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Physical Appearance Anxiety and Eating Disorders Symptomatology: A Systematic Review and Meta-Analysis

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ABSTRACT

The present study aimed to assess the link between physical appearance anxiety (PAA) and eating disorder (ED) symptomatology by a meta-analysis of existing literature. Eligible studies were searched across six electronic databases up until November 20, 2025. Pooled effect sizes (r) were calculated using random-effects models. Potential variables that influence effect heterogeneity were analyzed by univariable and multivariable meta-regressions. Influence analyses and a three-parameter selection model (3PSM) were used to assess robustness of the results and publication bias. Twenty-seven effect sizes from 21 studies ($N = 5261$) were obtained. The results indicated a strong association (i.e., $r = 0.559$) between the two variables under consideration, which was notably stronger (i) among females compared to males; and (ii) for overall eating disorder symptoms rather than bulimic symptoms. The results of this study advocate for further investigation into the effectiveness of addressing anxiety responses related to personal body traits, particularly among females, within the context of preventing and treating eating disorders.

1 | Introduction

The term 'body image' refers to the range of behaviors, cognitions, and emotions derived from the subjective experience of one's own body (Cash 2004). According to cognitive behavioral theoretical perspectives of body image, the fact that such experiences are negative may lead to the emergence of maladaptive coping strategies (Cash 2012). Among these strategies, those related to eating behavior (e.g., taking diet pills, restricting dietary intake, or adopting extreme diets) are extremely common (Herpertz-Dahlmann et al. 2015; Sharpe et al. 2018). This is noteworthy because the adoption of such strategies usually precedes the emergence of a serious mental health conditions such as eating disorders (EDs) (Franko and Omori 1999). Therefore, it comes as no surprise that studying the relationship between variables involving negative body image and the onset and maintenance of EDs has attracted particular research interest (Rodgers 2016; Rodgers and Melioli 2016).

Findings from meta-analytical investigations have been broadly consistent in revealing positive large-sized relationships (i.e., $r \geq 0.40$) between ED symptomatology and a range of variables implying negative body image. These include self-objectification (i.e., paying undue attention to one's appearance because of a learned social self-schema involving the prevalence of this trait over other aspects of the self) (Schaefer and Thompson 2018), body avoidance (i.e., the avoidance of public exposure of one's body resulting from excessive preoccupation with appearance) and body checking (i.e., putting body features such as weight or appearance under repeated checks and scrutiny) (Walker et al. 2018), body shame (the negative self-conscious emotion arising from perceiving

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Key Points

- This meta-analysis examined the relationship between physical appearance anxiety and the symptoms of eating disorders.
- Twenty-seven effect sizes from 21 studies ($N = 5{,}261$) showed a very large positive PAA–ED association ($r = 0.559$).
- The association was stronger among females than males and weaker for bulimic symptoms than for overall ED symptoms.
- Type of ED and percentage of females jointly explained 35.96% of the between-study heterogeneity.
- The findings highlight the need for further exploration of body-related anxiety, especially among females, in the context of preventing and treating ED.

one's own body as not conforming to social norms) (Nechita et al. 2021), or social physique anxiety (i.e., the form of anxiety derived from experiencing or anticipating possible negative interpersonal evaluations of one's body) (Alcaraz-Ibáñez et al. 2023). However, there are still a number of relevant negative body image variables whose connection with ED symptomatology has not yet been examined using meta-analytic techniques. Addressing this gap seems warranted in the light of the meta-analytic evidence suggesting that the proven positive relationship between negative body image and ED symptomatology may differ according to the precise nature of the former (Alcaraz-Ibáñez et al. 2023; Nechita et al. 2021; Schaefer and Thompson 2018; Walker et al. 2018). In particular, this latter circumstance implies that existing summarized evidence linking ED symptomatology with a given negative body image variable cannot be extrapolated to all of them.

One of the negative body image variables whose connection to ED symptoms has not hitherto been explored by employing meta-analytic techniques is physical appearance anxiety (PAA; i.e., feeling anxious, nervous, or tense because of one's own body) (Dion et al. 1990; Reed et al. 1991). A critical distinction lies in the internalized nature of PAA compared to related constructs. Unlike social physique anxiety (SPA), which is contingent upon anticipated external evaluations (Hart et al. 1989), or self-objectification, which involves viewing the self as an object (Fredrickson and Roberts 1997), PAA represents a core affective dimension of body image defined by subjective distress independent of social scrutiny. This distinction is salient for ED pathology because PAA captures the intrinsic affective vulnerability that drives maladaptive behaviors even in private settings. Due to interest in this construct, multiple self-report instruments have been developed to evaluate PAA.

Some measures, such as the Appearance Anxiety Scale (AAS; Dion et al. 1990), focus on assessing PAA exclusively as a trait (i.e., a relatively stable disposition across time and situations), whereas others, such as the Physical Appearance State and Trait Anxiety Scale (PASTAS; Reed et al. 1991), allow for differential assessment of both the trait and the state (i.e., a transient condition that can vary across time and situations). Prioritizing this construct is supported by its conceptualisation as an affective dimension of body image and by the central role that PAA-related processes play in the onset and maintenance of ED symptomatology, which together provide the basis for two main considerations. Firstly, the eminently emotional nature of PAA, which may translate into it being more closely related to its potential harmful outcomes than some other body image variables that are strictly cognitive in nature (Alcaraz-Ibáñez and Sicilia 2020; Cash 2012). Secondly, the fact that the emotion inherent to PAA is anxiety, which is thought to play a significant role on the onset and maintenance of ED (Forrest et al. 2019; Lee and Vaillancourt 2019).

Expanding the number of negative body image variables for which summarized quantitative data on their relationship with ED are available may provide additional insight into the potential psychological processes behind this group of important mental health conditions. In particular, because the evidence derived from addressing this task could be compared with that already available for other negative body image variables (Alcaraz-Ibáñez et al. 2023; Nechita et al. 2021; Schaefer and Thompson 2018; Walker et al. 2018) for the purpose of identifying differences in both the magnitude and the moderators of these relationships. This would allow conclusions to be drawn which may be useful in refining the content of actions geared towards treating and preventing ED, as well as in targeting their preferential beneficiaries. Accordingly, the present study was aimed at fulfilling a twofold objective. Firstly, to identify and summarize the available quantitative data on the relationship between PAA and ED symptomatology. Secondly, to examine the possible demographic and methodological moderating variables of such a relationship by exploring those emerging from the analysis of the common characteristics of the available studies.

2 | Methods

The present study was conducted following the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) statement (Page et al. 2021) (see Supporting Information S1 for the PRISMA checklist).

2.1 | Locating Studies

Six independent databases (i.e., *Web of Science, MEDLINE, Connect, PsycINFO, SciELO, Current Contents and Dissertations & Theses Global*) were used up until November 20, 2025, to identify possible eligible studies using the following search terms: "Physique anxiety", "Appearance anxiety", "Anxiety symptoms", "Eating disorders", "Eating", "Eating behavior", "Eating pathology", "Disordered eating", "Bulimia", "Anorexia", "Dietary", "Restraint", "Binge", "Pica", "Rumination", "Drive for thinness", "Weight concerns", "Shape concerns", and "Eating concerns". The full search strategy can be found on Supporting Information S2. A hand search of the reference lists of included studies was conducted to identify additional studies. *Endnote 21* software was used for reference management and duplicate removal during the screening phase. The first two authors individually selected

the papers by sequentially reviewing (a) their titles and abstracts, and (b) their full texts. Inter-rater agreement was high (Cohen's Kappa = 0.84; 93% observed agreement). In instances where study duplication was suspected (e.g., a thesis and a corresponding peer-reviewed publication using the same data), only the published study was utilized. Disagreements between the reviewers were addressed and resolved by consensus, with the involvement of the third author as necessary. The corresponding authors of the studies initially included in the review were contacted to obtain (i) unpublished data that may be acceptable for inclusion, and (ii) any relevant information overlooked in those studies (e.g., mean age for a specific sample).

2.2 | Eligibility Criteria

The present study collected quantitative data on the association between PAA and ED symptomatology as assessed by self-report instruments. In order to minimize publication bias, the literature search sought to retrieve data not only from published studies but also from unpublished studies.

2.2.1 | Inclusion Criteria

A study was deemed eligible upon the fulfillment of the following criteria: (i) at least one validated self-report instrument, with formally tested psychometric properties published in a peer-reviewed journal, providing continuous scores on PAA (i.e., defined as individuals feeling anxious or tense about their physical appearance) was utilized; (ii) at least one validated self-report instrument offering either continuous scores (i.e., indicating higher risk with elevated scores) or dichotomous scores (i.e., indicating at-risk or not at-risk status) examining ED symptomatology was employed; (iii) the papers were written in English or Spanish; and (iv) the necessary data to compute the required effect sizes (i.e., correlational data reported as Pearson's *r* or convertible to *r*) was available.

2.2.2 | Exclusion Criteria

Studies were excluded based on the following criteria: (i) the assessment of physical anxiety was conducted using conceptually non-comparable instruments (e.g., those developed to assess social physical anxiety or general anxiety); (ii) PAA or ED symptomatology scores derived from factor structures differed from those initially proposed; (iii) the use of isolated items to evaluate PAA or ED symptoms; (iv) the employment of composite scores from multiple psychometric scales assessing PAA or ED symptoms; (v) instances where PAA was assessed using the Physical Appearance State and Trait Anxiety Scale (PASTAS; Reed et al. 1991) without information on the specific version utilized (i.e., trait or state); (vi) the methodology of the study was experimental (i.e., participants had received some type of intervention), and (vii) study samples comprising fewer than 30 participants. This criterion was applied to minimize the influence of studies with insufficient statistical power and unstable effect size estimates, given that very small samples are highly susceptible to sampling errors and may bias both the pooled effects and the assessment of heterogeneity (Lin 2018).

2.3 | Coding Procedure

A coding frame was created based on the shared characteristics of the studies identified in a preliminary search and was subsequently pilot-tested. As indicated in previous meta-analytical studies (Alcaraz-Ibáñez et al. 2020, 2023), the effect sizes were categorized according to ED outcomes based on the classification and diagnostic criteria established in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (American Psychiatric Association 2022). This indicated the establishment of the primary coding categories for eating disorder (ED) outcomes: (i) overall ED symptoms (i.e., those obtained from generic screening tools or through the aggregation of scores from various symptom subscales); (ii) symptoms particular to a specific ED (e.g., those identified for binge eating); and (iii) diagnostic characteristics of a specific ED (e.g., dietary restraint in anorexia nervosa). The first two authors separately utilized the resultant coding sheet (see Supporting Information S3) to extract pertinent data from the identified studies. Inter-rater agreement was high (Cohen's Kappa = 0.78; 89% observed agreement). Disagreements were addressed and resolved by consensus with the aid of the third author when necessary.

2.4 | Risk of Bias

The Newcastle-Ottawa Scale (NOS) was used to assess the risk of bias in cross-sectional/survey studies (Hillen et al. 2017). This instrument facilitates the assessment of nine distinct elements, which are summed to yield a continuous total score ranging from 0 to 16. A low score on the NOS indicates a heightened risk of bias. The first two authors independently performed the risk of bias evaluation. When necessary, the third author assisted in resolving disagreements through consensus. Risk of bias scores were allocated, ranging from 8 to 10, to the 21 studies obtained through the aforementioned technique.

2.5 | Statistical Analysis

2.5.1 | Effect Size Calculations

Pearson's correlation coefficient (*r*) was utilized for the meta-analytic calculations of the PAA–ED relationship. Effect sizes were transformed from *r* to *z* prior to performing statistical analyses. To facilitate the comprehension of the results, effect sizes and their 95% confidence intervals (CIs) were subsequently translated from *z* to correlation coefficients (Borenstein et al. 2009).

Given the expected heterogeneity between studies, including variations in participant characteristics such as gender and age, as well as exposure and outcomes (Mueller et al. 2018), and considering that discrepancies in the distribution and sampling errors of effect sizes may explain the observed

differences, the pooled effect sizes were calculated utilizing a random-effects model (Pigott 2012). The I^2 statistic was utilized to evaluate statistical heterogeneity, with values of 25%, 50%, and 75% denoting low, moderate, and high heterogeneity, respectively (Higgins et al. 2003). The graphic display of studies heterogeneity plot analysis (GOSH) was employed to assess the robustness of the results. This procedure entails (i) fitting both K models and all $2k-1$ potential study combinations using three clustering algorithms (i.e., k-means, DBSCAN [density-based clustering non-parametric algorithm], and Gaussian mixture models); (ii) generating a plot that illustrates the pooled effect size and the between-study heterogeneity on the *x*- and *y*-axes, respectively (Olkin et al. 2012); and (iii) identifying particularly influential studies (i.e., outliers) within the context of the emerging clusters (Harrer et al. 2021) based on observed Cook's distance values.

When a minimum of 10 effect sizes were available, continuous variables (e.g., BMI, age, percentage of females, risk of bias, and publication year) and categorical variables (e.g., age group, gender, region, publication status, PAA assessment, PAA measure, type of ED, population concerning ED, and study design) were analyzed as potential sources of variance in heterogeneity utilizing a mixed-effects model (Fu et al. 2011). Categorical variables were converted into dummy variables via a binary code. Meta-regressions were performed utilizing (i) univariable models in which each potential moderator was considered in isolation, and (ii) multivariable models in which all significant moderators identified in the univariable models were simultaneously introduced. The variation explained by the moderators was calculated as a percentage and represented by R^2. A three-parameter selection model (3PSM) utilizing a simple model with a single cut-off point (<0.05) and devoid of moderators was employed to investigate publication bias. The three-parameter selection model (3PSM) computes both adjusted and unadjusted meta-analytical models, after which a likelihood ratio test compares them. When the results of the likelihood ratio test are significant, they indicate that the updated model should be retained, suggesting a publication bias (Coburn and Vevea 2019). The application of 3PSM is preferred over other methodological approaches for assessing publication bias when a significant degree of variability is anticipated, as demonstrated in the present study (Carter et al. 2019).

The magnitude of the PAA–ED relationship was interpreted using the following thresholds: very small (0.00 to 0.10), small (0.10 to 0.20), medium (0.20 to 0.30), large (0.30 to 0.40), and very large (>0.40) (Funder and Ozer 2019). All statistical analyses were performed in the R environment (version 4.2.2). Random-effects models were calculated using the restricted maximum likelihood (REML) method, which yields dependable outcomes even in the absence of normal data distribution (Langan et al. 2019).

2.5.2 | Dependence

Multiple effect sizes from a single sample invalidate the fundamental principle of independence between effect sizes, which is essential for conducting a meta-analysis (Becker 2000; Hedges 2009). To adhere to this principle, the following actions were implemented: (i) in instances where multiple dependent effects originated from various PAA measures (e.g., Peterson et al. 2008) or subscales encompassing more than one type of ED within a study (e.g., Reed et al. 1991), random elimination of effect sizes was performed until only one effect size persisted. This parsimonious approach was adopted to prioritize model stability and avoid over-parameterisation (Cheung 2014); and (ii) when distinct effect sizes were reported for several groups within the same study (e.g., male/female participants), each was analyzed separately (Cheung 2014).

3 | Results

3.1 | Physical Appearance Anxiety and Eating Disorders

Initially, 2698 outputs in were found. Following the research selection process (see Figure 1), 21 primary studies were identified, including 27 effect sizes ($N=5261$; see Table 1; see the list of included studies in Supporting Information S5). The meta-analytic random-effects model indicated a very large PAA–ED relationship ($r=0.559$, $p<0.001$; 95% CI = 0.508 to 0.606, $I^2=83\%$; see Figure 2). The moderator analysis conducted through a univariate meta-regression model (see Table 2) revealed the following significant moderators for categorical variables: (a) type of ED (omnibus-test [3, 23] = 3.207; $p=0.042$; $R^2=22.01$), indicating a diminished relationship for effect sizes associated with bulimia nervosa symptoms; and (b) gender (omnibus-test [2, 24] = 3.815; $p=0.036$; $R^2=21.80$), suggesting a reduced relationship in effect sizes from male participants. Following the exclusion of effect sizes lacking mean age ($K=11$) and BMI ($K=8$), the results from the univariable meta-regression analysis for continuous variables (see Table 2) indicated that the percentage of females was the only significant moderator (omnibus test [1, 25] = 5.193; $p=0.031$; $R^2=15.57$), with increases in this percentage correlating with heightened effect size magnitudes. Given that the two gender-related moderators were deemed statistically significant in the univariate meta-regression studies, only the potentially more precise one (% of females) was incorporated into the multivariate meta-regression study. The multivariable meta-regression analysis indicated that the type of ED and the percentage of females collectively accounted for 35.96% of the inter-study heterogeneity in the association between PAA and ED symptomatology (see Table 3).

3.2 | Sensitivity Analysis and Publication Bias

Influence analysis (see Supporting Information S4) identified five effect sizes from five studies as likely outliers (Bellew et al. 2006; Crino et al. 2019; Lindner and Tantleff-Dunn 2017; Tiggemann and Kuring 2004; Tiggemann and Lynch 2001). Upon the removal of these studies, the results from the adjusted model showed a correlation coefficient of 0.536 ($p<0.001$; 95% CI = 0.482 to 0.587; $I^2=76.9$), which was similar to the non-adjusted model that had a correlation coefficient of 0.559 ($p<0.001$; 95% CI = 0.508 to 0.606; $I^2=0.830$). The findings of 3PSM indicated no evidence of publication bias [$\chi^2(1)=0.543$, $p=0.461$].

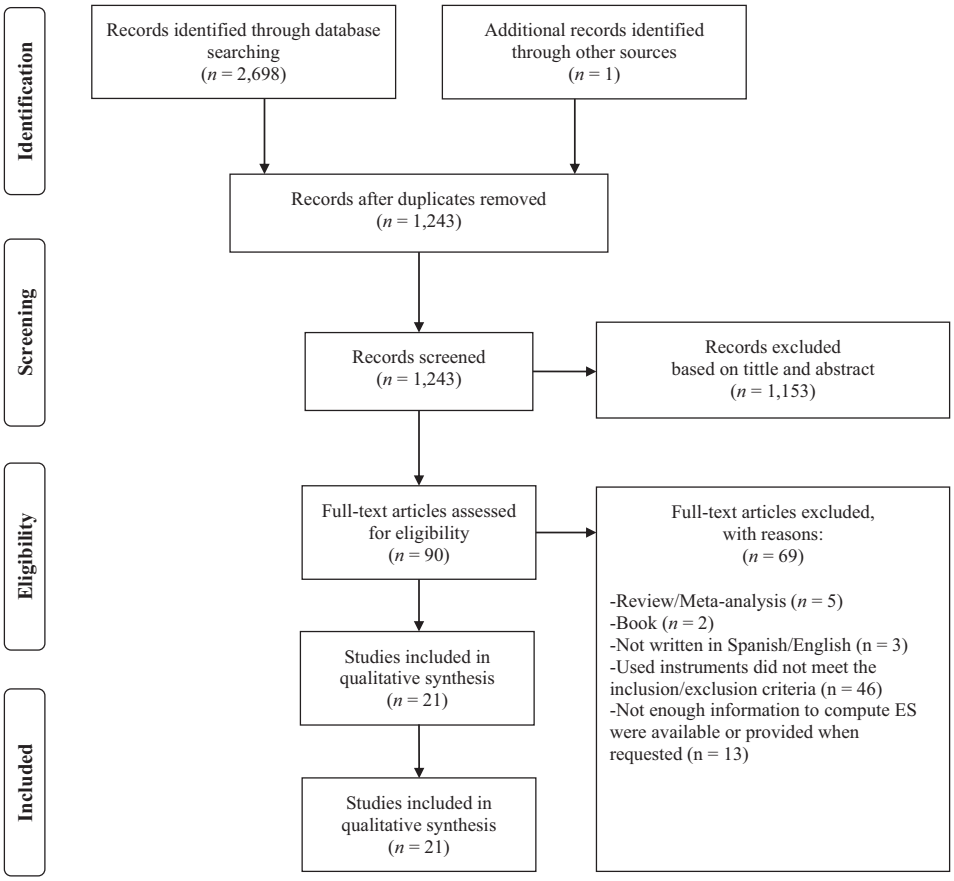

FIGURE 1 | PRISMA flow diagram of study selection.

4 | Discussion

The present study aimed to summarize existing quantitative evidence on the relationship between PAA and ED symptomatology. Results from the random-effects model including 27 effect sizes from 21 primary studies comprising 5261 participants showed a large-sized relationship (i.e., $r = 0.559$) between the two variables of interest, which tended to be (i) stronger among females rather than male individuals, and (ii) weaker for bulimic symptoms than for overall ED symptoms. Consistent with cognitive behavioral theoretical perspectives of body image (Cash 2012), the findings from the present study provide evidence for a positive association between PAA and ED symptomatology. However, because the evidence is cross-sectional, these findings should be regarded as correlational and do not allow for conclusions about temporal sequencing or causality. From a broader transdiagnostic perspective, these results align with models that suggest shared emotional and cognitive processes, including heightened negative affect and the over-evaluation of shape and weight, that transcend diagnostic boundaries. This interplay may contribute to the co-occurrence and mutual maintenance of eating disorders (EDs) alongside anxiety-related symptomatology (Fairburn et al. 2003; Mansell et al. 2009).

A first notable finding of the present study is that the magnitude of the relationship being examined was within the range (and more specifically near the upper end) of those previously reported by meta-analytical studies examining the relationship between variables implying negative body image and ED symptomatology (i.e., r between 0.390 and 0.588; Alcaraz-Ibáñez et al. 2023; Nechita et al. 2021; Schaefer and Thompson 2018; Walker et al. 2018). More specifically, the magnitude found in the present study is quite similar to that reported in a previous meta-analysis focused on a construct closely related to the PAA such as social physique anxiety (i.e., $r = 0.51$) (Alcaraz-Ibáñez et al. 2023). This suggests that ED symptomatology strongly links both constructs to a common core of appearance-related factors. However, PAA reflects anxiety based on internal self-evaluation, whereas SPA is tied to anticipated evaluations by others.

This finding contrasts with the fact that anxiety of social origin (although not necessarily derived from body features) has been proposed on the basis of meta-analytical research results as a vulnerability factor for EDs (Kerr-Gaffney et al. 2018). These results call for further examination of the specific and complementary contribution of each of the unique but to some extent overlapping elements present in these constructs. The present authors refer both to the character (social or non-social) and the domain (body-centred or general) of the anxious reaction (Alcaraz-Ibáñez et al. 2019, 2023; Kerr-Gaffney et al. 2018; Leary and Jongman-Sereno 2014).

Regarding moderator analyses, associations were weaker for bulimic symptoms than for overall ED symptomatology. A plausible explanation is that PAA operates as a primary affective driver

TABLE 1 | Study characteristics and extracted quantitative data for the physical anxiety–eating disorder relationship.

Study	*n*	Gender	% females	BMI	Age	Age group	Region	Population (ED)	PAA measure	PAA assessment	Publication status	Type of ED	ED measure	Risk of bias	(*r*)
Anschutz et al. (2009)	110	Female	100%	22.39	20.05	Adults	Europe	Non-Clinical	PASTAS-BW	State	Published	Diagnostic features of AN	DEBQ*	8	0.60
Bellew et al. (2006)	90	Female	100%	N.A.	21.18	Adults	Europe	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EAT-40	8	0.52
Crino et al. (2019)	187	Female	100%	N.A.	25.23	Adults	North America	Clinical	PASTAS-BW	State	Published	Overall ED symptoms	EDE-Q	10	0.70
Greenleaf and McGreer (2006; Physically active)	115	Female	100%	23.49	N.A.	Adults	Unknown	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EAT-26	10	0.61
Greenleaf and McGreer (2006; Sedentary)	70	Female	100%	22.8	N.A.	Adults	Unknown	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EAT-26	10	0.58
Gromel et al. (2000)	97	Both	76%	33.1	50.68	Adults	Unknown	Non-Clinical	PASTAS	State	Published	Symptoms of BN	EQ-R	8	0.35
Hallsworth et al. (2005)	83	Male	0%	25.81	27.6	Adults	Australia	Non-Clinical	AAS	Trait	Published	Symptoms of BN	EDI*	9	0.34
Hrabosky and Grilo (2007; Black)	67	Female	100%	30.99	N.A.	Adults	Unknown	Non-Clinical	PASTAS	Trait	Published	Diagnostic features of AN	EDE-Q*	9	0.58
Hrabosky and Grilo (2007; Hispanic)	53	Female	100%	29.87	N.A.	Adults	Unknown	Non-Clinical	PASTAS	Trait	Published	Diagnostic features of AN	EDE-Q*	9	0.29
Kessler (2010)	155	Female	100%	23.76	20.86	Adults	North America	Non-Clinical	AAS	Trait	Unpublished	Overall ED symptoms	EAT-26	9	0.60
Lindner and Tantleff-Dunn (2017)	654	Female	100%	23.37	23.37	Adults	North America	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EAT-26	9	0.57

(Continues)

TABLE 1 | (Continued)

Study	*n*	Gender	% females	BMI	Age	Age group	Region	Population (ED)	PAA measure	PAA assessment	Publication status	Type of ED	ED measure	Risk of bias	(*r*)
Mehak et al. (2018)	102	Female	100%	22.84	19.33	Adults	North America	Non-Clinical	AAS	Trait	Published	Symptoms of BE	BES	8	0.56
Noffsinger-Frazier (2004)	345	Female	100%	25.9	30.52	Adults	North America	Non-Clinical	AAS	Trait	Unpublished	Overall ED symptoms	EAT-26	8	0.61
Peterson et al. (2008)	256	Female	100%	22.8	20.6	Adults	North America	Non-Clinical	PASTAS-BW	Trait	Published	Overall ED symptoms	EAT-40	8	0.58
Reed et al. (1991)	205	Female	100%	NA	22.04	Adults	Unknown	Non-Clinical	PASTAS-BW	Trait	Published	Symptoms of BN	EDI*	8	0.36
Slater and Tiggemann (2010; Boys)	382	Male	0%	20.33	N.A.	Adolescents	Australia	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EDI	8	0.43
Slater and Tiggemann (2010; Girls)	332	Female	100%	19.96	N.A.	Adolescents	Australia	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EDI	9	0.66
Tiggemann and Kuring (2004; Men)	115	Male	0%	N.A.	N.A.	Adults	Australia	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EDI	10	0.58
Tiggemann and Kuring (2004; Women)	171	Female	100%	N.A.	N.A.	Adults	Australia	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EDI	10	0.70
Tiggemann and Lynch (2001)	322	Female	100%	25.37	45.02	Adults	Australia	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EDI	10	0.77
Tiggemann and Lynch (2001; Former dancers)	50	Female	100%	21.5	20.3	Adults	Australia	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EAT-26	9	0.56

(Continues)

TABLE 1 | (Continued)

Study	*n*	Gender	% females	BMI	Age	Age group	Region	Population (ED)	PAA measure	PAA assessment	Publication status	Type of ED	ED measure	Risk of bias	(*r*)
Tiggemann and Lynch (2001; Non dancers)	51	Female	100%	22.7	19.4	Adults	Australia	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EAT-26	9	0.56
Tiggemann and Williams (2012)	146	Female	100%	23.61	20.4	Adults	Australia	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EDI	9	0.71
Watson et al. (2013)	278	Female	100%	N.A.	20.53	Adults	North America	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EAT-26	9	0.47
Woolley (2009)	395	Female	100%	23.6	N.A.	Adults	North America	Non-Clinical	AAS	Trait	Unpublished	Overall ED symptoms	EAT-26	8	0.54
Zheng and Sun (2017; Men)	180	Male	0%	N.A.	N.A.	Adults	Asia	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EDI	10	0.39
Zheng and Sun (2017; Women)	250	Female	100%	N.A.	N.A.	Adults	Asia	Non-Clinical	AAS	Trait	Published	Overall ED symptoms	EDI	10	0.43

Note: Subscales of instruments are marked with an asterisk.

Abbreviations: AAS, Appearance Anxiety Scale; AN, anorexia nervosa; BE, binge eating; BES, Binge Eating Scale; BMI, body mass index; BN, Bulimia nervosa; DEBQ, Dutch Eating Behavior Questionnaire; EAT-26, Eating Attitudes Test-26; EAT-40, Eating Attitudes Test-40; ED, eating disorders; EDE-Q, Eating Disorder Examination-Questionnaire; EDI, Eating Disorders Inventory; EQ-*R*, Eating Questionnaire-Revised; N.A., not available; PAA, physique anxiety appearance; PASTAS, Physical Appearance State and Trait Anxiety Scale; PASTAS-BW, Physical Appearance State and Trait Anxiety Scale-Body Weight.

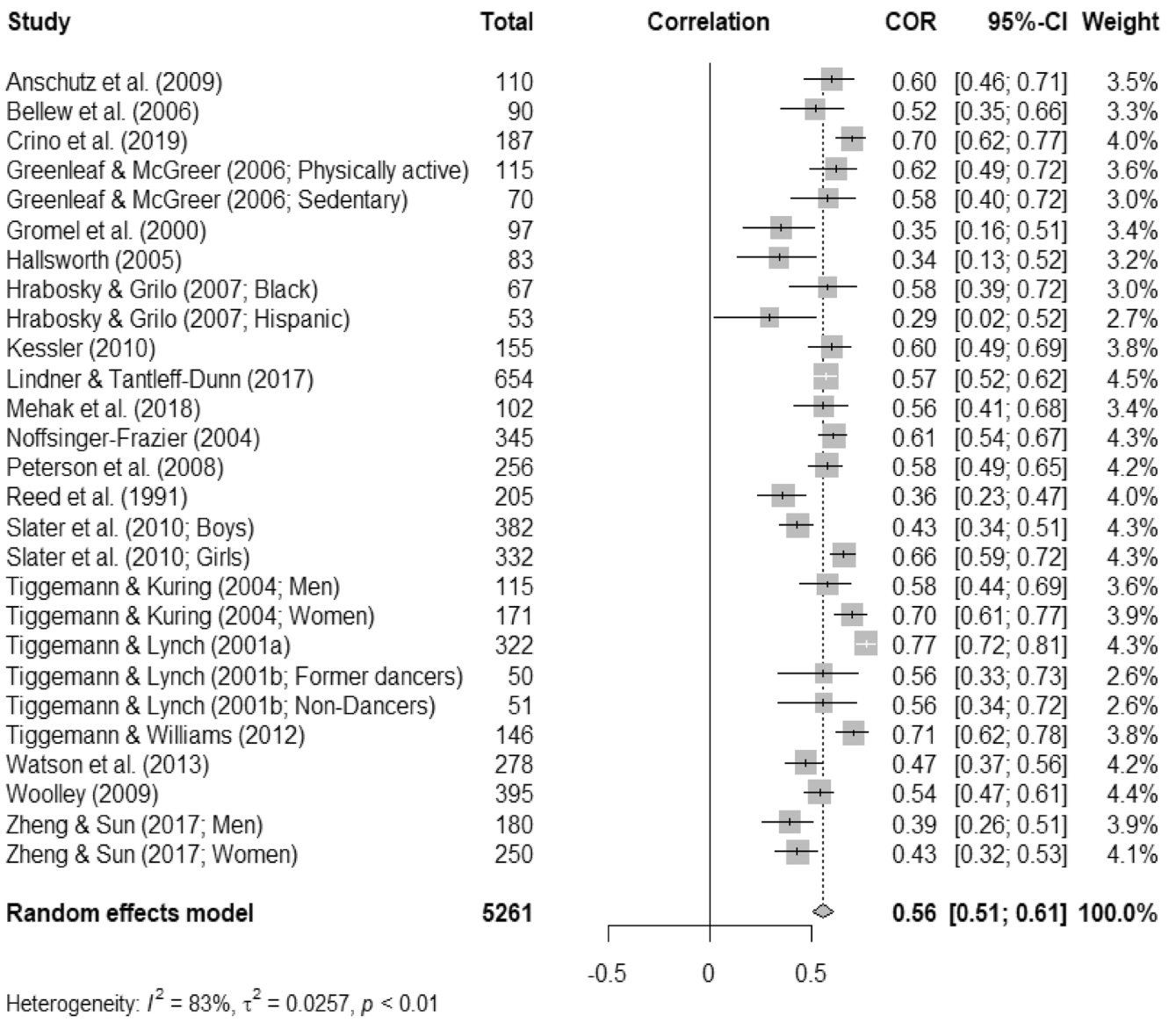

FIGURE 2 | Forest plot of the main meta-analysis: Pooled estimate for the PAA–ED relationship.

in restriction-dominated patterns, where the individual seeks to directly manage appearance-related distress through the control of physical attributes. In contrast, binge/purge behaviors are more often complexly determined by broader emotional dysregulation and impulsivity, rendering PAA a significant but perhaps less central maintaining factor in these specific symptom clusters (Pearson et al. 2015; Stice 2001). Moreover, the PAA-ED association was notably stronger among females, a finding that contrasts with research on social physique anxiety (Alcaraz-Ibáñez et al. 2023).

However, this finding is consistent with those concerning the relationship between ED symptomatology and a negative body image variable (such as self-objectification) that involves adopting the perspective of an external observer when judging one's own body (Schaefer and Thompson 2018). This discrepancy likely stems from internalized femininity norms that compel women to monitor their bodies as objects, translating PAA-related distress into control-oriented eating behaviors even in the absence of explicit social scrutiny (Else-Quest et al. 2012; Fredrickson and Roberts 1997; Tracy et al. 2007). This may imply that the repeated feelings of PAA experienced by females because of their body characteristics would translate into adopting eating behaviors focused on the control of these characteristics without the need for such feelings to be contingent on explicit external social evaluations. However, it should be noted that this is only one of the possible explanations for the findings, which would therefore require empirical verification.

Notably, the PAA-ED relationship remained robust irrespective of the assessment instrument employed. Although the AAS and PASTAS differ in specific aspects, their lack of significant moderation suggests they may be considered conceptually comparable in assessing appearance-related distress. Beyond the factors explored in the moderator analyses, the substantial heterogeneity initially observed suggests that other unmeasured variables (such as participants' ethnicity, socio-economic status, or the specific psychometric nuances of the diverse ED

TABLE 2 | Univariable meta-regression results for the physical anxiety–eating disorder relationship.

Moderators	*k*	β_0	95% CI		β_1	95% CI		Omnibus test	*p*	R^2
			Lower	Upper		Lower	Upper			
Type of ED	27							$F(3, 23) = 3.207$	0.042	22.01
Overall ED symptoms (RC)	20	**0.675**	**0.602**	**0.748**						
Symptoms of BN	3	**0.366**	**0.169**	**0.564**	**−0.308**	**−0.519**	**−0.098**			
Symptoms of BE	1	**0.633**	**0.285**	**0.981**	−0.042	−0.397	0.313			
Diagnostic features of AN (Dietary restraint)	3	**0.570**	**0.355**	**0.785**	−0.105	−0.332	0.122			
Population in terms of ED	27									
Non-Clinical (RC)	26	**0.621**	**0.550**	**0.692**				$F(1, 25) = 2.004$	0.169	4.10
Clinical	1	**0.867**	**0.516**	**1.218**	0.246	−0.112	0.604			
PAA measure	27							$F(2, 24) = 1.523$	0.238	2.68
AAS (RC)	20	**0.650**	**0.570**	**0.731**						
PASTAS-BW	4	**0.646**	**0.469**	**0.823**	−0.004	−0.198	0.190			
PASTAS	3	**0.443**	**0.210**	**0.676**	−0.207	−0.453	0.039			
PAA assessment	27							$F(1, 25) = 0.053$	0.819	0.00
Trait (RC)	24	**0.628**	**0.551**	**0.705**						
State	3	**0.654**	**0.434**	**0.874**	0.026	−0.207	0.259			
Gender	27							$F(2, 24) = 3.815$	0.036	21.80
Female (RC)	22	**0.672**	**0.600**	**0.744**						
Male	4	**0.473**	**0.306**	**0.639**	**−0.200**	**−0.381**	**−0.018**			
Both	1	**0.365**	**0.010**	**0.721**	−0.307	−0.669	0.056			
Age group	27							$F(1, 25) = 0.002$	0.964	0.00
Adults (RC)	25	**0.631**	**0.555**	**0.707**						
Adolescents	2	**0.625**	**0.378**	**0.873**	−0.006	−0.265	0.253			
Region	27							$F(4, 22) = 2.061$	0.121	19.29
North America (RC)	8	**0.663**	**0.548**	**0.779**						
Australia	9	**0.717**	**0.600**	**0.833**	**0.054**	−0.110	0.218			
Europe	2	**0.637**	**0.380**	**0.894**	**−0.027**	−0.308	0.255			

(Continues)

TABLE 2 | (Continued)

Moderators	*k*	β_0	95% CI		β_1	95% CI		Omnibus test	*p*	R^2
			Lower	Upper		Lower	Upper			
Asian	2	**0.437**	**0.204**	**0.669**	**−0.227**	−0.486	0.033			
Unknown	6	**0.514**	**0.362**	**0.665**	**−0.149**	−0.340	0.041			
Publication status	27							$F(1, 25) = 0.153$	0.699	0.00
Published (RC)	24	**0.625**	**0.548**	**0.703**						
Unpublished	3	**0.667**	**0.462**	**0.872**	0.042	−0.178	0.261			
Continuous moderators										
Age II	16	**0.610**	**0.296**	**0.924**	0.001	−0.010	0.013	$F(1, 14) = 0.075$	0.788	0.00
BMI	19	**1.081**	**0.461**	**1.701**	−0.018	−0.043	0.008	$F(1, 17) = 2.186$	0.158	2.25
% Females	27	**0.459**	**0.290**	**0.628**	**0.205**	**0.020**	**0.390**	$F(1, 25) = 5.193$	0.031	15.57
Year of publication	27	**0.654**	**0.468**	**0.841**	−0.002	−0.013	0.010	$F(1, 25) = 0.081$	0.779	0.00
Risk of Bias	27	−0.032	−0.793	0.730	0.074	−0.011	0.159	$F(1, 25) = 3.242$	0.084	10.09

Note: Statistically significant effects ($p < 0.05$) appear highlighted in bold.
Abbreviations: AAS, Appearance Anxiety Scale; AN, anorexia nervosa; BE, binge eating; BMI, body mass index; BN, Bulimia nervosa; ED, eating disorders; PASTAS, Physical Appearance State and Trait Anxiety Scale; PASTAS-BW, Physical Appearance State and Trait Anxiety Scale-Body Weight; R^2, explained variance; RC, reference category; β_0, intercept/mean effect size; β_1, estimated regression coefficient.

symptomatology scales) likely contributed to the remaining unexplained variance. Therefore, future studies should systematically account for these factors to further elucidate the complex dynamics underlying the PAA-ED association.

From a practical perspective, the results of the present study encourage incorporating body-related scenarios into therapies that, such as those based on cognitive bias modification, have proven effective in reducing anxious and ED symptomatology (Fodor et al. 2020; Matheson et al. 2019). This may imply inducing benign (instead of negative) interpretations of the own body or shifting the focus from the body to other characteristics of the self (Fodor et al. 2020; Reyes et al. 2020). Moreover, addressing PAA aligns with transdiagnostic frameworks such as Enhanced Cognitive Behavior Therapy (CBT-E), which targets the over-evaluation of shape and weight as a core maintenance mechanism (Fairburn et al. 2003). Clinicians might also adapt Third-Wave approaches, such as Acceptance and Commitment Therapy (ACT), to address PAA by fostering psychological flexibility regarding body-related distress (Linardon et al. 2019). Future research should corroborate the possibility that interventions focused on reducing anxiety levels specifically derived from a person's own body's features would translate into decreased ED symptomatology.

The present study has two main limitations. Firstly, the cross-sectional nature of all available data prevents the inferring of causality between the examined variables, despite the theoretical plausibility of the causal sequence PAA➔ED symptomatology (Cash 2012). Additionally, despite the stringent eligibility criteria applied, the conceptual overlap between PAA and related constructs (e.g., social physique anxiety, self-objectification) poses an inherent challenge for completely disentangling their independent effects. Further research aimed at isolating the unique variance of PAA would help to more precisely define its specific contribution to ED symptomatology.

Second, there was an absence or very limited data available for many of the potential moderators. This is evident from the very low number of effect sizes available for (i) symptoms of specific ED (e.g., bulimia/anorexia nervosa or binge eating) (American Psychiatric Association 2022); (ii) males or potentially relevant populations in the context at hand such as adolescents or clinical population in terms of ED (Rodgers 2016); and (iii) samples from non-Western countries. This limitation implies that the role of some of the variables previously identified as potential moderators of the relationship under examination (e.g., type of ED or geographical region; Alcaraz-Ibáñez et al. 2023) has not been thoroughly tested, and also advises being cautious in generalizing conclusions drawn from the data at hand to the general population. In light of these limitations, there is a need for future prospective primary research in this area which, by considering a comprehensive assessment of the different manifestations of ED, focuses on examining the relationship between this group of mental health conditions and PAA across a broad range of populations. Finally, the study protocol was not preregistered.

TABLE 3 | Multivariable meta-regression results for the physical anxiety–eating disorder relationship.

Moderators	k	β_0	95% CI		β_1	95% CI		Omnibus test	p	R^2
	27							$F(4, 22) = 3.839$	0.016	35.96
		0.526	**0.365**	**0.687**						
Symptoms of BN					**−0.271**	**−0.472**	**−0.070**			
Symptoms of BE					−0.070	−0.407	0.268			
Diagnostic features of AN (Dietary restraint)					−0.130	−0.347	0.087			
% Female					**0.177**	**0.004**	**0.349**			

Note: Statistically-significant effects ($p < 0.05$) appear highlighted in bold. Overall ED symptoms (Type of ED) were considered as the reference category.
Abbreviations: AN, anorexia nervosa; BE, binge eating; BN, bulimia nervosa; ED, eating disorders; R^2, explained variance; β_0, intercept/mean effect size; β_1, estimated regression coefficient.

While the core methodological framework was established a priori and implemented consistently throughout the process, the authors acknowledge that formal preregistration provides an additional layer of transparency and is an increasingly important standard in evidence synthesis.

5 | Conclusion

The evidence obtained makes it possible to incorporate PAA to the list of negative body image variables whose strong and positive relationship with ED symptomatology has been demonstrated through the use of meta-analytical techniques. The findings encourage further examination of the efficacy of addressing anxiety reactions arising from a person's own body characteristics (especially among female individuals) as part of the treatment and prevention of EDs.

Author Contributions

M.A.-I. and A.P. designed the study, performed the systematic search and data extraction, completed all statistical analyses and initial drafts of the manuscript. M.A.-I., A.P., A.F.D.-C., A.S., and M.D.G. contributed to the drafting of the manuscript and revisions. All authors assisted with drafting of the final version of the manuscript, including critical revisions for intellectual content.

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Ethics Statement

The authors have nothing to report.

Consent

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that supports the findings of this study are available in the Supporting Information of this paper.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Supporting Information: S1.** PRISMA 2020 checklist. **Supporting Information: S2** Full electronic search strategy by database. **Supporting Information: S3** Meta-analysis coding sheet. **Supporting Information: S4** GOSH plots and influence diagnostics. **Supporting Information: S5** List of included studies for the systematic review and meta-analysis.