Body Image 45 (2023) 133–141

Contents lists available at ScienceDirect

Body Image

journal homepage: www.journals.elsevier.com/body-image

Social physical anxiety and eating disorders: A systematic review and meta-analysis

Manuel Alcaraz-Ibáñez [a,1,2], Adrian Paterna [a,*,1,3], Mark D. Griffiths [b,4]

[a] Health Research Centre and Department of Education, University of Almería, Spain
[b] Psychology Department, Nottingham Trent University, UK

ARTICLE INFO

Article history:
Received 25 November 2022
Received in revised form 30 January 2023
Accepted 20 February 2023
Available online xxxx

Keywords:
Body image
Social anxiety
Eating pathologies
Eating behaviours
Self-presentation

ABSTRACT

The present study's aim was to summarize existing quantitative evidence linking social physique anxiety (SPA) and eating disorders (ED). Eligible studies were searched for up to June 2, 2022 in six databases: *MEDLINE, Current Contents Connect, PsycINFO, Web of Science, SciELO,* and *Dissertations & Theses Global.* Studies were considered eligible if they included information derived from self-report instruments that allowed for computing the relationship between SPA and ED. Pooled effect sizes (*r*) were computed using three-level meta-analytic models. Potential sources of heterogeneity were examined using univariable and multivariable meta-regressions. Influence analyses and a three-parameter selection model (3PSM) were used for the purpose of examining the robustness of the results and publication bias, respectively. Results summarizing 170 effect sizes from 69 studies ($N = 41{,}257$) showed two main groups of findings. Firstly, that SPA and ED were very largely related (i.e., $r = .51$). Secondly, that this relationship was stronger (i) among individuals from Western countries, and (ii) when ED scores concerned the diagnostic feature of bulimia/anorexia nervosa involving body image disturbances. The present study adds to the current understanding of ED by suggesting that SPA is a maladaptive emotion with a potential role in the onset and maintenance of these group of pathologies.

1. Introduction

Eating disorders (ED) are a relatively low but increasingly prevailing psychiatric condition with a high mortality and healthcare burden (Crow, 2014; Qian et al., 2022; Smink et al., 2012). This is evident in the light of statistics suggesting that up to 3.3 million healthy life years may be lost due to ED-related disability (James et al., 2018), or that healthcare costs are up to 48% higher among individuals with ED than in the general population (Samnaliev et al., 2015). In view of this, identifying the factors underlying the onset and maintenance of ED is a major area of research interest (Alcaraz-Ibáñez et al., 2020; Kerr-Gaffney et al., 2018; Puccio et al., 2016).

Evidence from epidemiological studies suggests that a wide range of factors may be involved in the aetiology of ED, including those of a psychosocial nature (Mitchison & Hay, 2014; Munro et al., 2017). Regarding psychological factors, experiences of social anxiety stemming from worries about not being able to make positive social impressions (Leary & Jongman-Sereno, 2014) and body image-related affective disturbances arising from negative subjective experiences of the body (Cash, 2012) have been proposed as relevant vulnerability factors for ED (Glashouwer et al., 2019; Kerr-Gaffney et al., 2018; Schaefer & Thompson, 2018; Walker et al., 2018). One construct encompassing these two issues is the form of social

anxiety that individuals derive from experiencing or anticipating negative interpersonal evaluations of their own body (i.e., social physique anxiety; SPA) (Hart et al., 1989).

The association between SPA and ED has been justified by arguing that trying to modify body appearance as a means of avoiding unfavourable social evaluations could lead to the adoption of specific potentially problematic eating strategies (Kowalski et al., 2006; Lanfranchi et al., 2015). In particular, because adopting these strategies (which may initially include skipping some meals, using diuretics/laxatives, fasting, or following diets) often precede the onset of clinically significant ED (Greenhalgh, 2016; Stice, 2002). Similarly, findings from a previous narrative review have supported the positive association between SPA and ED (Sabiston et al., 2014). However, both the magnitude of this relationship and the methodological and demographic factors that may condition it remain largely unknown. Addressing this gap in the literature may contribute to a better understanding of the potential role of SPA in the onset and maintenance of ED, which could translate into improving prevention and treatment efforts aimed at reducing the prevalence of ED.

Consequently, the present study had two main objectives. Firstly, to quantitatively summarize the current evidence for the relationship between SPA and ED. Secondly, to identify in an exploratory way, moderators of such a relationship. Irrespective of eventual moderators emerging from the analysis of the common features of the primary studies retrieved, four main candidate variables (i.e., gender, clinical status in terms of ED, SPA measure, and type of ED symptoms) merit prior consideration. Moreover, the fact of examining the possible moderating role of both gender and clinical status in terms of ED may contribute to clarify the inconclusive and sometimes contradictory results shown by primary studies examining this issue (Alcaraz-Ibáñez, Paterna, Griffiths, et al., 2020; Brunet et al., 2010; Koskina et al., 2011; Lanfranchi et al., 2015; Radix et al., 2019). Additionally, consideration of the SPA measure as a candidate moderating variable seems important in view the slight conceptual differences in the two instruments proposed for the assessment of such a construct: (i) the Social Physique Anxiety Scale (SPAS) (Hart et al., 1989) which is predominantly focused on physical features, and (ii) the Social Appearance Anxiety Scale (SAAS) which is arguably more focused on appearance (Hart et al., 2008). Also of interest in the context of examination of the SPA measure as a candidate moderator variables is the fact that several versions depending on the number of items included have been proposed for the SPAS a (Calmeiro et al., 2012; Hagger et al., 2007; Jin & Fung, 2021). Finally, examining the moderating role of the type of ED symptoms seems pertinent in view of both the varying nature of ED and the different ways in which their assessment have been made operational. Indeed, scores derived from self-report instruments

assessing ED may reflect the following three discrete groups of outcomes: (i) overall risk levels (e.g., those derived from generic screening instruments or those obtained as a result of aggregating scores from subscales covering different symptoms), (ii) symptoms specific to particular ED (e.g., bulimia nervosa), and (iii) specific diagnostic features of particular ED (e.g., dietary restraint in the case of anorexia nervosa) (Alcaraz-Ibáñez, Paterna, Sicilia, et al., 2020; American Psychiatric Association, 2013; Schaefer & Thompson, 2018).

2. Methods

The present study was carried out according to the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) statement (Page et al., 2021) (see Appendix A for the PRISMA checklist) and was pre-registered in PROSPERO (CRD42021237104).

2.1. Locating studies

Eligible studies were searched for up to June 2, 2022 in six databases: *MEDLINE, Current Contents Connect, PsycINFO, Web of Science, SciELO,* and *Dissertations & Theses Global* (see Appendix B for the full search strategy). Reference lists of included studies were hand-searched to identify additional potentially eligible studies.

Endnote X9 software was used for reference management and duplicate removal at the screening stage. Studies were independently selected by the two first authors by sequential examination of (a) their titles/abstracts, and (b) their full-texts. Inter-coder reliability in terms of Cohen's Kappa was .74 (99% agreement) for the abstract/title, and .89 (94% agreement) for the full text. In case of suspected duplication of studies (e.g., a thesis and its derived peer-reviewed publication), only published data were employed. Disagreements were discussed and resolved on a consensual basis with the assistance of a third author, if necessary.

Corresponding authors of the included studies were also contacted to solicit both unpublished data that might be suitable for inclusion and relevant information not provided in the studies (e.g., mean age of sample). One-third of the contacted authors provided data that were finally included in the analyses (33.4%).

2.2. Eligibility Criteria

The present study gathered data on the association between SPA and ED as assessed by self-report instruments. For the purpose of minimising publication bias, the literature search aimed to retrieve data both from published and unpublished studies.

2.2.1. Inclusion criteria. Studies meeting the following criteria were considered eligible: (i) at least one self-report instrument (this being understood as one whose psychometric properties had been formally tested in a peer-reviewed study) providing continuous scores of SPA was used; (ii) at least one validated self-report instrument providing ED scores of either a

continuous (i.e., the higher the score, the higher the higher the level of risk) or dichotomous nature (i.e., being at-risk or not at-risk) was used, (iii) studies were written in English or Spanish (the working languages of the authors), although there was no restrictions in terms of country of origin; and (iv) sufficient data were available for calculation of the effect sizes of interest.

2.2.2. Exclusion criteria. Studies were excluded on the basis of the following criteria: (i) the SPA or ED scores were obtained using versions of the instruments presenting modified factor structures from those originally proposed; (ii) isolated items assessing SPA or ED symptoms were used; (iii) composite scores comprising more than one validated questionnaire assessing SPA or ED symptoms but not scores derived from single instruments were used; and (iv) studies with less than 30 participants. The latter criterion was adopted given the likely increase in both sampling error and variations in the assessment of heterogeneity resulting from including studies featuring small sample sizes (Lin, 2018).

2.3. Coding Procedure

A coding frame was developed (and subsequently pilot-tested) taking into account the common features of the studies identified in a preliminary search. Consistent with previous meta-analytical research (e.g., Alcaraz-Ibáñez et al., 2020a), the effect-sizes were grouped in terms of ED outcomes taking into account the classification and diagnostic features proposed in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) (American Psychiatric Association, 2013). The resulting coding sheet (see Appendix C) was independently used by the two first authors when extracting relevant data from the retrieved studies. Inter-coder reliability (Cohen's Kappa) ranged from .72 to .93 (87% to 98% agreement). Disagreements were discussed and resolved on a consensual basis with the assistance of a third author, if needed.

2.4. Risk of Bias

The Newcastle-Ottawa Scale (NOS) for evaluating cross-sectional/survey studies (Hillen et al., 2017) was used for assessing risk of bias. The 0-16 range score of the NOS results from the evaluation of the following elements: (a) clarity of stated aim; (b) representativeness of the sample; (c) sample size; (d) non-respondents; (e) ascertainment of the exposure; (f) control of confounding factors; (g) comparability of participants in different outcome groups; (h) assessment of the outcome; and (i) statistical tests. Low scores on the NOS suggest an increased risk of bias. The risk of bias assessment was independently conducted by two first authors. Disagreements between reviewers were discussed and resolved on a consensual basis with the assistance of a third author, if needed. As a result of this procedure, scores between 7 and 13 in terms of risk of bias were assigned for the 69 retrieved studies.

2.5. Statistical Analysis

Pearson's correlation (*r*) was employed as the effect size index. When studies examined the relationship between SPA and ED considering the latter as a dichotomous variable (e.g., when instruments were used for screening purposes only; Alcaraz-Ibáñez et al., 2019), effect size was derived from mean scores, standard deviations, and sample size. Estimated effect sizes were *r*-to-*z* transformed before conducting statistical analyses. In the interest of facilitating interpretation of the results, effect sizes and their 95% confidence intervals (CI) were subsequently *z*-to-*r* transformed (Borenstein et al., 2009).

Several features of the primary studies included in this meta-analysis might imply that the principle of independence of effect sizes inherent to this technique had been violated (Becker, 2000). Firstly, the existence of multiple effect sizes involving different types of ED from the same study (e.g., symptoms of bulimia and overall ED; Bratrud et al., 2010). This was addressed by employing a three-level random effects model. By taking into account the hierarchical structure of the data, this technique allows for a differentiated examination of (i) the sampling variance for the observed effect sizes (level 1); (ii) the variance between effect sizes from the same study (level 2); and (c) the variance between studies (level 3) (Cheung, 2014; Van den Noortgate et al., 2013). A likelihood-ratio test was used to verify the adequacy of the three-level random effects model described above with respect to its less complex alternative (i.e., a two-level random effects model that does not assume that some of the effect sizes are nested within studies).

A second potential source of dependence was the existence of effect sizes from several population subgroups within the same study (e.g., men/women; Dakanalis et al., 2016). This was addressed by treating each effect size as if it were derived from a separate study when including it in the three-level random-effects model. (Cheung, 2014). A third and final potential cause of violation of the principle of independence was the presence of multiple effect sizes from the same population, for instance, when several instruments were used in the measurement of ED (Reichenberger et al., 2022) or in studies using longitudinal designs in which the relationship of interest was tested on multiple occasions (Levinson & Rodebaugh, 2016). This was addressed by randomly removing effect sizes until a single one remained (Cheung, 2014).

The presence of statistical heterogeneity at level 2 and level 3 was examined and quantified by using the *Q*-test and the I^2 statistic, with values of 25%, 50%, and 75% of the latter being respectively interpreted as indicative of low, moderate, and high heterogeneity (Higgins et al., 2003). In the presence of heterogeneity, three-level mixed-effects meta-regression models were used to explore potential sources of variance in two stages: (i) at the

univariate level (i.e., considering each potential moderator in isolation); and (ii) at the multivariate level (i.e., by simultaneously considering all the significant moderators identified in the first stage). Categorical variables were transformed into *k*-1 dummy variables by using a binary code. Explained variance by the moderators was quantified on a percentage basis and expressed by R^2. The robustness of the results was examined using graphic display of studies heterogeneity (GOSH) plot analysis. This procedure allows for fitting both *K* models and all 2^{k-1} possible study combinations. Consequently, once the models are calculated by employing three cluster algorithms (i.e., k-means, DBSCAN [density-based spatial clustering of applications with noise], and Gaussian mixture models), a plot is obtained in which the pooled effect size and the between-study heterogeneity are respectively displayed on the x- and on y-axis (Olkin et al., 2012). Cook's distance values are subsequently employed for the purpose of identifying particularly influential studies (i.e., outliers) within the context of the emerging clusters (Harrer et al., 2021).

Publication bias was examined using a three-parameter selection model (3PSM) involving a simple model with a single cut-off point (< .05) and no moderators, which involved comparison of unadjusted and adjusted meta-analytic models by means of a likelihood-ratio test. Statistically significant results of this test indicate that the fitted model should be retained, therefore suggesting the existence of publication bias (Coburn & Vevea, 2019). The use of the 3PSM has been recommended over other methodological alternatives for the purpose of examining publication bias in situations where a high degree of heterogeneity is observed (Carter et al., 2019).

Point mean estimates of effect sizes were interpreted as very small (.00 to .10), small (.10 to .20), medium (.20 to .30), large (.30 to .40), very large (> .40) (Funder & Ozer, 2019). The aforementioned statistical analyses were conducted in R (version 3.6.1). The three-level random-effects models were estimated using a restricted maximum likelihood (REML), which is expected to provide robust estimates even in the absence of normal data distribution (Langan et al., 2019).

3. Results

3.1. Description of Studies

A total of 2,954 outputs were initially identified. As a result of the study selection procedure (see Figure 1), 69 primary studies involving 170 effect sizes (N = 41,257) published between 1997 and June 2, 2022 (inclusive), were included in the systematic review and meta-analysis (see Appendix D for the complete list). The main characteristics of the retrieved studies

are shown in Appendix D. From the studies included in the meta-analyses, 59 were published peer-reviewed papers and 11 were doctoral dissertations or conference proceedings.

Two main instruments were employed for the assessment of SPA, these being: (a) the SAAS (K = 73); and (b) the different versions of the SPAS (i.e., SPAS-14, K = 1; SPAS-12, K = 57; SPAS-11, K = 3; SPAS-10, K = 1; SPAS-9, K = 23; the SPAS-7, K = 11; and SPAS-6, K = 1; K_{total} = 101). The studies included in the meta-analysis approached the examination of ED according to the following outcomes: (i) overall ED symptoms (K = 82), (ii) symptoms of binge eating (K = 2), (iii) symptoms of bulimia nervosa (K = 23), (iv) a single diagnostic feature of anorexia nervosa such as dietary restraint (K = 23), and (v) a diagnostic feature common both to bulimia nervosa and anorexia nervosa such as the body image disturbances mainly involving undue influence of body shape and weight on self-evaluation (K = 40). From the retrieved studies, 7 were conducted in non-Western regions (Asia, K = 7), 53 were conducted in Western regions (Australia, K = 3, Europe K = 82, America, K = 62; K_{total} = 147), and 10 did not report this information (K = 16). From the studies included in the meta-analyses, 63 employed a cross-sectional design (K = 161) while 6 employed a longitudinal design (K = 9). Four studies (K = 16) included in the meta-analysis were conducted with clinical populations in terms of ED. Mean age of the participants in the samples included in the meta-analysis ranged from 10.90 to 43.00 years (M_{age} = 21.59 years, SD_{age} = 5.86) and in body mass index (BMI) from 16.14 to 33.68 kg/m^2 (M_{BMI} = 21.82, SD_{BMI} = 3.11).

3.2. Social Physique Anxiety and Eating Disorder Symptoms

The results from the likelihood-ratio test [$\chi^2(1) = 32.296$, $p < .001$] suggested the adequacy of the three-level over the two-level random effect model. Findings from the three-level random effects model showed a very large effect size (r = .51, p <.001; 95% CI = .475 to .539; $I^2_{(level2)}$ = 25.63, $I^2_{(level3)}$ = 66.00 (see Appendix E). The results from the Q-test indicated significant heterogeneity (Q = 1924.045, $\tau^2_{(level2)}$ = .013, $\tau^2_{(level3)}$ = .032), which was globally estimated in terms of the I^2 statistic to be 91.29% ($I^2_{(level2)}$ = 26.10, $I^2_{(level3)}$ = 65.15). Findings from the univariate meta-regression analysis for categorical variables (see Table 1) showed two significant moderators. Firstly, the type of ED [$\chi^2(4) = 39.763$, $p < .001$; $R^2_{(level2)}$ = .636, $R^2_{(level3)}$ = .000], with the relationship under consideration being weaker in effect sizes involving symptoms specific to particular ED. Secondly, region [$\chi^2(2) = 11.031$, p = .004; $R^2_{(level2)}$ = .013, $R^2_{(level3)}$ = .148], with the relationship under consideration being stronger in effect sizes involving studies conducted in Western countries. After removing effect sizes for which no mean age (K = 31) and BMI (K = 63) were available, findings from the univariable meta-regression analysis for continuous variables (see Table 1) did not show any significant

moderators. Furthermore, the findings from the multivariable meta-regression analysis (see Table 2) showed that the type of ED (with weaker effects in the case of symptoms specific to particular ED) and region (with stronger effects being found in samples from studies conducted in Western countries), together explained 63.2% (level 2) and 00.0% (level 3) of the inter-study variability in the relationship under consideration.

3.3. Sensitivity Analysis and Publication Bias

After removing eight effect sizes from seven studies (Alcaraz-Ibáñez et al., 2020b; Alcaraz-Ibáñez et al., 2020c; Haase et al., 2002; O'Hara et al., 2016; Öztürk et al., 2022; Reichenberger et al., 2022; Wright, 2010) identified as potential outliers according to the results of influence analyses (see Appendix F), the results from the adjusted model (r = .51, p <.001; 95% CI = .479 to .532; $I^2_{(level2)}$ = 35.36, $I^2_{(level3)}$ = 51.41) were found to be consistent with those from the non-adjusted one (r = .51, p <.001; 95% CI = .475 to .539; $I^2_{(level2)}$ = 25.63, $I^2_{(level3)}$ = 66.00). The results of 3PSM did not suggest the presence of publication bias [$\chi^2(1) = 2.806$, p = .094].

4. Discussion

Social physique anxiety (SPA) has been proposed as a vulnerability factor for eating disorders (ED). However, both the magnitude of this relationship and the methodological and demographic variables that may condition it have not previously been examined using meta-analytical techniques. In order to fill this gap in the literature, the present study summarized existing quantitative evidence linking SPA and ED. Results from a three-level random-effects model including 170 effect sizes from 69 studies comprising 41,257 participants resulted in two main groups of findings. Firstly, that SPA and ED are very largely related (i.e., r = .51). Secondly, that only two of the candidate moderator variables being tested (i.e., region and type of ED) accounted for variability in the relationship of interest. Therefore, this tended to be stronger (i) among individuals from Western rather than non-Western countries, and (ii) when ED scores concerned the diagnostic feature of bulimia/anorexia nervosa involving body image disturbances than when these same scores reflect either overall ED symptoms, symptoms specific to bulimia nervosa, or a diagnostic feature of anorexia nervosa such as dietary restraint. These findings reinforce the notion that SPA is a maladaptive construct in that it may play a potential role in the onset and maintenance of ED (Lanfranchi et al., 2015; Levinson & Rodebaugh, 2016; Sabiston et al., 2014). The main implications drawn from the results obtained are discussed below, while also highlighting current gaps in the literature that warrant further research attention.

Notably, the magnitude of the relationship being examined is largely coincident with those reported when examining other potential antecedents of ED that, similar to SPA, involve body image concerns with a strong social nature. This is the case with body shame (the self-conscious emotion derived from individuals perceiving that their own body does not conform to social norms) (Nechita et al., 2021), self-objectification (i.e., the fact of individuals being vigilant about their own appearance as a result of learned social self-schema involving the prevalence of this feature over other aspects of the self) (Schaefer & Thompson, 2018), or body avoidance (the behavioural manifestation of individuals' over-concern with their own body consisting of avoiding its public exposure) (Walker et al., 2018). This similarity in the magnitude of the relationships suggests that steps should be taken to identify the actual role of each of these variables in the onset and maintenance of ED.

A meaningful step in this direction would be taking into account these variables when examining the relationship between SPA and ED. This may also apply to the group of body image disturbances that, having been proposed as diagnostic features of bulimia/anorexia nervosa (American Psychiatric Association, 2013), have been proved to predict the emergence of the behavioural components of ED over time (Sharpe et al., 2018), as well as to other variables that, while not specifically referring to body image, have been consistently suggested as likely risk factors for ED. The latter is the case for psychological traits such as maladaptive perfectionism (Brosof et al., 2019; Levinson & Rodebaugh, 2016) or other psychopathological conditions such as depression (Puccio et al., 2016). Progressive availability of these data could allow for using meta-analytic structural equation modelling (MASEM) techniques (Jak & Cheung, 2018) to explore the specific and complementary contributions previously attributed to body image-related variables (and particularly SPA) in explaining ED (Alcaraz-Ibáñez et al., 2020b; Alcaraz-Ibáñez et al., 2020c; Christian et al., 2021; Fitzsimmons-Craft et al., 2012; Radix et al., 2019).

The fact that no evidence was obtained to support the moderating role of gender, BMI, age, or clinical status in terms of ED suggests that the relationship between SPA and ED is largely consistent across individuals with different socio-demographic characteristics. Nor was there any evidence indicating that the magnitude of the relationship of interest depended on the psychometric instrument used for assessing SPA. This finding suggests that SPA is consistently linked with ED symptoms irrespective of whether the former is focused on physical features (Hart et al., 1989) or on appearance (Hart et al., 2008).

In contrast to the above, there is evidence to support the moderating role of two of the variables that were tested. Firstly, the region where the study was conducted, with stronger

effects being found among samples from Western countries. This finding seems consistent with the fact that individuals from predominantly individualistic cultures (as it is the case with Western countries) tend to confer particular value upon the need for self-presentation (Pandey, 2022). Secondly, the type of ED, which implies that SPA may not be equally relevant for all these pathologies. Therefore, the fact that the relationship between SPA and ED was stronger when it comes to the diagnostic criteria of bulimia nervosa and anorexia nervosa involving body image disturbances suggests that experiencing the former emotion and conferring undue influence of body shape and weight on self-evaluation (an inherent characteristic of this type of body image disturbances) tend to be largely coincident. An alternative or complementary possibility is that other content also present in the instruments assessing the criterion concerning body image disturbances (Fairburn & Beglin, 2008) such as the negative evaluation of one's own body (i.e., body dissatisfaction) may overlap to some extent with SPA (Alcaraz-Ibáñez & Sicilia, 2020; Levinson & Rodebaugh, 2012).

One of the main implications to be drawn from the findings of the present study concerns the potential effectiveness of addressing the issues underlying SPA as part of actions aimed at preventing and treating ED. These may include providing education on (i) the risks of addressing body-related self-presentation concerns by adopting strategies involving potentially unhealthy dietary patterns, and (ii) the existence of more adaptive alternative coping strategies. An example of the latter is promoting self-compassion interventions that educate individuals on adopting a conscious awareness of negative emotions, so that distressing feelings inherent to SPA are not avoided or suppressed, but rather assumed without prejudice as part of human experience (Turk & Waller, 2020).

Current ED preventive interventions that use cognitive dissonance techniques (e.g., the *Body Project;* Becker & Stice, 2017) may also consider targeting SPA, for example, by encouraging individuals to speak and act in ways that assume both ignoring that others may be judging their body and giving no value to such appraisals. The findings also suggest that a clinical intervention which has proven effective in treating ED such as cognitive behavioural therapy (Linardon et al., 2017) may benefit from incorporating the range of currently-targeted body-related dysfunctional cognitions and beliefs (i.e., experiencing body dissatisfaction and over-valuating body shape and weight; Linardon, 2018) of those inherent to SPA (e.g., considering that the body is subject to external negative evaluation).

4.1. Strengths and Limitations

To the best of the present authors' knowledge, this is the first meta-analytic study that synthesizes existing quantitative data concerning both the relationship between SPA and ED

and its potential moderators. The main strengths of the present study are derived from (i) the efforts made for the purpose of making the review as comprehensive as possible, which implied not imposing *a priori* restrictions on geographical location, target population, and publication status, as well as soliciting unpublished data from corresponding authors; (ii) using both univariate and multivariate techniques when testing candidate moderator variables; and (iii) using several methods that allow the dependence between the sizes under consideration to be taken into account (notably the adoption of a three-level random effects model).

The first main limitation of the present study is that almost all the retrieved data were derived from cross-sectional data, which makes it impossible to ascertain the temporary nature of the relationship under consideration. It is worth noting that the few studies that prospectively examined the relationship between SPA and ED mainly examined just one of the several possible temporal options. Therefore, evidence exists demonstrating that SPA may lead to increased symptoms of an ED (Brosof et al., 2019; Christian et al., 2021) or, alternatively, that being at-risk of suffering from an ED may lead to increased levels of SPA (Alcaraz-Ibáñez & Sicilia, 2020). However, the findings from the only study —at least to the present authors' knowledge — has tested the bidirectional nature of these relationships appear to support this possibility (Levinson & Rodebaugh, 2016). This paucity of evidence calls for future prospective longitudinal research to provide further insight into the temporal nature of the relationship between SPA and ED. A second noteworthy limitation derives from the limited data available for several of the variables examined in the moderator analyses, which might have conditioned their accuracy and scope. This was evidenced by the fact that (i) information concerning the geographical origin of the study was not provided in 16 out of the 170 effects sizes included, and (ii) the unbalanced number of available effect sizes available for the different types of ED, which ranged from 2 (binge eating symptoms) to 82 (overall ED symptoms). This limitation is particularly relevant considering that both geographical region and type of ED emerged as significant moderators of the relationship under consideration. In the light of these limitations, further primary research on this topic would definitely benefit from (i) improving the reporting of the socio-demographic characteristics, and (ii) exploring the degree of connection between SPA and ED by considering the latter according to the symptoms specific to the range of recognised nosological entities (e.g., anorexia nervosa, bulimia nervosa, avoidant/restrictive food intake disorder, binge eating disorder, etc.) and their particular diagnostic features (American Psychiatric Association, 2013).

4.2. Conclusion

The findings from the present study suggest that SPA and ED are largely related, with the relationship tending to be stronger (i) among individuals from Western countries, and (ii) when ED scores refer to the diagnostic features of bulimia/anorexia nervosa involving body image disturbances. These findings add to the field's understanding of ED by suggesting that SPA is a maladaptive emotion with a potential role in the onset and maintenance of these group of pathologies.

5. References

Alcaraz-Ibáñez, M., Sicilia, A., Díez-Fernández, D. M., & Paterna, A. (2020b). Physical appearance comparisons and symptoms of disordered eating: The mediating role of social physique anxiety in Spanish adolescents. *Body Image*, *32*, 145–149. https://doi.org/10.1016/j.bodyim.2019.12.005

Alcaraz-Ibáñez, M., Paterna, A., Griffiths, M. D., & Sicilia, A. (2020c). Examining the role of social physique anxiety on the relationship between physical appearance comparisons and disordered eating symptoms among Spanish emerging adults. *Scandinavian Journal of Psychology*, *61*(6), 803–880. https://doi.org/10.1111/sjop.12663

Alcaraz-Ibáñez, M., Paterna, A., Sicilia, A., & Griffiths, M. D. (2020a). Morbid exercise behaviour and eating disorders: A meta-analysis. *Journal of Behavioral Addictions*, *9*(2), 206–224. https://doi.org/10.1556/2006.2020.00027

Alcaraz-Ibáñez, M., & Sicilia, A. (2020). Analysis of the dynamic relationship between social physique anxiety and depressive symptoms in young adults. *Journal of Applied Developmental Psychology*, *66*, 101085. https://doi.org/10.1016/j.appdev.2019.101085

Alcaraz-Ibáñez, M., Sicilia, A., & Paterna, A. (2019). Exploring the differentiated relationship between appearance and fitness-related social anxiety and the risk of eating disorders and depression in young adults. *Scandinavian Journal of Psychology*, *60*(6), 569–576. https://doi.org/10.1111/sjop.12584

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders. DSM-5* (5th ed.). American Psychiatric Publishing.

Becker, B. J. (2000). Multivariate meta-analysis. In H. E. A. Tinsley & S. Brown (Eds.), *Handbook of applied multivariate statistics and mathematical modeling* (pp. 499–525). Academic Press.

Becker, C. B., & Stice, E. (2017). From efficacy to effectiveness to broad implementation: Evolution of the body project. *Journal of Consulting and Clinical Psychology*, *85*, 767–782. https://doi.org/10.1037/ccp0000204

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2009). *Introduction to meta-analysis*. John Wiley & Sons. https://doi.org/10.1002/9780470743386

Bratrud, S. R., Parmer, M. M., Whitehead, J. R., & Eklund, R. C. (2010). Social physique anxiety, physical self-perceptions and eating disorder risk: A two sample study. *Medicine & Science in Sports & Exercise*, *1*(3), 1–10. https://doi.org/10.1249/00005768-200505001-00805

Brosof, L. C., Calebs, B. J., & Levinson, C. A. (2019). Ethnic variance between Asian and

European American women in a six month prospective model of eating disorder and social anxiety symptom comorbidity. *Eating Disorders*, *27*(2), 110–122. https://doi.org/10.1080/10640266.2019.1585678

Brunet, J., Sabiston, C. M., Dorsch, K. D., & McCreary, D. R. (2010). Exploring a model linking social physique anxiety, drive for muscularity, drive for thinness and self-esteem among adolescent boys and girls. *Body Image*, *7*(2), 137–142. https://doi.org/10.1016/j.bodyim.2009.11.004

Calmeiro, L., Simões, C., Gaspar de Matos, M., & Gamito, P. (2012). Factorial validity and group invariance of the Portuguese short version of the Social Physique Anxiety Scale in adolescents. *Journal of Child and Adolescent Psychology*, *3*(2), 199–213.

Carter, E. C., Schönbrodt, F. D., Gervais, W. M., & Hilgard, J. (2019). Correcting for bias in psychology: A comparison of meta-analytic methods. *Advances in Methods and Practices in Psychological Science*, *2*(2), 115–144. https://doi.org/10.1177/2515245919847196

Cash, T. F. (2012). Cognitive-behavioral perspectives on body image. In T. F. Cash (Ed.), *Encyclopedia of body image and human appearance* (pp. 334–342). Academic Press (Elsevier). https://doi.org/10.1016/B978-0-12-384925-0.00054-7

Cheung, M. W. L. (2014). Modeling dependent effect sizes with three-level meta-analyses: A structural equation modeling approach. *Psychological Methods*, *19*(2), 211–229. https://doi.org/10.1037/a0032968

Christian, C. B., Ngo, B. K., Brosof, L. C., & Levinson, C. A. (2021). Social appearance anxiety moderates the relationship between thin-ideal internalization and eating disorder symptoms cross-sectionally and prospectively in adolescent girls. *Eating and Weight Disorders*, *26*(6), 2065–2070. https://doi.org/10.1007/s40519-020-01050-y

Coburn, K. M., & Vevea, J. L. (2019). *Estimating weight-function models for publication bias* (2.0.2).

Crow, S. (2014). The economics of eating disorder treatment. *Current Psychiatry Reports*, *16*(7), 14–16. https://doi.org/10.1007/s11920-014-0454-z

Dakanalis, A., Carrà, G., Calogero, R. M., Zanetti, M. A., Volpato, C., Riva, G., Clerici, M., & Cipresso, P. (2016). The Social Appearance Anxiety Scale in Italian adolescent populations: Construct validation and group discrimination in community and clinical eating disorders samples. *Child Psychiatry and Human Development*, *47*(1), 133–150. https://doi.org/10.1007/s10578-015-0551-1

Fairburn, C. G., & Beglin, S. (2008). Eating Disorder Examination Questionnaire (EDE-Q 6.0). In *Cognitive behavior therapy and eating disorders* (pp. 309–313). Guilford Press.

Fitzsimmons-Craft, E. E., Harney, M. B., Brownstone, L. M., Higgins, M. K., & Bardone-Cone, A. M. (2012). Examining social physique anxiety and disordered eating in college women. The roles of social comparison and body surveillance. *Appetite*, *59*(3), 796–805. https://doi.org/10.1016/j.appet.2012.08.019

Funder, D. C., & Ozer, D. J. (2019). Evaluating effect size in psychological research: Sense and nonsense. *Advances in Methods and Practices in Psychological Science*, *2*(2), 156–168. https://doi.org/10.1177/2515245919847202

Glashouwer, K. A., van der Veer, R. M. L., Adipatria, F., de Jong, P. J., & Vocks, S. (2019). The role of body image disturbance in the onset, maintenance, and relapse of anorexia nervosa: A systematic review. *Clinical Psychology Review*, *74*, 101771. https://doi.org/10.1016/j.cpr.2019.101771

Greenhalgh, S. (2016). Disordered eating/eating disorder: Hidden perils of the nation's fight against fat. *Medical Anthropology Quarterly*, *30*(4), 545–562. https://doi.org/10.1111/maq.12257

Haase, A. M., Prapavessis, H., & Glynn Owens, R. (2002). Perfectionism, social physique anxiety and disordered eating: A comparison of male and female elite athletes. *Psychology of Sport and Exercise*, *3*(3), 209–222. https://doi.org/10.1016/S1469-0292(01)00018-8

Hagger, M. S., Aşçi, F. H., Lindwall, M., Hein, V., Mülazimoğlu-Balli, O., Tarrant, M., Ruiz, Y. P., & Sell, V. (2007). Cross-cultural validity and measurement invariance of the social physique anxiety scale in five European nations. *Scandinavian Journal of Medicine & Science in Sports*, *17*(6), 703–719. https://doi.org/10.1111/j.1600-0838.2006.00615.x

Harrer, M., Cuijpers, P., Furukawa, T. A., & Ebert, D. D. (2021). *Doing meta-analysis with R: A hands-on guide* (1st ed.). Chapman & Hall/CRC Press.

Hart, E. A., Leary, M. R., & Rejeski, W. J. (1989). The measurement of social physique anxiety. *Journal of Sport and Exercise Psychology*, *11*(1), 94–104.

Hart, T. A., Flora, D. B., Palyo, S. A., Fresco, D. M., Holle, C., & Heimberg, R. G. (2008). Development and examination of the Social Appearance Anxiety Scale. *Assessment*, *15*(1), 48–59. https://doi.org/10.1177/1073191107306673

Higgins, J. P. T., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses testing for heterogeneity. *BMJ*, *327*, 557–560. https://doi.org/10.1136/bmj.327.7414.557

Hillen, M. A., Medendorp, N. M., Daams, J. G., & Smets, E. M. A. (2017). Patient-driven second opinions in oncology: A systematic review. *The Oncologist*, *22*(10), 1197–1211. https://doi.org/10.1634/theoncologist.2016-0429

Jak, S., & Cheung, M. W. L. (2018). Testing moderator hypotheses in meta-analytic structural equation modeling using subgroup analysis. *Behavior Research Methods*, *50*(4), 1359–1373. https://doi.org/10.3758/s13428-018-1046-3

James, S. L., Abate, D., Abate, K. H., Abay, S. M., Abbafati, C., Abbasi, N., Abbastabar, H., Abd-Allah, F., Abdela, J., Abdelalim, A., Abdollahpour, I., Abdulkader, R. S., Abebe, Z., Abera, S. F., Abil, O. Z., Abraha, H. N., Abu-Raddad, L. J., Abu-Rmeileh, N. M. E., Accrombessi, M. M. K., … Murray, C. J. L. (2018). Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*, *392*, 1789–1858. https://doi.org/10.1016/S0140-6736(18)32279-7

Jin, J., & Fung, S. F. (2021). Social Physique Anxiety Scale: Psychometric evaluation and development of a chinese adaptation. *International Journal of Environmental Research and Public Health*, *18*(20), 10921. https://doi.org/10.3390/ijerph182010921

Kerr-Gaffney, J., Harrison, A., & Tchanturia, K. (2018). Social anxiety in the eating disorders: A systematic review and meta-analysis. *Psychological Medicine*, *48*(15), 2477–2491. https://doi.org/10.1017/S0033291718000752

Koskina, A., Van Den Eynde, F., Meisel, S., Campbell, I. C., & Schmidt, U. (2011). Social appearance anxiety and bulimia nervosa. *Eating and Weight Disorders*, *16*(2), 142–145. https://doi.org/10.1007/bf03325321

Kowalski, K. C., Mack, D. E., Crocker, P. R. E., Niefer, C. B., & Fleming, T.-L. (2006). Coping with social physique anxiety in adolescence. *Journal of Adolescent Health*, *39*(2), 275.e9-16. https://doi.org/10.1016/j.jadohealth.2005.12.015

Lanfranchi, M.-C., Maïano, C., Morin, A. J. S., & Therme, P. (2015). Social physique anxiety and disturbed eating attitudes and behaviors in adolescents: Moderating effects of sport, sport-related characteristics, and gender. *International Journal of Behavioral Medicine*, *22*(1), 149–160. https://doi.org/10.1007/s12529-014-9406-6

Langan, D., Higgins, J. P. T., Jackson, D., Bowden, J., Veroniki, A. A., Kontopantelis, E., Viechtbauer, W., & Simmonds, M. (2019). A comparison of heterogeneity variance estimators in simulated random-effects meta-analyses. *Research Synthesis Methods*, *10*(1), 83–98. https://doi.org/10.1002/jrsm.1316

Leary, M. R., & Jongman-Sereno, K. P. (2014). Social anxiety as an early warning system: A refinement and extension of the Theory of Social Anxiety. In S. G. Hofmann & P. M. DiBartolo (Eds.), *Social Anxiety* (3rd ed., pp. 579–597). Elsevier.

https://doi.org/10.1016/B978-0-12-394427-6/00020-0

Levinson, C. A., & Rodebaugh, T. L. (2012). Social anxiety and eating disorder comorbidity: The role of negative social evaluation fears. *Eating Behaviors*, *13*(1), 27–35. https://doi.org/10.1016/j.eatbeh.2011.11.006

Levinson, C. A., & Rodebaugh, T. L. (2016). Clarifying the prospective relationships between social anxiety and eating disorder symptoms and underlying vulnerabilities. *Appetite*, *107*, 38–46. https://doi.org/10.1016/j.appet.2016.07.024

Lin, L. (2018). Bias caused by sampling error in meta-analysis with small sample sizes. *PLoS One*, *13*(9), e0204056. https://doi.org/10.1371/journal.pone.0204056

Linardon, J. (2018). Meta-analysis of the effects of cognitive-behavioral therapy on the core eating disorder maintaining mechanisms: implications for mechanisms of therapeutic change. *Cognitive Behaviour Therapy*, *47*(2), 107–125. https://doi.org/10.1080/16506073.2018.1427785

Linardon, J., Wade, T. D., de la Piedad Garcia, X., & Brennan, L. (2017). The efficacy of cognitive-behavioral therapy for eating disorders: A systematic review and meta-analysis. *Journal of Consulting and Clinical Psychology*, *85*(11), 1080–1094. https://doi.org/10.1037/ccp0000245.supp

Mitchison, D., & Hay, P. J. (2014). The epidemiology of eating disorders: Genetic, environmental, and societal factors. *Clinical Epidemiology*, *6*, 89–97. https://doi.org/10.2147/CLEP.S40841

Munro, C., Randell, L., & Lawrie, S. M. (2017). An integrative bio-psycho-social theory of anorexia nervosa. *Clinical Psychology and Psychotherapy*, *24*(1), 1–21. https://doi.org/10.1002/cpp.2047

Nechita, D. M., Bud, S., & David, D. (2021). Shame and eating disorders symptoms: A meta-analysis. *International Journal of Eating Disorders*, *54*(11), 1899–1945. https://doi.org/10.1002/eat.23583

O'Hara, L., Tahboub-Schulte, S., & Thomas, J. (2016). Weight-related teasing and internalized weight stigma predict abnormal eating attitudes and behaviours in Emirati female university students. *Appetite*, *102*, 44–50. https://doi.org/10.1016/j.appet.2016.01.019

Olkin, I., Dahabreh, I. J., & Trikalinos, T. A. (2012). GOSH - a graphical display of study heterogeneity. *Research Synthesis Methods*, *3*(3), 214–223. https://doi.org/10.1002/jrsm.1053

Öztürk, A., Limnili, G., & Kartal, M. (2022). Association between eating disorder risk and family structure and social appearance anxiety among college freshman. *Anadolu*

Psikiyatri Dergisi, *23*(1), 27–32. https://doi.org/10.5152/alphapsychiatry.2022.21229

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *International Journal of Surgery*, *88*, 105906. https://doi.org/10.1016/j.ijsu.2021.105906

Pandey, J. (2022). Self-presentation for impression management. In J. Pandey (Ed.), *Nature and Dynamics of Social Influence* (pp. 71–94). Springer. https://doi.org/10.1007/978-981-19-4598-4_4

Puccio, F., Fuller-Tyszkiewicz, M., Ong, D., & Krug, I. (2016). A systematic review and meta-analysis on the longitudinal relationship between eating pathology and depression. *International Journal of Eating Disorders*, *49*(5), 439–454. https://doi.org/10.1002/eat.22506

Qian, J., Wu, Y., Liu, F., Zhu, Y., Jin, H., Zhang, H., Wan, Y., Li, C., & Yu, D. (2022). An update on the prevalence of eating disorders in the general population: A systematic review and meta-analysis. *Eating and Weight Disorders*, *27*(2), 415–428. https://doi.org/10.1007/s40519-021-01162-z

Radix, A. K., Rinck, M., Becker, E. S., & Legenbauer, T. (2019). The mediating effect of specific social anxiety facets on body checking and avoidance. *Frontiers in Psychology*, *9*, 2661. https://doi.org/10.3389/fpsyg.2018.02661

Reichenberger, J., Radix, A. K., Blechert, J., & Legenbauer, T. (2022). Further support for the validity of the Social Appearance Anxiety Scale (SAAS) in a variety of German-speaking samples. *Eating and Weight Disorders*, *27*(3), 929–943. https://doi.org/10.1007/s40519-021-01171-y

Sabiston, C. M., Pila, E., Pinsonnault-Bilodeau, G., & Cox, A. E. (2014). Social physique anxiety experiences in physical activity: A comprehensive synthesis of research studies focused on measurement, theory, and predictors and outcomes. *International Review of Sport and Exercise Psychology*, *7*(1), 158–183. https://doi.org/10.1080/1750984X.2014.904392

Samnaliev, M., Noh, H. L., Sonneville, K. R., & Austin, S. B. (2015). The economic burden of eating disorders and related mental health comorbidities: An exploratory analysis using the U.S. Medical Expenditures Panel Survey. *Preventive Medicine Reports*, *2*(4), 32–34. https://doi.org/10.1016/j.pmedr.2014.12.002

Schaefer, L. M., & Thompson, J. K. (2018). Self-objectification and disordered eating: A meta-analysis. *International Journal of Eating Disorders*, *51*(6), 483–502. https://doi.org/10.1002/eat.22854

Sharpe, H., Griffiths, S., Choo, T. H., Eisenberg, M. E., Mitchison, D., Wall, M., & Neumark-Sztainer, D. (2018). The relative importance of dissatisfaction, overvaluation and preoccupation with weight and shape for predicting onset of disordered eating behaviors and depressive symptoms over 15 years. *International Journal of Eating Disorders*, *51*(10), 1168–1175. https://doi.org/10.1002/eat.22936

Smink, F. R. E., Van Hoeken, D., & Hoek, H. W. (2012). Epidemiology of eating disorders: Incidence, prevalence and mortality rates. *Current Psychiatry Reports*, *14*(4), 406–414. https://doi.org/10.1007/s11920-012-0282-y

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin*, *128*(5), 825–848. https://doi.org/10.1037//0033-2909.128.5.825

Turk, F., & Waller, G. (2020). Is self-compassion relevant to the pathology and treatment of eating and body image concerns? A systematic review and meta-analysis. *Clinical Psychology Review*, *79*, 101856. https://doi.org/10.1016/j.cpr.2020.101856

Van den Noortgate, W., López-López, J. A., Marín-Martínez, F., & Sánchez-Meca, J. (2013). Three-level meta-analysis of dependent effect sizes. *Behavior Research Methods*, *45*(2), 576–594. https://doi.org/10.3758/s13428-012-0261-6

Walker, D. C., White, E. K., & Srinivasan, V. J. (2018). A meta-analysis of the relationships between body checking, body image avoidance, body image dissatisfaction, mood, and disordered eating. *International Journal of Eating Disorders*, *51*(8), 745–770. https://doi.org/10.1002/eat.22867

Wright, N. (2010). *The relationship between social anxiety, disordered eating, and physical activity in overweight and obese individuals [Doctoral dissertation]*. Yeshiva University.

Table 1

Results of univariable meta-regression analyses

Moderators	*s*	*k*	β_0	95% CI		β_1	95% CI		χ^2	*p*	R^2_{level2}	R^2_{level3}	τ^2_{Level2}	τ^2_{Level3}
				Lower	Upper		Lower	Upper						
Type of ED	97	170							39.752	< .001	.636	.000	**.005**	**.039**
Overall ED symptoms (RC)		82	**.574**	**.527**	**.621**									
Symptoms of BN		23	**.447**	**380**	**.514**	**-.127**	**-.187**	**-.068**						
Symptoms of BE		2	**.505**	**.291**	**.718**	-.069	-.284	.146						
Diagnostic features of AN		23	**.451**	**.383**	**.520**	**-.123**	**-.187**	**-.058**						
Diagnostic features of AN and BN		40	**.648**	**.587**	**.709**	**.074**	**.018**	**.129**						
Population in terms of ED	97	170							0.602	.438	.004	.007	**.013**	**.033**
Non-Clinical (RC)			**.555**	**.510**	**.600**									
Clinical			**.626**	**.453**	**.799**	.071	-.108	.250						
SPA measure I	97	170							10.016	.188	.028	.127	**.012**	**.029**
SPAS-12 (RC)		57	**.527**	**.460**	**.595**									
SPAS-14		1	**.604**	**.190**	**1.018**	.077	-.343	.497						
SPAS-11		3	**.498**	**.211**	**.784**	-.029	-.324	.265						
SPAS-10		1	**.472**	**.060**	**.885**	-.055	-.473	.363						
SPAS-9		23	**.497**	**.373**	**.621**	-.030	-.171	.111						
SPAS-7		11	**.746**	**.608**	**.883**	**.218**	**.065**	**.372**						
SPAS-6		1	.354	-.052	.761	-.173	-.585	.239						
SAAS-16		73	**.578**	**.509**	**.646**	.050	-.045	.146						
SPA measure II	97	170							.367	.545	.000	.008	**.013**	**.033**
SPAS versions (RC)		97	**.549**	**.495**	**.604**									
SAAS-16		73	**.577**	**.506**	**.649**	.028	-.062	.118						
Gender	97	170							2.681	.443	.007	.038	**.013**	**.032**
Female (RC)		98	**.588**	**.532**	**.644**									
Male		17	**.530**	**.409**	**.651**	-.058	-.191	.075						
Both		53	**.511**	**.429**	**.592**	-.077	-.177	.022						
Other		2	**.617**	**.300**	**.935**	.029	-.293	.351						
Age groups	97	170							.360	.835	.000	.009	**.013**	**.033**
Adults (RC)		102	**.550**	**.496**	**.605**									
Adolescents		45	**.571**	**.487**	**.655**	.021	-.080	.121						
Mixed		23	**.589**	**.453**	**.725**	.039	-.108	.185						
Region	97	170							10.786	.005	.010	.150	**.013**	**.028**
Unknown (RC)		16	**.441**	**.320**	**.563**									
Western		147	**.593**	**.547**	**.638**	**.152**	**.022**	**.281**						
Non-Western		7	**.370**	**.214**	**.526**	-.071	-.269	.126						
Publication status	97	170							.055	.814	.001	.000	**.013**	**.033**
Published (RC)		152	**.558**	**.511**	**.605**									
Unpublished		18	**.571**	**.452**	**.690**	.013	-.114	.141						
Study design	97	170							.050	.823	.000	.002	**.013**	**.033**
Longitudinal (RC)		9	**.541**	**.369**	**.712**									
Cross-sectional		161	**.561**	**.516**	**.606**	.020	-.157	.198						
Continuous moderators														
Age II	76	139	**.539**	**.486**	**.592**	.001	-.008	.009	-26.945	1.000	.000	.000	**.015**	**.039**
BMI	40	80	**.565**	**.487**	**.643**	.002	-.022	.026	-43.474	1.000	.001	.000	**.018**	**.045**
% Female	97	170	**.560**	**.517**	**.603**	-.006	-.011	.000	3.413	.065	.000	.049	**.013**	**.032**
Year of publication	97	170	**.559**	**.517**	**.601**	-.040	-.080	.001	3.682	.055	.000	.052	**.013**	**.031**
Quality	97	170	**.558**	**.515**	**.601**	.032	-.001	.065	3.576	.059	.000	.068	**.013**	**.031**

Note: s = Number of studies; *k* = Number of effect sizes; β_0 = Intercept/mean effect size; β_1 = Estimated regression coefficient*;* CI= Confidence interval; R^2 = Explained variance; τ^2_{Level2} = Variance between effect sizes from the same study; τ^2_{Level3} = Variance between studies; ED = Eating disorders; RC= Reference category; BN = Bulimia nervosa; BE = Binge eating; AN = Anorexia nervosa; SPA = Social physique anxiety; SPAS = Social Physique Anxiety Scale; SAAS = Social Appearance Anxiety Scale; BMI = Body mass index. Statistically-significant effects ($p < .05$) appear highlighted in bold.

Table 2

Results of multivariable meta-regression analyses

Moderators	*s*	*k*	β_0	95% CI Lower	95% CI Upper	β_1	95% CI Lower	95% CI Upper	χ^2	*p*	R^2_{level2}	R^2_{level3}	τ^2_{Level2}	τ^2_{Level3}
	97	170							51.227	< .001	.632	.000	**.005**	**.033**
			.470	**.347**	**.594**									
Symptoms of BN						**-.136**	**-.196**	**-.075**						
Symptoms of BE						-.040	-.255	.176						
Diagnostic features of AN						**-.129**	**-.193**	**-.065**						
Diagnostic features of AN and BN						**.063**	**.007**	**.118**						
Western						**.141**	**.010**	**.272**						
Non-Western						-.100	-.296	.095						

Note: Overall ED symptoms (Type of ED) and Unknown (Region) were considered as the reference categories. Statistically-significant effects ($p < .05$) appear highlighted in bold. *s* = Number of studies; *k* = Number of effect sizes; β_0 = Intercept/mean effect size; β_1= Estimated regression coefficient; CI= Confidence interval; R^2 = Explained variance; τ^2_{Level2} = Variance between effect sizes from the same study; τ^2_{Level3} = Variance between studies; ED = Eating disorders; BN = Bulimia nervosa; BE = Binge eating; AN = Anorexia nervosa.

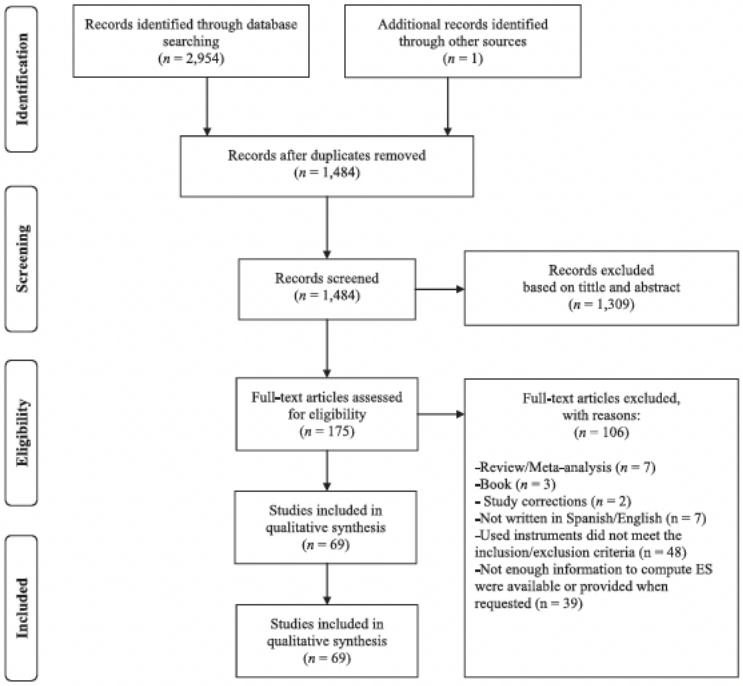

Fig. 1. PRISMA flow diagram of study selection.