) found no evidence for an association between body dissatisfaction and frequency estimations for colours that covaried with low or average weight bodes. Therefore, they concluded that women with high (compared to low) body dissatisfaction did not direct more attention to low or average weight bodies.

## 3.3. Quality assessment

All 34 studies were independently assessed for quality by authors TH and BE (80 % agreement; Cohen's $\kappa = 0.64$). Studies had a mean risk of bias score of 3.35 out of a possible 7 ($SD$ = 1.32; see Supplementary Materials for individual study scores). All 34 studies reported their participant eligibility criteria and most studies (29/34) sufficiently described participant demographics. The time period and location of recruitment was rarely reported (only by 2/34 studies); however, this is only a minor concern for assessing bias in this meta-analysis. A more major concern is that not all studies sufficiently evaluated the validity and reliability of their measures of attentional bias and body dissatisfaction. For example, only one study reported on the reliability of their measure of attentional bias within their sample. Studies tended to justify the use of their body dissatisfaction questionnaire based on reliability or validity demonstrated by previous research; however, only 17/34 studies additionally evaluated the reliability of their body dissatisfaction questionnaire within their sample. We also found that only a small number of studies (10/34) reported their data analysis approach and results in sufficient detail, e.g. by reporting exact *p*-values and methods for dealing with statistical assumptions and confounding variables, either in the paper or supplementary materials. Overall, the quality assessment highlighted many studies included in the review were at risk of bias and therefore results should be interpreted with caution.

## 4. Discussion

We conducted a systematic review and meta-analysis to investigate the relationship between body dissatisfaction and attentional bias towards low weight female bodies in non-clinical samples of women. In a previous systematic review, Rodgers and DuBois (2016) found initial evidence for a positive relationship between body dissatisfaction and attentional bias to low weight bodies in non-clinical populations. Our meta-analysis pooled effects from dot probe, electroencephalogram (EEG) recording, gaze tracking, and modified spatial cueing tasks. We found evidence for this positive association in women, but only for studies using gaze tracking as a measure of attentional bias. Therefore, our hypothesis was partially supported. Women with high body dissatisfaction, when compared to women with low body dissatisfaction, directed their gaze more frequently and for longer durations towards low weight female body stimuli. We did not find evidence for moderating effects on this relationship; however, the statistical power of the moderation analyses may have been too low to detect such effects.

The majority of studies included in this review used either the dot probe task or gaze tracking to measure attentional bias; however, we did not find evidence from dot probe studies for an association between body dissatisfaction and attention to low weight bodies. This methodological distinction is consistent with research in clinical populations (Stott et al., 2021). Eye-tracking studies indicate women with anorexia nervosa and bulimia nervosa gaze for longer at low weight female body stimuli than women without an eating disorder diagnosis (Blechert et al., 2009; Pinhas et al., 2014). In contrast, studies have not found evidence for this difference using a dot probe task (Lee & Shafran, 2008; Shafran et al., 2007). However, the research on clinical populations involves a small number of studies with very small sample sizes; therefore, these findings may not be robust (Stott et al., 2021).

The dot probe task demonstrated heterogenous results—a common finding in anxiety research where this task is used to measure attentional bias to threatening stimuli (Dennis-Tiwary et al., 2019). Many researchers have previously critiqued the dot probe task for having poor reliability (e.g. Parsons et al., 2019; Price et al., 2015; Rodebaugh et al., 2016; Schmukle, 2005). Further, there is evidence to suggest total gaze duration is a more reliable measure of attentional bias than traditional reaction time difference scores calculated using the dot probe task (Waechter et al., 2014). Therefore, it is possible that the dot probe task is not reliable enough to detect the positive relationship between body dissatisfaction and attentional bias to low weight bodies. As our quality assessment of the 34 included studies identified only one study that reported on the reliability of the measure of attentional bias, it is difficult to directly compare reliability between measures. Researchers have pointed out that in psychological science it is not routine practice to report on the reliability of cognitive-behavioural measures, which may have contributed to the widespread use of the dot probe task despite its poor psychometric properties (Parsons et al., 2019). Therefore, it is important for researchers in this field to adopt more consistent reporting practices for the psychometric properties of measures of attentional bias.

Although the dot probe task has poor reliability, some evidence indicates that it may not be the task itself that is unreliable, but the traditional method of calculating attentional bias scores. All dot probe studies in our meta-analysis calculated bias scores using the traditional approach of computing the difference in mean reaction times for trials with probes cued by low weight body vs control stimuli. This method assumes that attentional bias is stable and static across dot probe trials and that a person either expresses an attentional bias towards or away from the target stimulus category. On the contrary, Zvielli et al. (2015) analysed dot probe data at a trial level and found that a person's attentional bias fluctuates over the course of the task. Trial level bias scores were better predictors of psychopathological and addiction constructs than traditional bias scores, and demonstrated greater reliability. Therefore, the traditional bias scores used in our dot probe meta-analysis may not have captured the dynamic nature of attentional bias over time, which may have contributed to the heterogeneity of results.

Another possible explanation for the difference in meta-analysis results is that the dot probe studies did not recruit or group participants based on their body dissatisfaction scores, whereas at least three of the gaze tracking studies recruited participants specifically for having either high or low body dissatisfaction scores. Therefore, studies using gaze tracking may have reported larger effect sizes due to including participants with more extreme levels of body dissatisfaction. Future dot probe studies recruiting participants with more extreme body dissatisfaction scores may provide more evidence for the relationship between body dissatisfaction and attentional bias.

On the other hand, we did find some evidence to suggest the pooled gaze tracking effect may have been inflated due to publication bias, indicating that we should interpret these results with caution. Therefore, we should also consider the possibility that we only found an association between body dissatisfaction and attentional bias due to inflated gaze tracking effects. This interpretation is supported by our additional meta-analysis findings for EEG and modified spatial cueing studies, which also produced no evidence for an association between body dissatisfaction and attentional bias to low weight bodies. Some studies excluded from the meta-analysis also support this interpretation, including studies using the visual search task (Cass et al., 2020; Gaid, 2008), body size discrimination paradigm (Nazareth et al., 2019), and frequency estimation paradigm (Seifert et al., 2008). However, other studies excluded from the meta-analysis using the ARDPEI (Dondzilo et al., 2021) and RSVP tasks (Berrisford-Thompson et al., 2021) produced results more in line with gaze tracking studies. The gaze tracking results provide the most compelling evidence for a positive relationship between body dissatisfaction and attentional bias to low weight bodies. However, we interpret this evidence as weak given the possible influence of publication bias and lack of supporting evidence from studies using other measures of attention.

### 4.1. Strengths

In this review, we posed a narrow research question focussing on a specific attentional bias in one particular population. This allowed a deeper analysis of the literature including both qualitative and quantitative synthesis. To reduce bias in our review we followed recommendations proposed by Stott et al. (2021) and preregistered our review protocol, assessed studies for risk of bias, documented reasons for excluding studies, and assessed the impact of small study effects on our findings. We also aimed to reduce publication bias by including unpublished studies in our search strategy.

### 4.2. Limitations

The narrow focus of our review limits the generalisability of our conclusions. We focussed our review specifically on attentional bias to low weight bodies, because low weight bodies are likely targets for upward social comparisons and have been shown to increase body dissatisfaction (Bould et al., 2018; Groesz et al., 2002; Moreno-Domínguez et al., 2019; Tiggemann & McGill, 2004). However, the limited evidence for an association between body dissatisfaction and attentional bias to low weight bodies may not extend to other attentional biases. For example, Rodgers and DuBois (2016) found some initial evidence for a positive association between body dissatisfaction and attentional bias to high weight stimuli. This association may be more robust than the association between body dissatisfaction attentional bias to low weight bodies. We also restricted the review to studies on women, because research indicates attentional biases depend on gender differences in body ideals (Cho & Lee, 2013) and the majority of studies in this area have been conducted on women. Despite being understudied, body image disturbance and eating disorders are common among men (Gorrell & Murray, 2019; Mitchison & Mond, 2015). A recent review suggests that our conclusions may generalise to men, as male body dissatisfaction was associated with attentional biases to lean, high muscularity male bodies in some studies (Talbot & Saleme, 2022). However, further research is required to substantiate these findings.

The generalisability of our results is also limited because the included studies were predominantly conducted on young adult undergraduate students from North America, Europe, and Australia. Body dissatisfaction is commonly reported by women across cultures (Swami et al., 2010) and across the lifespan (Quittkat et al., 2019); however, our findings may not generalise to other populations. Our decision to only review studies written in English may have contributed to the culture bias in our studies, because our search strategy may have missed non-English papers from under-represented countries. Research suggests English language restrictions are unlikely to affect the conclusions of systematic reviews and meta-analyses (Dobrescu et al., 2021); however, future research should check the generalisability of our findings by reviewing non-English language papers.

Lastly, aside from measure of attentional bias, our moderation analyses found no evidence for an influence of moderating variables on our meta-analysis results. However, these null findings should be interpreted with caution because some of our moderation analyses involved small and imbalanced subgroups and therefore may have lacked statistical power to detect smaller moderator effects (Cuijpers et al., 2021).

### 4.3. Implications for future research

To improve the robustness of future research exploring the relationship between body dissatisfaction and attentional biases to low weight bodies, we have five recommendations. First, we encourage researchers to use gaze tracking measures of attention, e.g. gaze duration, because these measures currently provide the most compelling evidence for a relationship between body dissatisfaction and attentional bias to low weight bodies. Second, if researchers do not have the resources to conduct gaze tracking research, then we recommend researchers use the ARDPEI task (Dondzilo et al., 2021) or RSVP task (Berrisford-Thompson et al., 2021), because these measures have provided preliminary support for a positive relationship between body dissatisfaction and attentional bias to low weight bodies. Third, to prevent the ARDPEI and RSVP task from being susceptible to similar constraints as the dot probe task, we recommend that researchers avoid assuming attentional bias is stable and static across trials and analyse ARDPEI and RSVP data at trial level (Zvielli et al., 2015). Fourth, to help in the evaluation of different measures of attentional bias, we encourage researchers to adopt more consistent reporting standards for the psychometric properties of measures of attentional bias (Parsons et al., 2019). Fifth, to reduce the effects of publication bias on future systematic reviews and meta-analyses, we recommend authors report their unpublished findings as preprints in public repositories such as PsyArXiV (www.psyarxiv.com).

### 4.4. Conclusions

Our systematic review and meta-analysis provides evidence that women with high body dissatisfaction, when compared to women with low body dissatisfaction, direct more attention towards low weight female body stimuli. The most compelling evidence for this relationship comes from gaze tracking studies, with some preliminary supporting evidence from studies using the ARDPEI and RSVP tasks to measure attention. However, other measures of attention did not provide evidence for an association between body dissatisfaction and attentional bias. We make five recommendations for future research on this topic.


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## CRediT authorship contribution statement

**Thea House:** Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization. **Katrina Graham:** Investigation, Writing – review & editing. **Bridget Ellis:** Investigation, Writing – review & editing. **Helen Bould:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Angela Attwood:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Ian Stephen:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Kevin Brooks:** Conceptualization, Methodology, Writing – review & editing, Supervision. **Ian Penton-Voak:** Conceptualization, Methodology, Writing – review & editing, Supervision.

## Data Availability

The data and analysis code are publicly available from the Open Science Framework (DOI: 10.17605/OSF.IO/XMGKW).

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.bodyim.2022.12.003.

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