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**Psychological links between body image concerns and eating disorder psychopathology
in athletes and non-athletes**

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A thesis submitted in partial fulfilment of the requirements for the award of Doctorate in
Clinical Psychology at the University of Sheffield

The University of Sheffield

Faculty of Science

Clinical Psychology Unit, Department of Psychology

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Declaration

This thesis is submitted in partial fulfilment of the Doctorate of Clinical Psychology award at the University of Sheffield. It has not been submitted for any other degree or to any other institution.

Publications:

Part I: ***Body image concerns across different sports and sporting levels: A systematic review and meta-analysis*** has been published in *Body Image* (2023, online): <https://doi.org/10.1016/j.bodyim.2023.04.007>

Part II: A version of ***Psychological links between body image concerns and eating pathology among athletes: A longitudinal mediational study*** is under consideration with *Body Image*.

Structure and Word Count

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Lay summary

Body image in sports is complex and may depend on various factors, including sport type, competition level and gender. Moreover, sporting individuals may have multiple body images - evaluating their body in the context of sports (sport body image) and in the context of daily life and general beauty standards (social body image). It is important to understand body image concerns in athletes and others, as it might be a risk factor for eating disorder psychopathology in the general and sporting population.

Part I of the thesis reports a systematic review and meta-analysis that explored body image concerns across different sports and sporting levels. Twenty-one papers were included in the review and meta-analysis. In general, athletes had a better body image than non-athletes, with no reliable differences between different types of sport. Limitations of the papers included a lack of comparisons across competitive, non-competitive and non-athletes. Furthermore, more longitudinal studies are needed, to determine the role of different types of body image in sports (social, sporting).

Part II of the thesis developed on the findings from Part I, reporting a study that explored body image (social and sporting) across different sporting competition levels over six months. Since body image seems to be related to eating disorder psychopathology in sporting populations in complex ways, there was a need to understand the psychological mediators that may explain the link. The study explored possible psychological links (self-esteem; social appearance anxiety; fear of negative evaluation) between body image and eating psychopathology among competitive sports engagers, non-competitive sports engagers and sports non-engagers. Five hundred and ten adults completed questionnaires at three time-points over six months. Online measures of sports demographics, ED psychopathology, body image (social; sporting), self-esteem and social anxiety were completed at time 1. Answers on the

sports demographic questionnaire were used to sort participants into competitive sports engager, non-competitive sports engager and sports non-engager. The self-esteem and social anxiety measures were completed again at three months. Eating disorder psychopathology and body image measures were collected a further three months later (6 months after time 1). Competitive sports engagers had better body image and lower social anxiety than the other two groups. Poorer social body image and more positive appearance-related sporting body image predicted ED psychopathology among competitive sports engagers. However, there was no mediation effect of self-esteem or social anxiety. Recommendations are made for engaging in sporting competition in ways that enhance wellbeing.

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Part I: Literature review

Body image concerns across different sports and sporting levels:

A systematic review and meta-analysis

Abstract

Objective: Mixed findings exist regarding whether athletes have different levels of body image concerns to non-athletes. Such body image concerns have not been reviewed recently, meaning that new findings need to be incorporated into our understanding of the adult sporting population. This systematic review and meta-analysis aimed first to characterize body image in adult athletes versus non-athletes, and second to explore whether specific sub-groups of athletes report different body image concerns. Impact of gender and competition level were considered.

Method: Systematic literature searches were conducted across three electronic databases (Scopus, PsycINFO, PubMed). The search terms were used in a two-component strategy (Body Image Terms; Sporting Terms) across article titles, abstracts and key words. All eligible studies were assessed for quality. Following a narrative review, a meta-analysis was conducted to quantify the outcomes.

Results: A systematic search identified 21 relevant papers, mostly rated moderate quality. While the narrative synthesis indicated possible differences between types of sport, the meta-analysis demonstrated that athletes in general reported lower body image concerns than non-athletes. In general, athletes had a better body image than non-athletes, with no reliable differences between different types of sport.

Conclusion: A combination of prevention and intervention strategies might assist athletes in focusing on the benefits to their body image without encouraging restriction/compensation or overeating. Future research should define comparison groups clearly, along with attending to training background/intensity, external pressures, gender and gender identity.

Key words: body image; eating disorder; athletes; sport; review; meta-analysis

Practitioner Points

- Athletes reported lower body image concerns than non-athletes.
- Clinicians might consider recommending sports participation to service users, since participating in sport may promote positive body image and reduce the risk of developing an eating disorder.
- Clinicians should use clinical judgment when recommending sports participation, since some individuals may be vulnerable to exercising excessively and compulsively.
- Clinicians could be involved in developing specific programmes aimed at reducing body image concerns in athletes who are at risk of body image concerns and eating disorder.

Body image concerns across different sports and sporting levels:

A systematic review and meta-analysis

Introduction

Body image is an individual's subjective evaluation of their own physical appearance (Thompson et al., 1999). Negative body image is common amongst men and women in the general population (Tiggemann, 2004). Body concerns impact general wellbeing, including greater psychological distress (Coco et al., 2014) and symptoms of depression (Puccio et al., 2016). Such concerns are also associated with disordered eating behaviors and are a critical element of eating disorders (Menzel et al., 2010; Peat et al., 2008; Waller & Mountford, 2015).

Several theories have been developed to explain the acquisition and maintenance of body image disturbance (Thompson et al., 1999). Sociocultural theory contends that body image concerns stem from aspiring to a thin ideal promoted in Western societies that is difficult to achieve (Morrison et al., 2004). Awareness of the thin ideal, internalisation of the thin ideal and the perceived pressures to be thin all contribute to body image concerns (Stice, 2002; Thompson & Stice, 2001). Family, peers and the media may reinforce the thin ideal through comments that support and perpetuate the internalisation of the ideal (e.g., criticism, teasing regarding weight) (Levine & Harrison, 2004; Thompson & Stice, 2001).

Body image in athletes

Despite the fact that there are many beneficial mental health effects from being physically active (World Health Organization, 2019), some risk factors increase the likelihood of body image concerns among athletes. For example, social pressures from coaches to attain a particular physique can promote such concerns (Beckner & Record, 2016). Athletes may also experience performance-related factors that

increase their desire for a specific body ideal and subsequent body dissatisfaction (e.g., enhanced performance due to body type; weight requirements for their sport) (Sundgot-Borgen & Torstveit, 2004; 2010). On the contrary, engaging in sports can increase body appreciation and body functionality (and improve body image), since individuals appreciate their own bodies for how they function, rather than how they look (Soulliard et al., 2019).

Other factors may account for differences in body image concerns in athletes, including: background of sport training; intensity of training and training regime; sports uniforms and regular weight/composition measurements (Beckner & Record, 2016; Budzisz & Sas-Nowosielski, 2021; Coppola et al., 2014; Hausenblas & Fallon, 2006; Petrie & Greenleaf, 2012; Reel et al., 2013; Steinfeldt et al., 2013; Stoyel et al., 2021). Gender differences may also exist, with male athletes tending to strive for muscularity and women tending to strive for leanness (Cordes et al., 2016).

Body image in athletes can also differ according to the context (e.g., social or athletic setting) – a phenomenon that De Bruin et al. (2011) have labelled ‘contextual body image’. Qualitative studies have since confirmed this, showing that athletes have multiple body images, particularly an athletic and a social body image (Follo, 2007; Russell, 2004). For instance, women rugby players positively interpreted their body shape (strong, muscular) during matches as a tool for performance (athletic body image) (Russell, 2004). However, they felt their athletic bodies failed to meet feminine beauty standards of western society (social body image). Conversely, aesthetic and endurance athletes may experience more positive body image in daily life since their lean bodies fit cultural ideals (Torstveit et al., 2008). Thus, some athletes may be at less risk of body image concerns due to better resembling the societal ideal body image (Egan, 2019).

Recent reviews have compared body image across athletes and non-athletes. However, this is more generally under the umbrella of 'disordered eating' or 'eating disorder psychopathology', and thus relevant papers on body image may have been missed (Chapa et al., 2022; Karrer et al., 2020; Stoyel et al., 2019). Two systematic reviews have focused specifically on body image in athletes versus non-athletes. However, the former is outdated and the latter only focused on female adolescents (Hausenblas & Symons Downs, 2001; Varnes et al., 2013).

Across the majority of all relevant reviews, athletes report lower body dissatisfaction than non-athletes (Chapa et al., 2022; Hausenblas & Symons Downs, 2001; Karrer et al., 2020; Varnes et al., 2013). However, those findings may be impacted by moderating factors, such as gender, sport type and competition level (Benau et al., 2020; Stoyel et al., 2019).

Gender differences

Hausenblas and Symons Downs (2001) is the only review to date that explores body image across both male and female athletes. They found no differences between genders regarding body dissatisfaction. However, only 19.2% of the comparisons involved in their review included male athletes. Over the past two decades, there has been more such research, showing higher body satisfaction in athletes versus non-athletes in both females and males (Chapa et al., 2022; Karrer et al., 2020; Varnes et al., 2013). However, research directly comparing males and females has been contradictory. Some have found both male and female athletes feel pressured to be thin (Francisco et al., 2012), while other authors have found that female athletes felt more pressurised to fit a lean ideal, and experience higher body dissatisfaction and lower positive body image (Byrne & McLean., 2002; Gapin & Kearns, 2013; Giel et al., 2016; Reel et al., 2010; Soulliard et al., 2019). Conversely, Bratland-Sanda and

Sundgot-Borgen (2012) outline specific risk factors for poor body image in male athletes, including drive for muscularity and anabolic androgenic steroid use.

There also remains a considerable gap in the body image literature for trans athletes (Varnes et al., 2013). These mixed findings indicate the need for a review that considers the potential impact of gender and gender identity on body image in athletes.

Sporting Type

Sports can be divided into those that are 'nonaesthetic/non-lean' and those that are 'aesthetic/lean' (Chapa et al., 2022). Lean sports rely on a thin physique to maximise sport performance (e.g., running, gymnastics), whilst non-lean sports (e.g., ball sports, strength activities) do not emphasise leanness for aesthetics or performance (Chapa et al., 2022; McFee, 2013).

Although Hausenblas and Symons Downs (2001) found that sport type failed to moderate body image concerns in athletes versus controls, other systematic reviews have since consistently found athletes in lean sports report more body dissatisfaction versus those in non-lean sports (Chapa et al., 2022; Stoyel et al., 2019; Swami et al., 2009; Teixidor-Batlle et al., 2021; Varnes et al., 2013). Specifically, poor body image has been found in lean sport populations, including gymnasts, dancers, long distance runners, ice skaters and swimmers (Kong & Harris, 2015; Krentz & Warschburger, 2013; Steinfeldt et al., 2013; Sundgot-Borgen, 1994).

Competition level

Some reviews have found that more competitive athletes experience less body dissatisfaction than non-athletes and club/recreational athletes (Hausenblas & Symons Downs, 2001; Karrer et al., 2020). However, other researchers have found more body image concerns with increasing competition level (DiBartolo & Shaffer, 2002; Hoag, 2012; Kato et al., 2011; Robinson & Ferraro, 2004). It may be that

differences in body image across competition levels vary depending on other factors mentioned above (e.g., coaching pressures, sport type, body ideals). To summarise, research findings on body image across competition levels are contradictory and warrant further research.

Rationale for this systematic review and meta-analysis

The last systematic review focusing on body image across genders was conducted 21 years ago by Hausenblas and Symons Downs (2001). Since then, the field of body image research has grown and has included more male participants. Whilst Varnes et al. (2013) provided an update on body image research up to 2012, they only included young female college athletes. Since there are many confounding variables (such as puberty; differences in child development) that impact body image in children (de Bruin & Oudejans, 2018; Kantanista et al., 2018), a review focusing on adults is warranted. Moreover, since Varnes et al. (2013) review, there has been a shift in the body image literature to focus on positive body image and protective factors (e.g. exercise and sports participation). Therefore, an update on the literature on body image in athletes is warranted across all genders and on adults, and a meta-analysis will allow for quantification of the effects found in that literature. This literature review will consider the impact of competition level, sport type and gender, due to their potential impact on body image. Whilst a qualitative appraisal reduces bias by using pre-specified eligibility criteria and search terms, a quantitative meta-analysis supplements this by more precisely characterizing the strength and direction of relationships between sports and body image (Higgins & Green, 2011). A quantitative meta-analysis also enables the opportunity to clarify potential inconsistencies within the literature.

Aims

The current systematic review and meta-analysis has the primary aim of characterizing body image in adult athletes versus adult non-athletes, across all genders. The secondary aim is to explore whether specific sub-groups of athletes report higher levels of body image concerns by considering sport type (lean/non-lean), competition level and gender.

Method

Preparatory planning

This systematic review and meta-analysis was guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. These aim to improve the quality of systematic reviews (Moher et al., 2015). Prior to the main literature search, scoping searches were conducted on 28/06/22 using Scopus and Google Scholar, to determine whether there was sufficient literature on body image in sports populations to merit such a review. PROSPERO (international register of systematic reviews) was consulted, and confirmed no systematic reviews have been registered on this topic. The protocol was preregistered on Open Science Framework prior to the full search (https://osf.io/8e5bg/?view_only=6a1e0093823548efb65dd2c59cc0c27a) (Appendix A).

Two alterations from the registered protocol were made. First, in the terminology in the title and aims of the initial protocol, 'body dissatisfaction' was replaced with 'body image concerns', to capture the different constructs of body image used in the research field. Second, in light of the number of papers found, meta-analyses were added to further analyse the data gathered more quantitatively.

Search Strategy

The literature search was initially conducted by the first author on 1st August

2022, and then updated on 22nd March 2023. A colleague screened 10% of the overall search results to check agreement between the authors regarding the papers deemed suitable for inclusion against our inclusion/exclusion criteria. There was 100% agreement level between the first author and colleague. For this full systematic review, three electronic databases were searched since inception (Scopus, PsycINFO, and PubMed). The search terms (Table 1) were used in a two-component strategy (Body Image Terms; Sporting Terms) across article titles, abstracts and key words. These search terms were based on those used in previous systematic reviews on body image measures (Kling et al., 2019) and body image in athletes (Hausenblas & Symons Downs, 2001; Karrer et al. 2020).

'Grey literature' (materials that have not been peer-reviewed, such as dissertations, conference materials and self-posted materials) was eligible for inclusion. However, we excluded papers that were not in English, and papers where no primary effect size could be calculated. Backward searching was conducted on identified studies by searching reference lists. Previous reviews of body image in the context of sports were also searched to identify any other relevant studies.

Table 1*Search terms*

Terms	Search Terms
Term A	"negative body image*" OR "positive body image*" OR "body dissatisfaction" OR "body satisfaction" OR "body ideal*" OR "weight concern*" OR "shape concern*" OR "body esteem" OR "appearance concern*" OR "social avoidance" OR "body image avoidance" OR "appearance anxiet*" OR "appearance-related anxiet*" OR "appearance-related concern*" OR "muscularity satisfaction" OR "muscularity dissatisfaction" OR "body shape satisfaction" OR "body shape dissatisfaction" OR "weight satisfaction" OR "weight dissatisfaction" OR "appearance satisfaction" OR "appearance dissatisfaction" OR "body image satisfaction" OR "body image dissatisfaction" OR "body checking behav*" OR "body shame" OR "appearance comparison*"
Term B	"athlete*" OR "sport" OR "competitive versus non-competitive" OR "competitive or non-competitive" OR "competition level*" OR "sporting level*" OR "aesthetic sport*" OR "nonaesthetic sport*" OR "lean sport*" OR "non-lean sport*" OR "endurance sport*" OR "combat sport*" OR "team sport*" OR "racket sport*" OR "ball sport*" OR "weight* sport*" OR "run*" OR "hiking" OR "cycling" OR "swim*" OR "crossfit"

Note. Term A and Term B were combined using the 'AND' operator.

Papers were imported into Mendeley reference management software. Duplicates were removed. Studies were then hierarchically screened against the inclusion/exclusion criteria, according to title, abstract and then full text. Papers were included if they met all inclusion criteria. The information extracted included author(s), publication year, study location, study aims, study design, sample and methodology. Primary outcome measures of body image and the measure used were obtained.

Effect sizes for the body image outcomes were also extracted. Key discussion points and limitations were recorded. The first author and a colleague independently conducted data extraction for all studies that met the inclusion criteria and agreed in all cases.

Inclusion and Exclusion Criteria

The inclusion criteria were guided by the PICOS framework (Table 2), as recommended by the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2019). Table 2 shows the inclusion/exclusion criteria. All studies were required to be of quantitative design. The search was restricted to adults, defined as individuals aged 17 and above. We excluded children and younger adolescents because of the many confounding impacts of puberty on body image and sports involvement. Most students start college/university aged 18 years, but some start as they approach that age and some students routinely start at 17 years (e.g., in Scotland). Therefore, as many studies are based on college/university students, it was important not to miss those who were 17 years old. If a study did not include a minimum age, it was included in the analysis if the mean age minus the *SD* was at least 17 years. Studies recruiting university students were included on the assumption that the minimum age requirement for university is 17 years and above.

To explore body image across sporting levels, studies had to include participants from at least two of the following three groups: competitive athletes, non-competitive athletes, and/or non-athletes. An 'athlete' is considered "an individual who by virtue of special training or natural talent, is fit to compete in a physically demanding sport", as defined by the Oxford Dictionary of Sports Science and Medicine (Kent, 2006). In line with previous reviews (Chapman & Woodman, 2016; Varnes et al., 2013), this systematic review defined 'competitive athletes' as individuals who

compete in competitive sports competitions for their sport (e.g., Olympians, National Collegiate Athletic Association Divisions). They are described by terms such as, 'competitive athlete', 'professional' and/or 'elite". Non-competitive athletes are described by words such as, 'non-competitive', 'recreational', and/or words relating to their sport who were not competing (e.g. 'runners', 'cyclists'). 'Non-athletes' are described as 'non-athletes', 'controls' and/or 'sedentary'. Regarding sport type, this systematic review was guided by previous reviews (Hausenblas & Symons Downs, 2001) and thus included sports such as bodybuilding. Participants whose sports are considered outside the aforementioned definition of athlete will also be considered as 'non-athletes'. For example, individuals engaging in sports such as chess would not be considered athletes since chess is not considered physically demanding (Parry, 2019). Any uncertainties were discussed between the researchers.

Papers had to be written in English. They had to include a clear, quantifiable measure of body image specific to either athletes or non-athletes. Tools that measured an individual's subjective evaluation of their own physical appearance were considered as body image measures (Thompson et al., 1999). Various search terms relating to the different constructs of 'body image' (both negative and positive facets of body image) were used to capture all relevant papers. Body image can be measured using a number of validated tools whereby high scores reflect higher body image concerns (e.g., Eating Disorder Inventory; Garner et al., 1983). Other tools may assess positive body image, where high scores reflect lower body image concerns (e.g. Body Appreciation Scale; Tylka & Wood-Barcalow, 2015b). Where there were multiple outcome measures, we used the primary outcome measure of body image as identified by the authors. If the authors did not explicitly state a primary outcome measure, then we identified the measure that was most prominently used by the

authors in their analyses (as listed in the Results section).

Table 2

Inclusion/Exclusion Criteria, including PICO framework (Patient, Intervention, Comparator, Outcome)

Inclusion	Exclusion
<u>Patient</u>	<u>Patient</u>
<ul style="list-style-type: none">• Samples must be above 17+ years of age• Samples must include athletes• Studies must be written in the English language	<ul style="list-style-type: none">• Participants below 17 years• Samples that do not include athletes (as defined above)• Studies written in a language other than English
<u>Design</u>	<u>Design</u>
<ul style="list-style-type: none">• Quantitative study design	<ul style="list-style-type: none">• Qualitative studies, single case experimental designs, case studies, commentaries, and protocols
<u>Comparator</u>	
<ul style="list-style-type: none">• The study includes a sample of two or more of the following comparison groups: competitive athletes and/or non-competitive athletes and/or non-athletes (see text for definition of ‘athlete’)	
<u>Outcome</u>	<u>Outcome</u>
<ul style="list-style-type: none">• Must include a quantifiable body image measure• Sufficient information to compute effect size	<ul style="list-style-type: none">• Studies without a focus on body image

Quality assessment

Study quality was assessed to ascertain methodological quality and risk of bias and to inform areas for future directions. A scoping search revealed the majority of studies were cross-sectional designs. Whilst Berra et al. (2008) developed the STROBE (STrengthening the Reporting of Observational Studies in Epidemiology) tool for cross-sectional designs, it only appraises the quality of cross-sectional studies and does not address risk of bias or other aspects of quality. Instead, the Critical Appraisal Skills Programme (CASP) (2018) Cohort Study checklist enables review of a range of components (selection bias, study design, outcome bias, confounders, attrition, implications for practice) (Appendix B). The CASP (2018) Cohort Study checklist was slightly altered to make it more applicable to cross-sectional studies. Specifically, the question: “Was the exposure accurately measured to minimise bias?” was altered to, “Were the comparator groups accurately categorised to minimise bias?”.

All studies were evaluated against the checklist by the lead author. This consisted of 12 questions divided into three sections (Are the results of the study valid?; What are the results?; Will the results help locally?). Ratings are either ‘yes’, ‘no’ or ‘cannot tell’. CASP does not provide a total score. However, the number of ‘yes’ responses were totalled to assist in consideration of study quality when synthesising the findings. Two of the questions consisted of two parts and thus a total score of 14 could be obtained. Studies were placed into low (0-5 ‘yes’), moderate (6-10 ‘yes’) and high-quality categories (11-14 ‘yes’), created by the authors.

Planned analysis

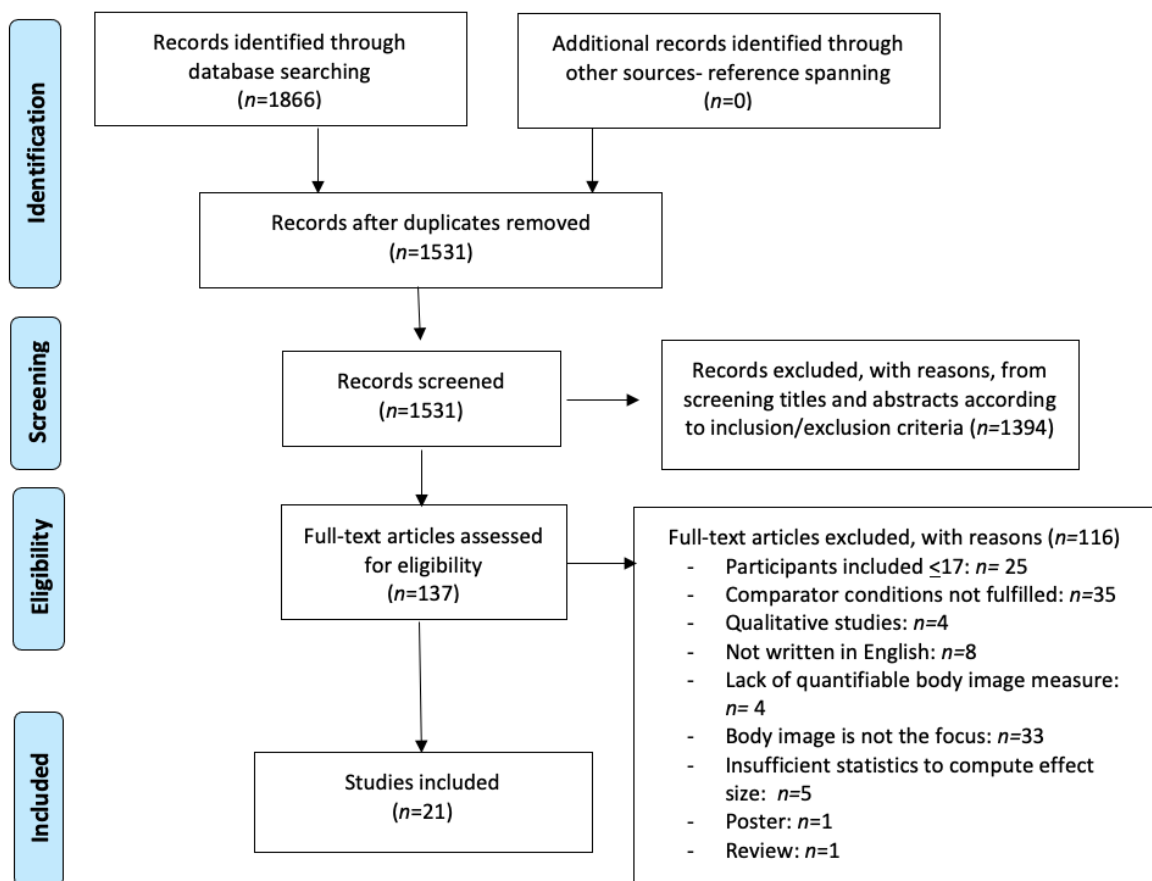
Data selection and extraction

Figure 1 shows the search process in a PRISMA diagram (Moher et al., 2009).

1866 papers were identified from database searching. Papers were imported into Mendeley reference management software. After removing duplicates, 1531 records remained and were screened by title and abstract against the inclusion/exclusion criteria. Of these, 137 studies were eligible for full-text screening, and 116 of those studies were excluded for not fulfilling the inclusion/exclusion criteria (Figure 1). Thus, 21 studies were identified as meeting the inclusion criteria. No additional papers were identified through reference scanning of the identified papers.

Figure 1

PRISMA (Moher et al., 2009) diagram of search strategy



Meta-analyses

In addition to the narrative synthesis of all reviewed studies, five random effects meta-analyses were conducted. These were conducted with and without the weaker quality papers and with and without any outliers, to determine whether inclusion of those papers influenced the outcome. As noted above, these meta-analyses were not part of the pre-registration, so should be noted as a deviation from the original plan. They were included because the number of papers discovered was higher than originally expected, allowing more definitive quantitative conclusions to be reached.

The statistical package used was MAVIS v1.1.3 (Meta-Analysis via Shiny; <http://kylehamilton.net/shiny/MAVIS/>) (Hamilton, 2011). Random effects models were used, due to the variation across study characteristics meaning that no single effect size could be assumed (Borenstein et al., 2009). The meta-analyses compared: i) competitive athletes and non-athletes; ii) competitive and non-competitive athletes; iii) lean and non-lean athletes; iv) lean athletes and non-athletes; and v) non-lean athletes and non-athletes. No meta-analysis was conducted on non-competitive athletes versus non-athletes due to only one paper being found that compared these populations. Within each meta-analysis, studies using the same sample for multiple comparisons were combined using the formula recommended by Cochrane (Higgins & Green, 2011). For example, basketballers, volleyballers, and softballers were combined into one sample of non-lean athletes and compared to the control group (non-athletes).

Effect size calculations.

Effect sizes (Cohen's d) were directly obtained from studies (Cohen, 1988). If Cohen's d was unavailable, the mean and standard deviation were obtained and the effect size (Cohen's d) was calculated using the Campbell Collaboration effect size

calculator (Wilson, 2022). If means and SDs were not available, then effect sizes other than Cohen's d were converted to Cohen's d using the Campbell Collaboration effect size calculator (Wilson, 2022). Separate effect size comparisons were made across different i) competition levels and ii) sport types. An effect size of 0.2 was considered small, 0.5 medium and 0.8 large (Cohen, 1988). This process enabled clearer comparison across studies.

Hedges' g was calculated to adjust for unequal sample sizes across groups. Heterogeneity was examined using the I^2 and Cochran's Q statistics (Higgins et al., 2003). In general, I^2 values of 25% reflect low heterogeneity, 50% moderate heterogeneity and 75% or more indicate high heterogeneity (Higgins et al., 2003). The Q -statistic is the weighted sum of squared differences between observed effects and *weighted* average effect. Significance of Q statistic indicates heterogeneity.

Publication bias was examined using funnel plots to visualise standard errors vs effect sizes, with trim-and-fill used where the funnel plot was asymmetrical (Quintana, 2015). Egger's regression test examined publication bias (Egger et al., 1997).

Results

Study characteristics

Key characteristics are outlined in Appendix C. The majority of studies were conducted in the USA ($N = 11$), followed by Canada ($N = 3$), United Kingdom ($N = 2$), Australia ($N = 1$), Spain ($N = 1$), Turkey ($N = 1$), France ($N = 1$) and Italy ($N = 1$). All studies were cross-sectional. A total sample of 3827 participants were recruited across all of the studies within this review. Individual study sample sizes ranged from 44 to 798. The majority of studies included university students ($N = 17$).

Table 3 shows how participant groups were categorised into competitive

athletes, non-competitive athletes, and non-athletes. Most studies recruited two or more of these samples from the offset ($N = 18$), whilst three studies stratified their sample into these categories using their own questionnaires (Benau et al., 2020; Iacolino et al., 2017; Smith et al., 2010).

Sixteen of the 21 studies provided sufficient information to sort research according to sport type (lean/non-lean). This division into lean and non-lean sports was based on previous research on eating disorders in athletes (Chapman & Woodman, 2016; Mancine et al., 2020; Sundgot-Borgen & Torstveit, 2004). Across all studies, 714 participants were considered lean athletes and 702 participants were considered non-lean (Figure 2).

Table 3

Categorisation of studies according to athletic status (non-athletes, non-competitive athletes, competitive athletes)

Non-athletes ($N = 16$)			
Non-athletes	Further information on non-athletes	Number of studies	Researchers (date)
By definition ($n=13$)	'Non-athlete' term used	$n=11$	Aşçi (2004) Benau, Wiatrowski & Timko (2020) Di Bartolo & Shaffer (2002)* Dinucci et al. (1994) Hoag (2012) Reinking & Alexander (2005)* Robinson & Ferraro (2004) Soulliard et al. (2019) Soulliard et al. (2021) Warren, Stanton & Blessing (1990)* Wiggins & Moode (2000)*
	'Non-exerciser' term used	$n=1$	Furnham, Titman & Sleeman (1994)
	'Non-sporting' term used	$n=1$	Iacolino et al. (2017)*
Using the term 'control' or 'comparison group' ($n = 3$)	'Control'	$n=2$	Arroyo et al. (2008)* Filaire et al. (2007)*
	'Comparison group- classroom subjects'	$n=1$	Loosemore et al. (1989) ^b *
Non-competitive Athletes ($n=6$)			

Non-competitive level	Further information on non-competitiveness	Number of studies	Researchers (date)
Explicitly stating participants as not competing (<i>n</i> =4)	'Non-competitive' term used	<i>n</i> =2	Goldfield, Blouin & Woodside (2006) Goldfield (2009)
	Never competed and no plans to compete in the next 12 months	<i>n</i> =2	Kong & Harris (2015) Smith, Wright & Winrow (2010)
Terminology alluding to non-competitiveness (<i>n</i> =2)	Regularly worked out in the gym	<i>n</i> =1	Loosemore et al. (1989) ^b
	Fitness lifters with 6 months minimum experience	<i>n</i> =1	Hale et al. (2013)
Competitive Athletes (<i>n</i> =21)			
Competition level (least to most competitive) (number of studies)	Further competition level information (least to most competitive)	Number of studies	Researchers (date)
Collegiate (<i>n</i> =12)	Division not specified	<i>n</i> =2	Loosemore et al. (1989) ^b Wiggins & Moode (2000)
	Division III	<i>n</i> =1	Di Bartolo & Shaffer (2002)
	Division II	<i>n</i> =1	Robinson & Ferraro (2004)
	Division I	<i>n</i> =5	Kong & Harris (2015) ^a Reinking & Alexander (2005) Soulliard et al. (2019) Soulliard et al. (2021) Warren, Stanton & Blessing (1990)
	First university team	<i>n</i> =1	Furnham, Titman & Sleeman (1994)
	Across competition levels (recreational, club, collegiate, elite)	<i>n</i> =2	Benau, Wiatrowski & Timko (2020) ^a Hoag (2012)
Competition participation/training (<i>n</i> =5)	Recently trained for a competition or in training for a competition	<i>n</i> =2	Iacolino et al. (2017) [*] Smith, Wright & Winrow (2010)
	Actively training for a competition	<i>n</i> =2	Goldfield, Blouin & Woodside (2006) Goldfield (2009)
	Competed in ≤3 competitions (expert bodybuilders)	<i>n</i> =1	Hale et al. (2013) ^{a*}
	Competed in ≥10 competitions (expert bodybuilders)	<i>n</i> =1	Hale et al. (2013) ^a
Elite (<i>n</i> =6)	'Elite' or synonym 'Semi-pro/pro'	<i>n</i> =2	Arroyo et al. (2008) Kong & Harris (2015) ^a Benau, Wiatrowski & Timko (2020) ^a
	National teams	<i>n</i> =3	Aşçi (2004) Dinucci et al. (1994) Filaire et al. (2007)

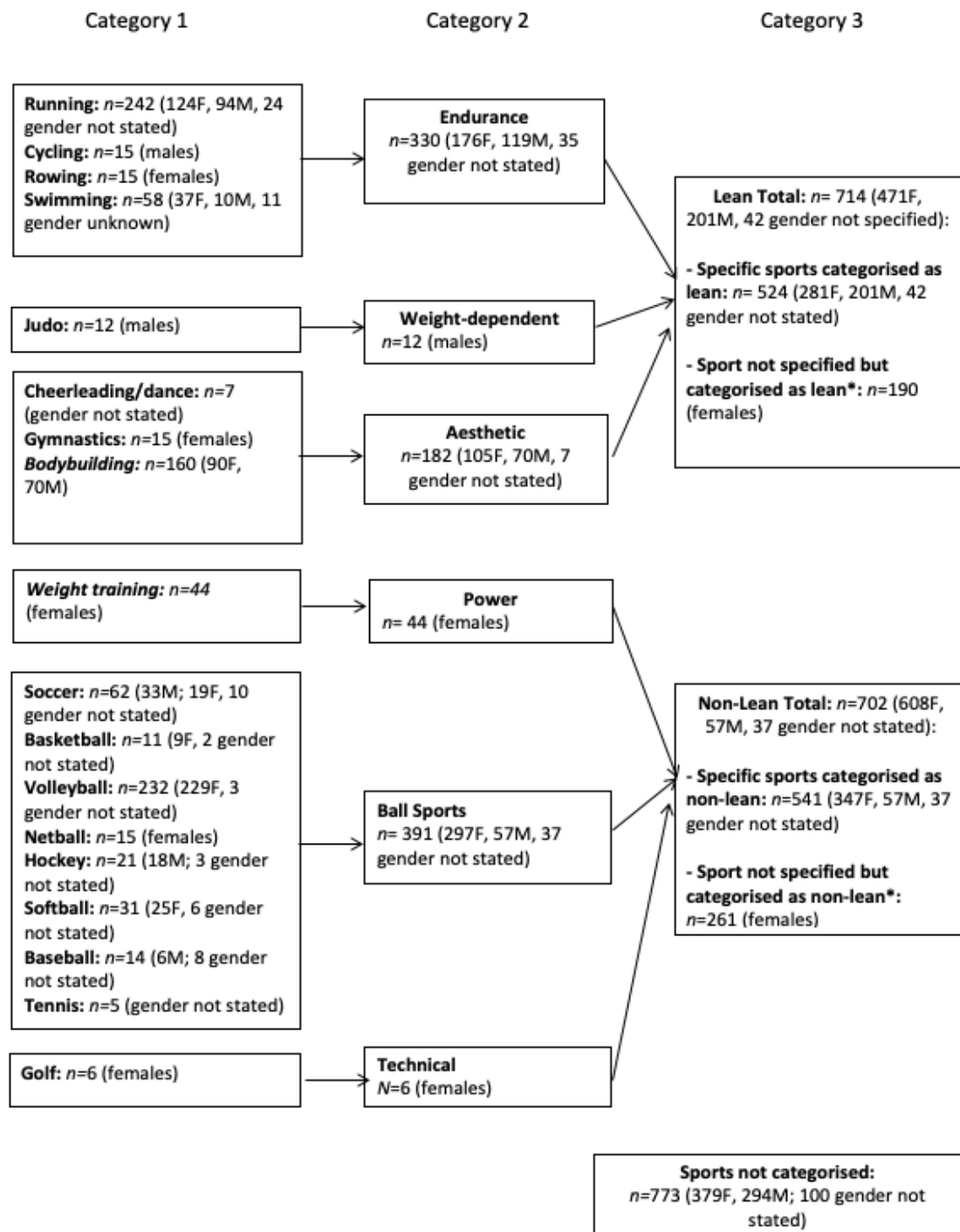
Note. * denotes a study with poorly defined criteria of competitive/non-competitive/non-athlete.

^a indicates studies recruiting more than one group of competitive athletes. ^b denotes the study that recruited across all three conditions.

Eleven studies recruited females only and four studies recruited only males. The remaining studies included a roughly equal gender ratio (i.e., 50-60%) ($N = 2$) or were predominantly female ($N = 4$). Across all study samples, females were most represented ($N = 2593$), followed by males ($N = 1116$). Only two studies (Soulliard et al., 2019; Soulliard et al., 2021) considered gender identity other than the sex assigned at birth. One participant across all studies was a transwoman (Soulliard et al., 2019). See Figure 2 for the gender split across sport types.

Figure 2

Diagram showing the number of participants across different sport types, based on Murphy (2005)



Note. F: Females, M: Males * These subjects are not included in any of the category 1 or category 2 boxes since specific sports were not provided.

Quality assessment

All studies passed the screening questions and were therefore quality assessed using the CASP Cohort Checklist (CASP, 2018). Most studies were rated moderate ($N = 12$), followed by high ($N = 5$) or low ($N = 4$) in methodological quality. See Appendix D for further information on quality assessment.

A strength of the studies was that they all addressed a clearly focused issue (body image) and recruited participants in an acceptable way. However, ten studies had unclear definitions of groups. 'Non-athletes' were the poorest defined group, which was problematic for comparisons since there is a possibility that they included athletes ($N = 9$).

Whilst 18 studies included reliability and/or validity data on the measure used, only 12 received a 'yes' rating on the accuracy of outcome measure used. This is because six did not use the most up-to-date version of the Eating Disorders Inventory (EDI) (see Appendix C). Three studies received a 'can't tell' since they did not provide reliability or validity data on the measure used (Arroyo et al., 2008; Filaire et al., 2007; Furnham et al., 1994).

The majority of studies controlled for confounding variables and took this into account in their analysis ($N = 15$). However, a weakness of all studies was that they were not longitudinal. Other flaws included small sample sizes, unequal sample size comparisons, and minimal consideration of confounding variables.

Body image measures used

Studies varied on the primary body image measure administered (Appendix C). The most common measure of body image disturbance was the body dissatisfaction subscale of the Eating Disorders Inventory (EDI-BD) ($N = 9$). Four studies used questionnaires that required participants to rate the figures that best represented their body.

Other studies measured muscularity body dissatisfaction ($N = 4$). Two of these adapted the EDI-BD to create a Drive for Bulk Scale. Specifically, the direction of items was reversed (e.g., 'too big' to 'too small') and references to body parts were altered to the more mesomorphic bodybuilding ideal. One study used the Muscle Dysmorphia Inventory (MDI) (Rhea et al., 2004). The Size Symmetry subscale was extracted as a measure of body image disturbance. One study measured muscular body dissatisfaction as the difference between actual and ideal figure ratings using the Somatomorphic Matrix Test (Pope et al., 2000).

Six studies used measures where higher scores reflected positive body image. To avoid confusion in collating all the different measures to ascertain body image concerns, the current review describes those with more positive body image as having 'fewer body image concerns'. The most commonly used measure was the Body Esteem Scale ($N = 3$). However, two researchers used another measure (developed by Franzoi & Shields, 1984), whilst Filaire et al. (2007) created a French-Canadian version based on a different Body Esteem Scale (Leichner et al., 1994). Other positive body image measures included the Body Appreciation Scale 2 (Tylka & Wood-Barcalow, 2015b; $N = 1$) the State-based Body Appreciation Scale (Homan, 2016; $N = 1$), and the Physical Self-Perception Profile body attractiveness subscale (Fox & Corbin, 1989; $N = 1$).

Qualitative findings: Narrative review

Tables 4-8 summarise the papers that were used in the narrative review. These are divided into studies that compare body image by competition level and sport type.

Review findings I: Competition level

To accomplish the first aim of this review, comparisons between non-athletes and athletes were made whilst also considering competition level (Table 4). Most studies compared competitive athletes with non-athletes ($N = 15$). Only one study

compared non-competitive athletes with non-athletes (Loosemore et al., 1989). Five studies compared competitive and non-competitive athletes. Of note is the fact that nine studies had unclear definitions of non-athletes. All 21 studies recruited competitive athletes. Most studies recruited competitive athletes from collegiate sports (university sports) teams ($N = 12$) and non-athletes from university courses ($N = 9$). Collegiate sports were part of the National Collegiate Athletic Association (NCAA), which ranges from division I (most competitive) to division III (least competitive) (NCAA, 2022).

Athletes vs non-athletes.

Considering body image in adult athletes versus adult non-athletes, the majority of papers showed that athletes had lower body image concerns than non-athletes ($N = 11$) (Table 4). Four reported no significant differences, but three of those were of low quality and so should be interpreted with caution. Only three papers found that athletes had higher body image concerns than non-athletes based on comparisons with competitive (Filaire et al., 2007; Hoag, 2012) and non-competitive athletes (Loosemore et al., 1989). To summarise, the evidence was in favour of the conclusion that athletes have lower body image concerns than non-athletes.

Role of gender.

Apart from Hoag (2012) and Wiggins and Moode (2000), all of the studies of females only showed that female athletes had lower body image concerns than female non-athletes, but this pattern was not repeated in the small number of studies recruiting only males ($N = 3$). Four studies directly compared male athletes with female athletes, but findings varied widely. However, the unequal sample sizes for males and females in all of these samples make it impossible to draw conclusions relating to any gender difference.

Table 4*Summarised results of the studies comparing athletes versus non-athletes*

Paper	Comparison groups: athletes vs non-athletes [Gender]	Body image measure (interpretation)	Outcome	Interpretation
Arroyo et al. (2008)	Competitive (Soccer players) vs non-athletes [all males]	Somatomorphic Matrix Test	There were no body-dissatisfaction differences between the soccer players and controls for both muscularity (78.5% players and 82.2% controls were dissatisfied) and % body fat (64.3% players and 64.3% controls dissatisfied)	No significant difference between competitive soccer players and non-athletes.
Aşçi (2004)	Competitive (elite athletes of different sports) [207M; 122F] vs non-athletes [275M; 194F]	The Physical Self-Perception profile- Body attractiveness subscale (higher scores indicate more positive body image attractiveness)	Athletes scored higher than non-athletes on the body attractiveness subscale ($p < .01$) No significant main effect of sex on body attractiveness ratings.	Athletes scored significantly higher than non-athletes on body attractiveness, indicating fewer body image concerns No effect of gender.
Benau, Wiatrowski & Timko (2020)	Competitive athletes [87M; 96F] of different sports vs non-athletes [15M; 81F]	EDI-3 (BD)*	Male athletes vs female athletes were defined by greater body dissatisfaction (Welch's $t(263.83) = 10.65$, $p < 0.001$, $d = 1.27$). Omnibus MANOVA revealed the main effect of athletics was not significant, $F(8, 268) = 1.06$, $p = 0.389$, $\eta^2 = 0.031$. However, the gender \times athletics interaction was significant $F(8, 268) = 2.16$, $p = 0.031$, $\eta^2 = 0.061$.	Male athletes had significantly higher body dissatisfaction than female athletes No difference on body dissatisfaction between competitive and non-athletes.
Di Bartolo & Shaffer (2002)	Competitive athletes of different sports vs non-athletes [all females]	EDI-1 (BD)* BIS (greater scores indicate	Athletes scored significantly lower on body dissatisfaction than non-athletes on the: EDI: $F(1, 207) = 20.71$, $p < .001$, $\eta^2 = 0.09$ BIS: $F(1, 207) = 7.59$, $p < .01$, $\eta^2 = 0.04$	Athletes reported significantly lower body dissatisfaction than non-athletes both the BDI and BIS.

		higher body dissatisfaction)		
Dinucci et al. (1994)	Competitive athletes (basketballers, volleyballers, softballers) vs non-athletes [all females]	Body Esteem Scale (Weight Concern subscale) (higher scores indicate more positive body esteem).	For weight concern, Duncan's multiple-range test ($\alpha=.05$) indicated the mean of controls was significantly lower than mean of each of the three athletic groups (basketball, volleyball, softball).	Non-athletes reported significantly lower body esteem than athletes (basketball, volleyball, softball) and thus had more body image concerns.
Filaire et al. (2007)	Competitive athletes (Judoists; Cyclists) vs non-athletes [all males]	Body Esteem Scale Canadian-French version (Weight satisfaction)= higher scores represent higher body-esteem.	ANOVA revealed significantly higher Body-esteem Weight Satisfaction for non-athletes as compared to the athletes (Judoists; Cyclists), $p < .05$.	Nonathletes had significantly higher body esteem than athletes (Body esteem scale).
Furnham, Titman & Sleeman (1994)	Competitive athletes (netballers, rowers, bodybuilders) vs non-athletes [all females]	Body Shape Selection (attractiveness subscale)- higher scores indicate more positive body image	One-Way ANCOVAs revealed exercisers perceived themselves as significantly more attractive than non-exercisers ($p < .05$).	Exercisers perceived their body as significantly more attractive than non-exercisers
Hoag (2012)	Competitive volleyballers vs non-athletes [all females]	EDI-1 (BD)	MANOVA (BMI as covariate) Volleyball players scored significantly higher on the body dissatisfaction subscale [Mean = 10.00 (+ 2.25)] compared with non-athletes [Mean = 9.14 (+2.32)]. $F(1,322)= 10.09$, $p = .002$, $\eta^2 = .030$.	Athletes had significantly higher body image concerns than non-athletes.

Iacolino et al. (2017)	Competitive athletes of different sports vs non-athletes (70M, 125F)	Body Uneasiness Test (Body Image Concern) (higher scores indicate more body image concerns)	Athletes scored significantly lower on body image concern than non-athletes ($p < .05$).	Athletes had significantly lower body image concern than non-athletes
Loosemore et al. (1989)	Competitive hockey players vs non-athletes [all male]	EDI-1 (BD)*	ANOVA between all comparison groups (competitive, non-competitive, non-athlete) revealed a significant difference between the three groups ($p < .0001$). Duncan's Multiple Range indicated no significant difference between hockey players and non-athletes.	No significant difference on body dissatisfaction.
Reinking & Alexander (2005)	Competitive athletes of different sports vs non-athletes [all females]	EDI-2 (BD)*	Athletes had significantly lower scores in body dissatisfaction than non-athletes ($p = .01$).	Athletes had significantly lower body dissatisfaction than non-athletes.
Robinson & Ferraro (2004)	Competitive athletes (Speed; Technique) vs non-athletes [all females]	EDI-1 (BD)*	Nonathletes expressed more dissatisfaction than both technique and speed focussed athlete groups ($p < .05$)	Nonathletes had significantly higher dissatisfaction than technique and speed focussed athletes.
Soulliard, Fitterman-Harris, Perry, Poe & Ross (2021)	Competitive athletes of different sports vs non-athletes [Cisgender: 219F; 67M]	SBAS-2 (higher scores indicate greater body appreciation)	Cisgender men reported higher levels of body appreciation compared to cisgender women: $t(284) = 2.60, p = .01, d = 0.61$, When controlling for gender, student athletes reported higher levels of body appreciation compared with nonathletes. $F(1,283) = 19.36, p < .001, \eta^2 = .06$.	Men reported significantly higher body appreciation than women. Athletes reported significantly higher body appreciation than nonathletes.
Soulliard, Kauffman, Fitterman-Harris, Perry	Competitive athletes of different sports vs non-athletes [Cisgender:	BAS-2 (higher scores indicate greater body appreciation)	Women athletes reported lower body appreciation than male athletes $t(77) = 4.52, p < .001$.	Men reported significantly higher body appreciation than women. Athletes reported higher body appreciation than non-athletes.

& Ross (2019)	180F, 73M; 1 Transwoman]		When controlling for gender, student athletes reported significantly higher levels of body appreciation than non-athletes: $F(1,249)=9.10, p<.001, n^2=0.71$ (medium effect).	
Warren, Stanton & Blessing (1990)	Competitive athletes (gymnasts; runners; athlete controls) vs non-athletes [all females]	EDI-1 (BD)*	Non-athletes scored significantly higher on body dissatisfaction than runners ($p<.05$) but not gymnast nor athlete controls (non-lean sports) ($p>.05$)	Nonathletes had significantly higher body dissatisfaction than runners. No significant difference between nonathletes and gymnasts; or non-athletes and athlete controls
Wiggins & Moode (2000)	Competitive athletes of different sports vs non-athletes [all female]	Body Esteem Scale (weight concern subscale): higher scores indicate higher body esteem	No significant difference between athletes and non-athletes on body esteem (weight concern) ($p>.05$).	No significant difference
Loosemore et al. (1989)	Non-competitive bodybuilders vs non-athletes [all male]	EDI1-BD	ANOVA between all comparison groups (included non-athletes too) revealed a significant difference between the three groups ($p<.0001$). Duncan's multiple Range test indicated body builders had significantly higher body dissatisfaction than non-athletes (no p value reported).	Non-competitive athletes had significantly higher body dissatisfaction than non-athletes

Note. Comparison groups separated by a semicolon indicate different comparison groups used in analyses. M: Males; F: Females. BMI: Body Mass Index.

* Study did not use the most up-to-date EDI

EDI(1;2;3)= Eating Disorder Inventory (version used), SBAS-2= state-based Body Appreciation Scale 2, BAS-2= Body Appreciation Scale-2;

BES: Body Esteem Scale, BIS: Body Image Survey

Table 5

Summarised results of the studies comparing competitive athletes versus non-competitive athletes

Paper	Comparison groups: competitive athletes vs non-competitive [Gender]	Body image measure (interpretation)	Outcome	Interpretation
Goldfield (2009)	Competitive bodybuilders vs non-competitive weight training [all females]	EDI-1 (BD) Drive for Bulk (higher scores indicate higher desire for muscularity)	No significant differences on the Body Dissatisfaction variable ($p > .05$). Competitive bodybuilders scored significantly higher on the Drive For Bulk Scale $F(1,43)=9.4$, $p=.004$, partial eta squared=.18 than non-competitive weight training athletes.	No significant difference on EDI. Competitive bodybuilders reported significantly higher drive for bulk scores than non-competitive weight trainers.
Goldfield, Blouin & Woodside (2006)	Competitive bodybuilders vs non-competitive bodybuilders [all males]	EDI- (BD) Drive for Bulk (higher scores indicate higher desire for muscularity)	No significant differences ($p > .05$) between competitive and recreational bodybuilders regarding both body dissatisfaction and drive for bulk.	No significant difference on body dissatisfaction and drive for bulk.
Hale, Diehl, Weaver & Briggs (2013)	Competitive bodybuilders (expert) vs non-competitive fitness lifters [all females]	Muscle Dysmorphia Inventory: Size Symmetry (higher scores indicate more body image concerns)	Female bodybuilders scored higher than fitness lifters for size symmetry scales of the MDI ($F(2,71)=11.09$, $p < .01$). Follow up turkey post hoc tests: expert bodybuilders scored significantly higher than fitness lifters ($p < .05$)	Competitive 'expert' bodybuilders reported significantly higher size symmetry vs non-competitive fitness lifters.

Kong & Harris (2015)	Competitive (elite, recreational) vs non-competitive athletes of different sports [all females]	Figure Rating Scale (FRS): Difference between FRS current and FRS sport= sporting body dissatisfaction (higher scores indicate greater body dissatisfaction)	Sporting body dissatisfaction did not significantly differ between any of the three groups (elite, recreational athletes, non-competitive athletes ($p>.05$).	No significant difference on body dissatisfaction.
Loosemore et al. (1989)	Competitive (Hockey players) vs non-competitive (bodybuilders) [all males]	EDI-1 (BD)	ANOVA between all comparison groups (included non-athletes too) revealed a significant difference between the three groups ($p<.0001$). Duncan's multiple Range test indicated body builders (non-competitive) had significantly higher body dissatisfaction than hockey players (competitive).	Non-competitive bodybuilders reported significantly higher body dissatisfaction than competitive hockey players.
Smith, Wright & Winrow (2010)	Competitive runners vs non-competitive runners [94M; 90F]	SPAS (higher scores indicate higher appearance anxiety)	A MANCOVA revealed a significant overall effect, Wilks's $\Lambda = .39$, $F(30, 499.66) = 6.21$, $p < .001$ on various different measures. Univariate F test for SPAS revealed no significant difference between competitive and non-competitive runners on appearance anxiety scores ($p>.05$).	No significant difference Means and SD were similar for competitive males and competitive females; and non-competitive males and non-competitive females. Post hoc tests were not conducted on SPAS scores due to ns main effect.

Note. Comparison groups separated by a semicolon indicate different comparison groups used in analyses. M: Males; F: Females.

EDI(1;2;3)= Eating Disorder Inventory (version used), SBAS-2= state-based Body Appreciation Scale 2, BAS-2= Body Appreciation Scale-2;

BES: Body Esteem Scale, MDI= Muscle Dysmorphia Inventory

Competition level.

As with gender, there was no consensus on whether non-competitive athletes had higher body image concerns than competitive athletes (Table 5). These findings did not appear to be impacted by gender.

Review findings II: Sport type

For the second aim, research was categorised according to sport type (Lean/Non-lean). Gender was also considered for any impact on findings. These were compared across studies including two or more of the following comparator groups: lean sport(s); non-lean sport(s), non-athletes (Table 6-8).

Lean vs non-lean sports.

Seven studies compared lean sports and non-lean sports (Table 6). The majority showed that lean athletes had higher body image concerns than non-lean athletes ($N = 4$). One showed no significant difference, and two reported mixed findings dependent on the body image measure used or the lean comparison group used (runners vs gymnasts). Comparisons across genders could not be made, as six of the seven studies recruited females only.

Lean sports vs non-athletes.

There were mixed findings comparing lean athletes and non-athletes (Table 7). In two studies, lean athletes had better body image than non-athletes, while in two others non-athletes had better body image than lean athletes. Finally, there was no difference in the fifth study. However, the number of studies was small, and three studies were of weak quality.

Non-lean sports vs non-athletes.

The dominant pattern was that non-lean athletes had lower body image concerns than non-athletes. One study showed non-lean athletes (volleyballers) had

higher body image concerns than non-athletes (Hoag, 2012). Two studies did not show any difference (Table 8). It is noteworthy that the two studies reporting no significant differences were the only two comparing males only, whilst those showing significant differences were on female samples. Therefore, this pattern of better body image among non-lean athletes may be impacted by gender.

Table 6*Summarised results of the studies comparing lean athletes versus non-lean athletes*

Paper	Comparison group(s) [Gender]	Body image measure (interpretation)	Outcome and interpretation	Interpretation
Hale et al. (2013) ^{ab}	Lean sports (Expert bodybuilders ^a) vs non-lean (Fitness lifters ^b) [all female]	MDI- Size symmetry subscale (higher scores=higher dissatisfaction with body)	Significant MANOVA group main effect (Wilks' lambda =.44, F (12, 132)= 5.59, $p<.05$. Univariate F tests indicated significant differences in size symmetry (F (2,71)=11.09, $p<.01$. Follow-up Tukey post hoc tests showed expert bodybuilders scored significantly higher than fitness lifters ($p<.05$).	Lean athletes reported significantly higher body dissatisfaction than non-lean athletes.
Kong & Harris (2015) ^{ab}	'Lean athletes' (elite + recreational) ^{ab} vs 'Non-lean athletes' ^{ab} [all female]	Figure rating scale	Compared with non-lean athletes, lean athletes showed greater general body dissatisfaction [F (1, 314)=4.08, $p=.044$, partial $\eta^2=.013$] and sporting body dissatisfaction [F(1,314) = 12.7, $p < .001$, partial $\eta^2 = .039$].	Lean athletes reported significantly higher body dissatisfaction than non-lean athletes (both general and sporting body dissatisfaction)
Goldfield (2009) ^{ab}	Lean (Bodybuilders ^a) vs non-lean (weight training athletes ^b) [females]	EDI-1 (BD) Drive for Bulk Scale	EDI-BD: no significant differences between bodybuilders (lean) and weight trainers (non-lean) Drive for bulk: ANOVA revealed that bodybuilders ^a reported significantly higher scores on drive for bulk than weight training controls: F(1,43) = 9.4, $p=.004$, partial eta square = .18	No significant difference on EDI. Lean (bodybuilders) reported significantly higher Drive for Bulk than weight trainers.
Reinking & Alexander (2005) ^a	'Lean athletes' (females) ^a vs 'Non-lean athletes' (females) ^a	EDI-2 (BD)	Lean sport athletes had higher body dissatisfaction scores than non-lean athletes ($p=.008$).	Lean athletes reported significantly higher body dissatisfaction than non-lean athletes.

Robinson & Ferraro (2004) ^a	Lean (swimming and running ^a) vs non-lean (golf and volleyball ^a) [females]	EDI-1 (BD)	No significant difference on body dissatisfaction between lean and non-lean athletes ($p>.05$).	No significant difference
Warren, Stanton & Blessing (1990) ^a	'Lean sport' (runners ^a ; gymnasts ^a) vs Non-lean sport ('athlete controls ^a ') [females]	EDI-1 (BD)	Non-lean athletes scored significantly higher on body dissatisfaction than runners ($p<.05$) but not gymnasts ($p>.05$).	Lean (runners) had significantly lower body dissatisfaction than non-lean athletes. No significant difference between lean (gymnasts) and non-lean athletes
Loosemore et al. (1989) ^{ab}	Lean (bodybuilders ^b) vs non-lean (hockey players ^a) [males]	EDI-1 (BD)	ANOVA between all comparison groups (included non-athletes too) revealed a significant difference between the three groups ($p<.0001$). Duncan's multiple Range test indicated body builders (non-competitive) had significantly higher body dissatisfaction than hockey players (competitive).	Lean bodybuilders had significantly higher body dissatisfaction than non-lean hockey players.

Note. Comparison groups separated by a semicolon indicate different comparison groups used in analyses. M: Males; F: Females.

EDI(1;2;3)= Eating Disorder Inventory (version used), MDI= Muscle Dysmorphia Inventory

^a indicates competitive sport, ^b indicates non-competitive sport

Table 7*Summarised results of the studies comparing lean athletes versus non-athletes*

Paper	Comparison groups [gender]	Body image measure	Outcome and interpretation	Interpretation
Reinking & Alexander (2005) ^a	'Lean athletes' ^a versus non-athletes [females]	EDI-2 (BD)	No significant difference between lean athletes and non-athletes ($p > .05$)	No significant difference between lean and non-athletes.
Robinson & Ferraro (2004) ^a	Lean athletes (swimming ^a and running ^a) versus non-athletes [females]	EDI-1 (BD)	Nonathletes scored significantly higher on body dissatisfaction compared with lean athletes ($p < .05$)	Non-athletes reported significantly higher body dissatisfaction than lean athletes.
Warren, Stanton & Blessing (1990) ^a	'Lean sport' (runners ^a ; gymnasts ^a) versus non-athletes [females]	EDI-1 (BD)	Using BMI as a covariate, nonathlete controls had higher body dissatisfaction than runners ($p < .05$) but were not significantly different to gymnasts ($p > .05$)	Non-athletes reported significantly higher body dissatisfaction than runners but not gymnasts
Loosemore et al. (1989) ^{ab}	Lean (bodybuilders ^b) versus non-athletes [males]	EDI-1 (BD)	Bodybuilders had significantly higher body dissatisfaction scores than nonathletes (ANOVA: $p < .0001$, Duncan's multiple range test).	Lean bodybuilders reported significantly higher body dissatisfaction than nonathletes
Filaire et al. (2007) ^a	Lean athletes (cyclists ^a ; Judoists ^a) versus non-athletes [males]	Body Esteem Scale (weight concern) (higher scores represent higher body esteem)	ANOVA revealed significantly higher Body-esteem Weight Satisfaction for non-athletes as compared to the athletes (Judoists; cyclists) $p < .05$.	Nonathletes had significantly higher body esteem than lean athletes (both cyclists; and Judoists)

Note. Comparison groups separated by a semicolon indicate different comparison groups used in analyses. M: Males; F: Females.

EDI(1;2;3)= Eating Disorder Inventory (version used)

^a indicates competitive sport, ^b indicates non-competitive sport

Table 8*Summarised results of the studies comparing non-lean athletes versus non-athletes*

Paper	Comparison groups (Gender)	Body image measure	Outcome and interpretation	Interpretation
DiNucci et al. (1994) ^a	Non-lean (Basketball ^a , volleyball ^a and softball ^a players) versus nonathletes [F]	Body Esteem Scale (Weight Concern) = higher scores indicate more positive feelings about body weight.	Duncan's multiple range test indicated non-athletes scored significantly lower on weight concern than the means of the athletic groups ($p < .05$).	Non-athletes reported significantly lower body esteem than non-lean athletes (basketball, volleyball, softball) and thus more body image concerns.
Hoag (2012)	Non-lean athletes (volleyballers) vs non-athletes [all females]	EDI1-BD	MANOVA with BMI as covariate: Volleyball players scored significantly higher on the body dissatisfaction subscale [Mean = 10.00 (+ 2.25)] compared with non-athletes [Mean = 9.14 (+2.32)]. $F(1,322) = 10.09$, $p = .002$, $\eta p^2 = .03$.	Non-lean athletes had significantly higher body image concerns than non-athletes
Reinking & Alexander (2005) ^a	'Non-Lean athletes' ^a versus non-athletes [F]	EDI-2 (BD)	Significant difference between non-lean athletes and non-athletes ($p < .01$).	Non-lean athletes had significantly lower body dissatisfaction than nonathletes.
Robinson & Ferraro (2004) ^a	Non-lean athletes (golf ^a and volleyball ^a) versus non-athletes ^a [all females]	EDI-1 (BD)	Nonathletes scored significantly higher on body dissatisfaction compared with non-lean athletes ($p < .05$)	Non-lean athletes had significantly lower body dissatisfaction than nonathletes.
Warren, Stanton & Blessing (1990) ^a	'Non-lean sport' (athlete controls ^a) versus non-athletes [F]	EDI-1 (BD)	Using BMI as a covariate, nonathlete controls had higher body dissatisfaction than non-lean athlete controls ($p < .05$).	Controlling for BMI, non-lean athletes had significantly lower body dissatisfaction than non-athletes.
Loosemore et al. (1989) ^{ab}	Non-lean (Hockey ^b) versus non-athletes [M]	EDI-1 (BD)	ANOVA between all comparison groups (lean, non-lean, nonathletes) revealed a significant difference among the three groups ($p < .0001$). Duncan's Multiple Range indicated no significant difference between hockey players and non-athletes.	No significant difference between non-lean hockey players and nonathletes.
Arroyo et al. (2008)	Soccer players ^a versus non-athletes [M]	Somatomorphic Matrix Test	There were no body-dissatisfaction differences between the soccer players and controls for both muscularity (78.5% players and 82.2% controls were dissatisfied) and % body fat (64.3% players and 64.3% controls dissatisfied)	No significant difference between non-lean soccer players and nonathletes.

Note. Comparison groups separated by a semicolon indicate different comparison groups used in analyses. M: Males; F: Females.

EDI(1;2;3)= Eating Disorder Inventory (version used), BD= Body Dissatisfaction

^a indicates competitive sport, ^b indicates non-competitive sport

Quantitative analyses: Meta-analyses

Random effects meta-analyses were conducted initially with all papers included, and then were re-run without outliers and without papers that were of weak quality, to determine whether those papers influenced the outcome. These are presented in Table 9.

Meta-analyses based on all papers

The random effects meta-analyses for all papers is presented in Table 9a, and the associated forest plots are presented in Figure 3. There was a reliable difference between lean and non-lean athletes, with a medium effect size. However, none of the other effects were significant.

Inspection of the forest plots (Figure 3) showed that some studies tended not to match the trend for the individual analysis. Hale et al. (2013), Filaire et al. (2007), and Loosemore et al. (1989) were considered outliers as they clearly did not overlap the confidence intervals of the other studies. Filaire et al. (2007) and Loosemore et al. (1989) were also low quality studies. Thus, these three studies were removed from the meta-analyses as outliers and they were re-run (see Appendix E, Table E1a). Similarly, the low quality papers (Appendix D) were removed for a further set of analyses, to ensure that they did not obscure effects (see Appendix E, Table E1b). In each case, the removal of those papers substantially improved the identified differences and effect sizes. Therefore, they were removed from the dataset for the final analyses. On removal of the low quality studies, Hoag (2012) was identified as a further outlier among the remaining medium to high quality papers. Hoag (2012) was thus removed from the dataset for the final analyses.

Meta-analyses based on final set of papers

Table 9b presents the results of the final five random effects meta-analyses,

with the outliers and weak quality papers removed. The meta-analyses showed a broad pattern of athletes reporting less body-image concerns than non-athletes, with medium effect sizes. For competitive athletes versus non-athletes, the meta-analysis showed a significant difference ($g = -.52$, $P < .0001$), indicating that the athletes had fewer body image concerns than the non-athletes. There was moderate heterogeneity ($I^2 = 52.47\%$). Non-lean athletes reported fewer body concerns than non-athletes ($g = -0.69$, $P < .0001$). There was low heterogeneity ($I^2 = 0\%$), supported by the non-significant Q value. However, there were no remaining papers to allow a comparison of lean athletes with non-athletes. These results support the conclusions of the narrative synthesis.

In contrast, there were no differences between classes of athletes (competitive athletes versus non-competitive athletes; lean athletes versus non-lean athletes). There was no evidence of significant heterogeneity in these non-significant meta-analyses.

Tests of publication bias were mixed. In only one of the significant comparisons (competitive athletes versus non-athletes), Egger's statistic was significant, and the trim and fill method applied to the funnel plot indicated publication bias (Appendix F).

Table 9

Results of the five random effects meta-analyses, based on: a) all papers; and b) with low-quality papers and outliers removed

a) Preliminary analyses, based on all papers

Comparison	K	N	Weighted mean effect size g [95% CI]^a	Q	I²	Eggers
Competitive athletes vs. non-athletes	16	3117	-0.30 [-0.67 – 0.07], $p = .1170$	111.374, $p < .0001$	95.65%	$P = .896$
Competitive athletes vs. Non-competitive athletes	6	682	-0.06 [-0.87 – 0.75], $p = .8827$	39.986, $p < .0001$	95.13%	$P = .830$
Lean athletes vs non-lean athletes	7	657	0.57 [0.20 – 1.13], $p = .0437$	34.196, $p < .0001$	88.74%	$P = .272$
Lean athletes vs non-athletes	5	329	0.49 [-0.68 – 1.67], $p = .4090$	71.095, $p < .0001$	95.37%	$P = .001$
Non-lean athletes vs non-athletes	7	783	-0.43 [-0.78 - -0.07], $p = .0178$	46.308, $p < .0001$	79.31%	$P = .057$

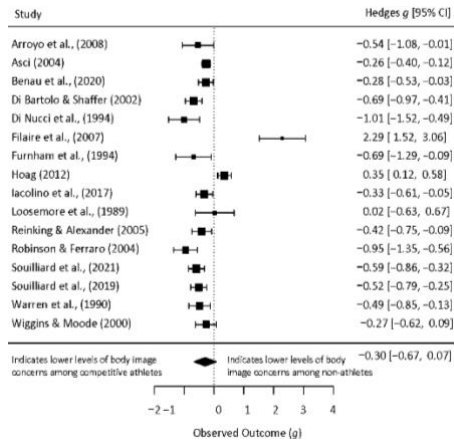
b) Final random effects meta-analyses, with low-quality papers and outliers removed

Comparison	K	N	Weighted mean effect size g [95% CI]^a	Q	I²	Eggers
Competitive athletes vs. non-athletes	11	2441	-0.44 [-0.52 - -0.36], $p < .0001$	24.862, $p = .0056$	59.78%	$P = .007$
Competitive athletes vs. Non-competitive athletes	4	601	-0.15 [-0.32 – 0.03], $p = .0983$	0.055, $p = .9970$	0%	$P = .185$
Lean athletes vs non-lean athletes	4	492	0.14 [-0.04 – 0.32], $p = .1191$	2.286, $p = .5150$	0%	$P = .030$
Lean athletes vs non-athletes	-	-	-	-	-	-
Non-lean athletes vs non-athletes	4	291	-0.69 [-0.93 - -0.44], $p < .0001$	3.164, $p = .3670$	0%	$P = .334$

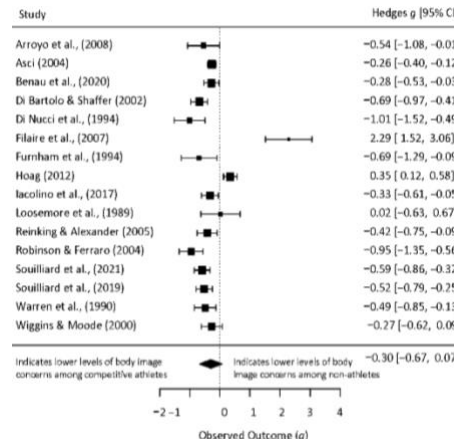
Figure 3

Random effects meta-analyses for all papers: Forest plots comparing body image effect sizes (95% CI) across groups of athletes and non-athletes

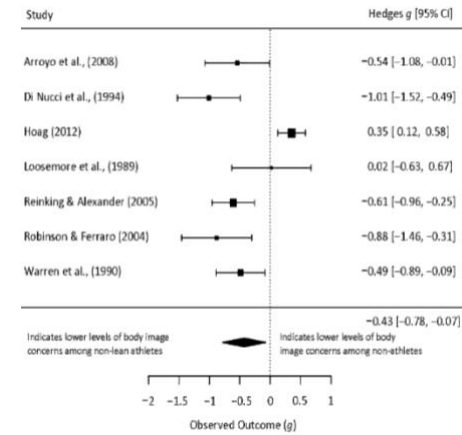
a) Competitive athletes vs non-athletes



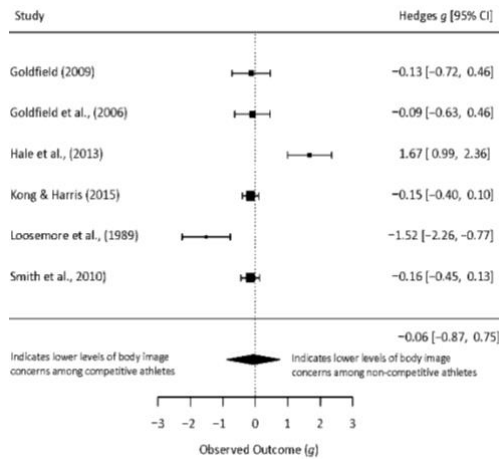
b) Lean athletes vs non-athletes



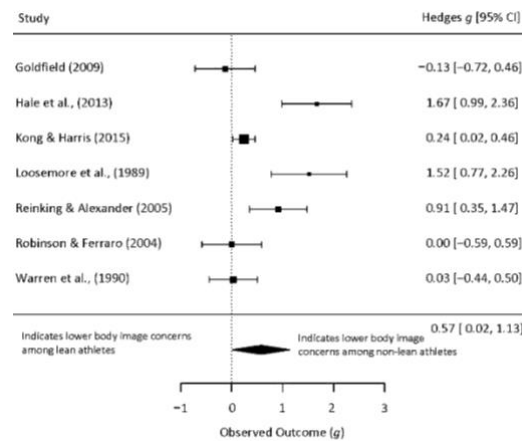
c) Non-lean athletes vs non-athletes



d) Competitive athletes vs non-competitive athletes



e) Lean athletes vs non-lean athletes



Discussion

The current review synthesised findings from 21 studies to determine whether athletes had lower body image concerns than non-athletes across all genders. It considered whether specific sub-groups of athletes reported higher body image concerns by considering sport type. The potential role of competition level and gender were also considered. Most studies were rated moderate in quality. Low-quality papers and four outliers (two of which were also low quality papers) were excluded from the meta-analysis, to ensure that the conclusions were robust.

Overall, the meta-analysis confirmed and extended the conclusions of the narrative review, so the meta-analysis outcomes will be the focus of the summary of the findings here. The most robust finding was that athletes have lower levels of body image concerns than non-athletes. Athletes had fewer body image concerns than non-athletes, though there were not the high- or medium-quality studies needed to reach that conclusion for lean athletes in the meta-analysis. In contrast, there were no robust differences between groups of athletes in the meta-analysis, though lean athletes had greater body image concerns than non-lean athletes in the narrative review.

Links to existing research

Only 19% of studies considered male athletes, which is comparable to the 19.2% in Hausenblas and Symons Downs' (2001) systematic review on body image across all ages and genders. Thus, a female bias still appears to operate in research exploring body image in athletes. The finding that athletes had fewer body image concerns overall than non-athletes mirrors previous review findings (Chapa et al., 2022; Hausenblas & Symons Downs, 2001; Hausenblas & Fallon, 2006; Karrer et al., 2020; Varnes et al., 2013), though the narrative review indicates that this effect is

possibly more due to the experience of non-lean athletes.

In contrast to some individual studies (Chapa et al., 2022; Stoyel et al., 2019; Swami et al., 2009; Varnes et al., 2013), lean athletes did not display reliably higher body image concerns than non-lean athletes (particularly in the meta-analysis). Therefore, it is possible that participation in a range of sports types promotes positive body image, increasing psychological wellbeing (Landers & Arent, 2001), but that extraneous factors (e.g., the impact of level of dress) might explain some of the individual lean/non-lean differences found, as some lean sport athletes (e.g. volleyball players; swimmers) commonly dress in more revealing ways (Kampouri et al., 2019). Factors such as background of sport training, individual/non-individual competition, and intensity of training (Budzisz & Sas-Nowosielski, 2021; Hausenblas & Fallon, 2006) might also explain the apparent impact in some individual studies on lean athletes. However, that difference did not apply across studies in the more robust quantitative review, suggesting that it might be more common factors that influence body image across sports, such as pressures from others (coaches, parents, friends, judges) and training regimes (Petrie & Greenleaf, 2012; Reel et al., 2013).

Limitations

The results of this review should be considered in light of its limitations. Only one author quality assessed the papers, which may have increased the chances of bias. Many studies had issues such as poor definitions of comparator groups (regarding both competition level and sport type). 'Non-athletes' were particularly poorly defined, meaning that they could have included individuals who participated in some sports, thus confounding study findings and making it hard to generalize findings both locally and in practice. Studies over-represented one country (the USA), university/college students, some sports (endurance, aesthetic and ball sports) and

female participants, limiting their generalizability further. A further complication is that there might be relevant differences between the function and experience of different sports. For example, body building might merit separate consideration in future, as the goal for competition can be focused on physique perfection itself. Some of the meta-analyses were conducted on a small number of studies, which is problematic when assessing heterogeneity, since this can increase the bias of I^2 and reduce the power of the Q statistic (von Hippel, 2015). Finally, given the nature of the literature and how it is focused and reported, some positive body image terms may have been missed. Future research should focus more fully on positive body image, using a wider set of constructs and reporting them clearly (including keywords and highlights).

Future research

Future research should recruit all genders and gender identities. Researchers should provide clear details about participants' sport type, competitive level and ethnicity, since these were lacking across the studies in the current review. To ensure replicability, it will also be important to provide details about the specific sport types categorised as 'lean' and 'non-lean', a wider range of sports (e.g., weight-dependent; technical), and factors such as training background and frequency (Budzisz & Sas-Nowosielski, 2021). All competition levels should be considered across groups as such data are highly limited at present. Researchers should recruit across sport types (lean athletes, non-lean athletes and non-athletes) so that any differences and similarities in body image are better understood. Critically, it is important to note that the research in this field is overwhelmingly cross-sectional in nature. Longitudinal designs are needed to enhance the interpretability of the findings, to allow the positive or negative impact of sport participation to be considered from a causal and developmental perspective.

The measures used also need careful consideration, as they are not always relevant to the sporting population. For example, the EDI neglects the upper body, which may be of more concern to males, making the measure less appropriate for male populations (Hausenblas & Symons Downs, 2001). Furthermore, the EDI does not account for the different body images experienced by athletes (social; sporting) (De Bruin et al., 2011). Other researchers also created their own measures without providing validity statistics, and such details should be a requirement in future studies. It will also be important to address positive and negative aspects of body image in the same datasets (Tylka & Wood-Barcalow, 2015a), as well as considering multiple aspects of body image (e.g., an athletic and social body image - Russell, 2004). Muscularity should be measured as a body image construct in future research on athletes. To enable comparisons across gender and gender identities, body image measures that target by gender and gender identity could be created and validated across sport types (e.g., specific questions could be scored or weighted differently depending on gender or gender identity). Finally, to mitigate against confounds such as puberty, the review focused only on those aged 17 years and above. Future research might explore body image in athletes younger than 17 years, considering age as a potential moderator of findings.

Clinical implications

These findings indicate that participation to healthy levels in sports might promote positive body image. Therefore, encouraging participation in sports might promote wider wellbeing, since poor body image has been linked to eating disorders (Coco et al., 2014; Menzel et al., 2010; Waller & Mountford, 2015). Thus, in prevention terms, participation in an exercise programme can improve body image (Hausenblas & Fallon, 2006).

However, excessive and compulsive exercise can be harmful. Therefore, the potential negative impact of sports on body image should also be considered, with athletes being encouraged to reflect on their own body image and seek support as necessary (Koulanova et al., 2021). Sports coaches should also be advised to be attentive to athletes on an individualised basis in order to ensure that support is offered if an athlete has poor body image (Koulanova et al., 2021). Specific risk factors to consider and address might include: reducing frequent weight/composition measures; avoiding comments on body image; and reducing pressures to wear uniforms or revealing costumes. Programmes could be implemented to reduce body image concerns in athletes at risk of EDs (Becker et al., 2012). Ensuring athletes have positive body image is important since negative body image is a predictor of a variety of health problems, including depression, eating disorders and obesity (Stice, 2002).

Conclusion

The current review and meta-analysis have shown better body image among athletes in general rather than among non-athletes, with little difference between types of sporting activity. However, existing research in the field has a range of limitations, which require attention in future research. The review has potential clinical implications in terms of the potential benefits and negative impact of exercise at different levels.

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Appendices

Appendix A

OSF Protocol

Systematic review

* **Review title:** Body image concerns across different sports and sporting levels: a systematic review

* **Anticipated or actual start date:** 28/06/2022

* **Named contact:** Rachel Burgon

* **Named contact email.** rburgon1@sheffield.ac.uk

* **Organisational affiliation of the review.**

The University of Sheffield

* **Review team members and their organisational affiliations.**

Miss Rachel Burgon (University of Sheffield)

Professor Glenn Waller (University of Sheffield)

* **Funding sources/sponsors.** Not applicable.

* **Conflicts of interest.** None.

* **Review question.**

Does body image differ in adults between sporting populations and non-sporting populations?

Does body image differ across different sport types?

Does body image differ across different genders?

Does body image differ across different sporting levels (e.g. competitive athletes versus non-competitive athletes)?

* **Searches.**

The review will be based on PRISMA guidelines.

Scoping searches were conducted using Scopus and Google Scholar on 28/06/22.

A full search will be conducted after registering the study on Open Science Framework and is planned for 01/08/22. The search will be conducted across Scopus, PsycINFO and PubMed.

* **Condition or domain being studied.**

Body image and other related constructs (body dissatisfaction, body shame, body appreciation, body satisfaction)

* **Participants/population.**

Athletes and non-athletes (defined below).

* **Intervention(s), exposure(s).**

No intervention to be used as this is a review of prevalence of symptoms (rather than treatment impact).

* **Comparator(s)/control.**

To explore body image across sporting levels, studies must include participants from two of the following three comparator groups: competitive athletes, non-competitive athletes, non-athletes. 'Competitive' and 'non-competitive' athletes are defined by the Oxford Dictionary of Sports Science and Medicine's definition of athlete: "an individual who by virtue of special training or natural talent, is fit to compete in a physically demanding sport" (Kent, 2006). A distinction will then be made between competitive and non-competitive athletes; aligning with previous reviews (Chapman & Woodman, 2016; Varnes et al., 2013). This review defines 'competitive athletes' as individuals in the top sporting competition level (e.g. Olympians, NCAA Division I). They are described by words: 'competitive', 'professional' and/or 'elite'. Non-competitive athletes are described by words: 'non-competitive', 'recreational', and/or words relating to their sport (e.g. 'runners', 'cyclists'). 'Non-athletes' are described as 'non-athletes', 'controls' and/or 'sedentary'. Participants whose sports are considered outside the aforementioned definition of athlete will also be considered as 'non-athletes'. Any uncertainties will be discussed between the two researchers (RB and GW).

* **Types of study to be included.**

Inclusion criteria:

- Samples must be 17+ years of age
- Studies must be written in the English language
- Samples must include athletes (as defined above)
- The study includes a sample of two or more of the following comparison groups: competitive athletes and/or non-competitive athletes and/or non-athletes
- Must include a quantifiable body image measure
- Quantitative study design
- Sufficient information to compute effect size to be included in quantitative review
- Published in a peer-reviewed journal

Exclusion criteria:

- Participants below 17 years
- Studies written in a language other than English
- Samples that do not include athletes (as defined above)
- Qualitative studies, book chapters, dissertations or theses, single case experimental designs, case studies, commentaries and protocols
- Studies without a focus on body image

* **Main outcome(s).**

Body image is an individual's subjective evaluation of their own physical appearance (Thompson et al., 1999). Body image can be measured using a number of validated tools.

This systematic review will compare quantifiable measure(s) of body image between athletes and non-athletes. It hopes to add to the evidence base for the prevalence of body image in athletes versus non-athletes to inform future interventions. This is important since body concerns can impact general wellbeing, including greater psychological distress (Coco et al., 2014) and symptoms of depression (Puccio et al., 2016). Body image concerns are also associated with disordered eating behaviour and are a critical element of eating disorders (Peat et al., 2008; Menzel et al., 2010; Waller & Mountford, 2015).

* **Data extraction (selection and coding).**

One researcher (RB) will conduct the study selection process. This will include conducting the search; data selection, coding and synthesis. This will be guided through discussion with the second researcher (GW). RB will discuss any uncertainty about a study's inclusion with GW.

Search terms will be used in a two-component strategy (body image terms; sporting terms) and will be based on previous systematic reviews in this field.

Database searches will be restricted to published articles and excluded the grey literature.

Backward searching will be conducted on identified studies by searching reference lists. Previous reviews of body image in the context of sports will also be searched to identify any other relevant studies. If full texts are unavailable, attempts will be made to contact the authors for access to texts.

Papers will be imported into Mendeley reference management software.

Duplicates will be removed. Studies will then hierarchically be screened against the inclusion/exclusion criteria, according to title, abstract and then full text. Papers will be included if they meet all inclusion criteria.

The information extracted will include author(s), publication year, study location, study aims, study design, sample and methodology. Primary outcome measures of body image and the measure used will be obtained. Additional outcome variables and effect size will also be extracted. Key discussion points and limitations will be recorded.

*** Risk of bias (quality) assessment.**

We will use the CASP checklist to assess methodological quality and risk of bias (CASP, 2018).

The appropriate checklist that aligns with the individual study's methodology will be selected (e.g. longitudinal; cohort study designs). Approximately 20% of papers will be second rated by a researcher outside the team.

*** Strategy for data synthesis.**

Data will be collated in Microsoft Excel.

Tables summarising each study will be included and will include key information from data extraction (e.g. researchers' names, participants, body image measure used).

There will be separate tables for studies using competitive athletes, non-competitive athletes and non-athletes. Authors will be listed across different tables since the inclusion criteria requires that they recruit more than one comparator groups.

*** Analysis of subgroups or subsets.**

Planned subgroup analyses will be conducted on potential moderators of the relationship between body image in athletes versus non-athletes.

Subgroups of sporting competition level will be analysed (competitive athletes, non-competitive athletes and non-athletes).

Subgroups of sporting types will be analysed where detail is given (e.g. aerobic, runners, cyclists).

Subgroups of genders will be analysed separately (e.g. males, females, non-binary etc.)

*** Country.**

United Kingdom

Keywords.

Systematic review, body image, body dissatisfaction, athlete, sports psychology, sport

Appendix B

CASP Checklist- Cohort Studies



CASP Checklist: 12 questions to help you make sense of a **Cohort Study**

How to use this appraisal tool: Three broad issues need to be considered when appraising a cohort study:

- ▶ Are the results of the study valid? (Section A)
- ▶ What are the results? (Section B)
- ▶ Will the results help locally? (Section C)

The 12 questions on the following pages are designed to help you think about these issues systematically. The first two questions are screening questions and can be answered quickly. If the answer to both is “yes”, it is worth proceeding with the remaining questions. There is some degree of overlap between the questions, you are asked to record a “yes”, “no” or “can’t tell” to most of the questions. A number of italicised prompts are given after each question. These are designed to remind you why the question is important. Record your reasons for your answers in the spaces provided.

About: These checklists were designed to be used as educational pedagogic tools, as part of a workshop setting, therefore we do not suggest a scoring system. The core CASP checklists (randomised controlled trial & systematic review) were based on JAMA ‘Users’ guides to the medical literature 1994 (adapted from Guyatt GH, Sackett DL, and Cook DJ), and piloted with health care practitioners.

For each new checklist, a group of experts were assembled to develop and pilot the checklist and the workshop format with which it would be used. Over the years overall adjustments have been made to the format, but a recent survey of checklist users reiterated that the basic format continues to be useful and appropriate.

Referencing: we recommend using the Harvard style citation, i.e.: *Critical Appraisal Skills Programme (2018). CASP (insert name of checklist i.e. Cohort Study) Checklist. [online] Available at: URL Accessed: Date Accessed.*

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Paper for appraisal and reference:.....

Section A: Are the results of the study valid?

1. Did the study address a clearly focused issue?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

HINT: A question can be 'focused' in terms of

- the population studied
- the risk factors studied
- is it clear whether the study tried to detect a beneficial or harmful effect
- the outcomes considered

Comments:

2. Was the cohort recruited in an acceptable way?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

HINT: Look for selection bias which might compromise the generalisability of the findings:

- was the cohort representative of a defined population
- was there something special about the cohort
- was everybody included who should have been

Comments:

Is it worth continuing?

3. Was the exposure accurately measured to minimise bias?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

HINT: Look for measurement or classification bias:

- did they use subjective or objective measurements
- do the measurements truly reflect what you want them to (have they been validated)
- were all the subjects classified into exposure groups using the same procedure

Comments:

4. Was the outcome accurately measured to minimise bias?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

HINT: Look for measurement or classification bias:

- did they use subjective or objective measurements
- do the measurements truly reflect what you want them to (have they been validated)
 - has a reliable system been established for detecting all the cases (for measuring disease occurrence)
 - were the measurement methods similar in the different groups
 - were the subjects and/or the outcome assessor blinded to exposure (does this matter)

Comments:

5. (a) Have the authors identified all important confounding factors?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

HINT:
• list the ones you think might be important, and ones the author missed

Comments:

5. (b) Have they taken account of the confounding factors in the design and/or analysis?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

HINT:
• look for restriction in design, and techniques e.g. modelling, stratified-, regression-, or sensitivity analysis to correct, control or adjust for confounding factors

Comments:

6. (a) Was the follow up of subjects complete enough?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

HINT: Consider

- the good or bad effects should have had long enough to reveal themselves
- the persons that are lost to follow-up may have different outcomes than those available for assessment
- in an open or dynamic cohort, was there anything special about the outcome of the people leaving, or the exposure of the people entering the cohort

6. (b) Was the follow up of subjects long enough?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

Comments:

Section B: What are the results?

7. What are the results of this study?

HINT: Consider

- what are the bottom line results
- have they reported the rate or the proportion between the exposed/unexposed, the ratio/rate difference
- how strong is the association between exposure and outcome (RR)
- what is the absolute risk reduction (ARR)

Comments:

8. How precise are the results?

HINT:

- look for the range of the confidence intervals, if given

Comments:

9. Do you believe the results?

Yes	<input type="checkbox"/>
Car't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider
- big effect is hard to ignore
 - can it be due to bias, chance or confounding
 - are the design and methods of this study sufficiently flawed to make the results unreliable
 - Bradford Hills criteria (e.g. time sequence, dose-response gradient, biological plausibility, consistency)

Comments:

Section C: Will the results help locally?

10. Can the results be applied to the local population?

Yes	<input type="checkbox"/>
Car't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider whether
- a cohort study was the appropriate method to answer this question
 - the subjects covered in this study could be sufficiently different from your population to cause concern
 - your local setting is likely to differ much from that of the study
 - you can quantify the local benefits and harms

Comments:

11. Do the results of this study fit with other available evidence?

Yes	<input type="checkbox"/>
Car't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

Comments:

12. What are the implications of this study for practice?

Yes	<input type="checkbox"/>
Can't Tell	<input type="checkbox"/>
No	<input type="checkbox"/>

- HINT: Consider
- one observational study rarely provides sufficiently robust evidence to recommend changes to clinical practice or within health policy decision making
 - for certain questions, observational studies provide the only evidence
 - recommendations from observational studies are always stronger when supported by other evidence

Comments:

Appendix C

Study Characteristics, separated by comparison groups (competitive, non-athletes, non-competitive)

Author(s) (Date)	Location	Sample [Males; Females] Mean age (\pm SD) ^c	Sample comparison classification: competitive, non-competitive, non-athlete (recruitment strategy); [Males; Females]	Body Image measure(s) used	Construct measured
<i>Competitive athletes versus non-athletes (n=16)</i>					
Arroyo, González-de-Suso, Sanchez, Ansotegui, & Rocandio, (2008)	Spain	56 undergraduate males	Competitive: 28 male soccer players (University academy)= competitive Non-athletes: 28 male undergraduates (university students participating in a study to assess their nutritional status).	Somatomorphic Matrix Test ^{§++} (Pope et al., 2000)- figure rating - Body Fat: Perceived actual body image; perceived ideal body image - Fat Free Mass index (FFMI) (Muscularity): Perceived actual body image; perceived ideal body image Body dissatisfaction: Difference between actual and ideal body image (Body Fat; FFMI)	Body dissatisfaction (Body Fat; Muscularity)
Aşçi (2004)	Turkey	798 Elite athletes and undergraduate non-athletic controls [482M; 316F], mean age ^c national level: 19.1 (\pm 3.3) years (male), 18.5 (\pm 3.6) years (female)	Competitive: 329 Elite athletes (recruited through national teams); [207M; 122F] Non-athletes: 469 'non-athletic' university students (enrolled on courses in a Sport department) [275M; 194F]	The Physical Self-Perception profile ⁺ (Fox & Corbin, 1989): indicate how much of that kind of person they are on five subscales including body attractiveness.	Body attractiveness subscale (perceived attractiveness of body)

Author(s) (Date)	Location	Sample [Males; Females] Mean age (\pm SD) ^c	Sample comparison classification: competitive, non-competitive, non-athlete (recruitment strategy); [Males; Females]	Body Image measure(s) used	Construct measured
Benau, Wiatrowski & Timko (2020)	United States	279 university students sorted into sports or non-sports categories based on answers to a questionnaire [177F; 102M]	(Recruited from University course, course not specified) Competitive athletes*:183 engaging in at least one sport [87M;96F] Separated by competition level: 42 recreational athletes 74 club level 63 collegiate level 2 semi-pro/pro 2 Competition level not specified Non-athletes: 96 engaging in no sports [15M; 81F]	Eating Disorder Inventory-3 (Body dissatisfaction subscale) (Garner, 2004)	Body dissatisfaction
Di Bartolo & Shaffer (2002)	United States	209 female undergraduate students	Competitive: 94 female college athletes (Division III university teams) Non-athletes: 115 female 'non-athletes' (from psychology classes)	Eating Disorder Inventory-1 (body dissatisfaction subscale only) (Garner, Olmstead & Polivy, 1983) ^a Body Image Survey [†] (Fallon & Rozin, 1985): difference between actual and ideal body image (figure rating)	Body dissatisfaction

Author(s) (Date)	Location	Sample [Males; Females] Mean age (\pm SD) ^c	Sample comparison classification: competitive, non-competitive, non-athlete (recruitment strategy); [Males; Females]	Body Image measure(s) used	Construct measured
Dinucci, Finkenberg, McCune, McCune & Mayo (1994)	United States	65 female university students	Competitive: 31 Female athletes (Division I, top ranked or conference champion): - 9 basketball players - 10 volleyball players - 12 softball players Non-athletes: 34 female non-athlete university 'controls' (recruitment not specified)	Body Esteem Scale (weight concern subscale) ⁺ (Franzoi & Shields, 1984) Higher scores indicate higher body esteem	Body self-esteem: Weight concern
Filaire, Rouveix, Pannafieux & Ferrand (2007)	France	44 males Judoist mean age ^c : 19.5 (\pm 0.5) Cyclist mean age ^c : 21.2 (\pm 2.8) Nonathlete mean age ^c : 21.8 (\pm 1.8)	Competitive: 27 competitive athletes (recruited through national training teams): - 12 Judo national level - 15 Cyclist national level Non-athletes: 17 'controls' (maths students doing an average 2 hours exercise per week and not training for a particular sport)	Body Esteem Scale- Weight concern subscale (Canadian-French version) ⁺ - Mendelson et al., 2001 Higher scores indicate higher body esteem	Body self-esteem: Weight concern subscale
Furnham, Titman & Sleeman (1994)	England	60 females (40 undergraduates), mean age ^c 22.96 (\pm 4.93) years	(Recruited from a gym, student union, further education courses) Competitive (First university team) 45 athletes - 15 netball players - 15 rowers - 15 bodybuilders Non-athlete: 15 'non-exercisers'	Body Shape Selection ^{bt} (figure rating) (constructed by researchers based on the Repertory Grid Technique (Kelley, 1955) and their own prior research (Furnham, 1981; Furnham & Alibhai, 1983)-attractiveness subscale	Body dissatisfaction-attractiveness subscale

Author(s) (Date)	Location	Sample [Males; Females] Mean age (\pm SD) ^c	Sample comparison classification: competitive, non-competitive, non-athlete (recruitment strategy); [Males; Females]	Body Image measure(s) used	Construct measured
Hoag (2012)	United States	326 females Volleyballers mean age: 19.76 (\pm 1.08) Non-athletes mean age: 19.44 (\pm 1.16)	Competitive: 209 volleyballers (competitive, across divisions I, II, III) Non-athletes: 117 'non-athletes'	Eating Disorder Inventory-1 (body dissatisfaction subscale) (Garner, Olmstead & Polivy, 1983) ^a	Body dissatisfaction
Iacolino, Pellerone, Formica, Concetta Lombardo & Tolini (2017)	Italy	200 students stratified according to whether they engaged in sport or not (35.3%M; 62.7%F) [70M, 125F]	- Competitive: 100 'sporting subjects' (recruited from Sicilian sport centres and enrolled in the Faculty of Motor Science at Kore University) participated in at least one non-agnostic competition over the past 12 months. - Non-athletes: 100 (psychology students at Kore University) 'non-sporting subjects'	Body uneasiness test (Cuzzolaro et al., 2006) includes 5 factors: Weight phobia, body image concerns, avoidance, compulsive self-monitoring; depersonalisation). GSI higher than 1.2= significant discomfort with body.	Body dissatisfaction (Body image concerns subscale of Body Uneasiness Test)
Reinking & Alexander (2005)	United States	146 female undergraduates	Competitive: 84 collegiate athletes (Recruited from university teams- Division I) Non-athletes: 62 undergraduate non-athletes (not athletes in collegiate sports), (recruited from resident halls) Separated as: 16 Lean sports 68 non-lean sports	Eating Disorder Inventory-2 (Body dissatisfaction) (Garner, 1991) ^a	Body dissatisfaction

Author(s) (Date)	Location	Sample [Males; Females] Mean age (\pm SD) ^c	Sample comparison classification: competitive, non-competitive, non-athlete (recruitment strategy); [Males; Females]	Body Image measure(s) used	Construct measured
Robinson & Ferraro (2004)	United States	108 female university students, 18 years and above	Competitive: 53 female varsity athletes: 6 golf; 10 volleyball 15 swimming; 22 track (recruited from university sports teams) Separated according to sport type: 16 technique (golf + volleyball) (non-lean) 37 speed (swimming and track) (lean) Non-athletes: 55 female nonathletes (recruited from psychology undergraduate course)	Eating Disorder Inventory-1 (body dissatisfaction subscale) (Garner, Olmstead & Polivy, 1983) ^a	Body dissatisfaction
Soulliard, Fitterman-Harris, Perry, Poe & Ross (2021)	United States	286 undergraduates, aged 18-30 years [Cisgender: 219F; 67M]	(University students- specific recruitment strategy not stated): Competitive: 75 student athletes (Division I) 6 men baseball 13 women softball 5 men soccer 19 women soccer 10 men swimming 22 women swimming Nonathletes: 211 'non-athletes'	State-based Body appreciation scale-2 (SBAS-2) ⁺ (Homan, 2016); adapted from Body appreciation scale (BAS-2) (Tylka & Wood-Barcalow, 2015b)	Body appreciation in a general context

Author(s) (Date)	Location	Sample [Males; Females] Mean age (\pm SD) ^c	Sample comparison classification: competitive, non-competitive, non-athlete (recruitment strategy); [Males; Females]	Body Image measure(s) used	Construct measured
Soulliard, Kauffman, Fitterman-Harris, Perry & Ross (2019)	United States	254 undergraduate students, aged 18-38 [Cisgender: 180F, 73M; 1 Transwoman]	(Recruited via email to all students and an online research website for psychology undergraduate course students) Competitive: 79 athletic students (Division I athletes): 8 baseball; 2 Basketball; 7 cheerleading/dance; 24 track/crosscountry; 3 hockey; 10 soccer; 6 softball; 11 swimming; 5 tennis; 3 volleyball Non-athletes: 175 'non-athletes'	Body appreciation scale (BAS-2) ⁺ (Tylka & Wood-Barcalow, 2015b)	Body appreciation
Warren, Stanton & Blessing (1990)	United States	126 undergraduate female students	(Recruited through university: sports teams, university course): Competitive: 74 female athletes (Division I): - 27 'lean sport athletes (15 gymnasts, 12 cross country runners) - 47 non-lean sport athletes (basketball, golf, volleyball, swimming, tennis) Non-athletes: 52 female nonathlete college controls (for course credit)	Eating Disorder Inventory-1 (body dissatisfaction subscale) (Garner, Olmstead & Polivy, 1983)	Body dissatisfaction
Wiggins & Moode (2000)	United States	124 female university students, aged 17-35 years.	(Recruited through university- specific strategy not stated) Competitive: 67 female intercollegiate athletes (division not specified) Non-athletes: 57 female 'non-athletes'	Weight concern subscale of the Body Esteem Scale (Franzoi & Shields, 1984) ⁺	Body self-esteem: Weight concern

Author(s) (Date)	Location	Sample [Males; Females] Mean age (\pm SD) ^c	Sample comparison classification: competitive, non-competitive, non-athlete (recruitment strategy); [Males; Females]	Body Image measure(s) used	Construct measured
Competitive athletes versus non-competitive athletes (n=5)					
Goldfield (2009)	Canada	45 females: mean age ^c : 26.3 (\pm 5.3) competitive; 27.3 (\pm 5.7) recreational	(Recruited from local gyms) Competitive: 20 competitive female bodybuilders (actively training for a competition) Non-competitive: 25 'recreational weight training' female controls (never competed and no plans to compete in next 12 months)	Eating Disorder Inventory-1 (Body dissatisfaction subscale) (Garner, Olmstead & Polivy, 1983) ^a Drive for Bulk Scale ^b §, created as modification of body dissatisfaction subscale	Body dissatisfaction Drive for Bulk
Goldfield, Blouin & Woodside (2006)	Canada	74 males, recruited from local gyms, mean age ^c : 33.6 (\pm 8.9) men with bulimia; 26.7 (\pm 5.0) competitive bodybuilders; 24.9 (\pm 5.0) recreational bodybuilders	(Recruited from local gyms) 27 competitive male bodybuilders (actively training for a competition) 25 recreational male bodybuilders (never competed and no plans to compete in next 12 months) 22 men with Bulimia (Recruited from a university fitness centre)	Eating Disorder Inventory-1 (Body dissatisfaction subscale) (Garner, Olmstead & Polivy, 1983) ^a Drive for Bulk Scale ^b §, created as modification of body dissatisfaction subscale	Body dissatisfaction Drive for Bulk
Hale, Diehl, Weaver & Briggs (2013)	United States	74 females, aged 18-48 years.	Competitive*: - 26 expert female bodybuilder: \geq 10 competitions - 29 novice female bodybuilders: \leq 3 competitions (not included in analyses due to heterogeneity within the group) Non-competitive: 19 fitness lifters: 6 months minimum experience.	Muscle Dysmorphia Inventory [§] (MDI; Rhea et al. 2004) subscales: Size symmetry)	Muscularity body dissatisfaction (Muscle dysmorphia)

Author(s) (Date)	Location	Sample [Males; Females] Mean age (\pm SD) ^c	Sample comparison classification: competitive, non-competitive, non-athlete (recruitment strategy); [Males; Females]	Body Image measure(s) used	Construct measured
Kong & Harris (2015)	Australia	320 female athletes, aged 17-30 years.	(Recruited via sports clubs, dance companies and gyms, plus informative websites about eating disorders) Competitive*: - 128 Elite; 112 'recreational' (compete at local, state, national level- Division I) Non-competitive: - 80 non-competitive athletes Categorised as: 174 lean; 146 non-lean	Figure Rating Scale (FRS) [†] (own current figure, ideal figure, figure most athletically capable for sport) (Stunkyard, Sorensen & Schulsinger, 1983)	General body dissatisfaction: FRS (Current)- FRS (ideal) Sporting body dissatisfaction: FRS (Current) – FRS (Sport)
Smith, Wright & Winrow (2010)	England	184 distance runners (94M; 90F), mean age ^c : 28.05 (\pm 6.83) years old.	(Recruited from running teams/personal association with researcher): Competitive (competed within last year or planning to compete):47 competitive male runners; 44 competitive female runners Non-competitive: 47 non-competitive male runners; 46 non-competitive female runners	Social Physique Anxiety Scale (SPAS) (Hart, Leary & Rejeski, 1989)	Appearance anxiety

Competitive athletes versus non-competitive athletes versus non-athletes (n=1)

Author(s) (Date)	Location	Sample [Males; Females] Mean age (\pm SD) ^c	Sample comparison classification: competitive, non-competitive, non-athlete (recruitment strategy); [Males; Females]	Body Image measure(s) used	Construct measured
Loosemore, Mable, Galgan, Balance & Moriarty (1989)	Canada	54 male undergraduates	Competitive: 18 male undergraduate hockey players (recruited from the university varsity league, unspecified division) Non-competitive: 18 male bodybuilders (recruited from university fitness centre and regularly worked out) Non-athletes: 18 male 'classroom subjects' ('comparison group' recruited from psychology undergraduate course)	Eating Disorders Inventory-1 (body dissatisfaction subscale) (Garner, Olmstead & Polivy, 1983)	

Note. M: Males, F: Females. GSI: Global Severity Index score. ED: Eating Disorder. NCAA: National Collegiate Athletic Association.

*: includes a sample with more than one competitive athlete group.

^a Did not use the most up-to-date EDI.

^b researchers created their own body image measure.

^c mean age (SD) has been provided for studies that failed to report age ranges and/or were undergraduates.

⁺study measured positive body image

^{\$}study measured muscular body dissatisfaction

[†]study used figure ratings

Appendix D

Quality assessment of included studies using the Critical Appraisal Skills (CASP) Cohort checklist

Researchers (Date)	Q1	Q2	Q3	Q4	Q5a	Q5b	Q6a	Q6b	Q7	Q8	Q9	Q10	Q11	Q12	Y count	N/CT count	Rating
Arroyo et al. (2008)	Y	Y	Y	C	N	Y	Y	N	Y	C	C	C	Y	Y	8	6	Moderate
Aşçi (2004)	Y	Y	Y	Y	Y	Y	Y	N	Y	C	C	Y	Y	C	10	4	Moderate
Benau, Wiatrowski & Timko (2020)	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	13	1	High
Di Bartolo & Shaffer (2002)	Y	Y	C	N	Y	Y	Y	N	Y	C	Y	Y	Y	Y	10	4	Moderate
Dinucci et al. (1994)	Y	Y	Y	Y	N	N	Y	N	Y	C	C	C	Y	C	7	5	Moderate
Filaire et al. (2007)	Y	Y	C	C	Y	N	Y	N	C	C	C	C	Y	C	5	9	Low
Furnham, Titman & Sleeman (1994)	Y	Y	Y	C	Y	Y	C	N	Y	C	C	Y	Y	C	8	6	Moderate
Goldfield (2009)	Y	Y	Y	N	Y	Y	Y	N	Y	C	Y	Y	Y	C	10	4	Moderate
Goldfield, Blouin & Woodside (2006)	Y	Y	Y	N	Y	Y	Y	N	Y	C	Y	Y	Y	C	10	4	Moderate
Hale et al. (2013)	Y	Y	C	Y	Y	Y	C	N	Y	C	Y	C	Y	Y	9	5	Moderate
Hoag (2012)	Y	Y	C	N	Y	Y	Y	N	Y	C	Y	N	Y	Y	9	5	Moderate
Iacolino et al. (2017)	Y	Y	C	Y	Y	Y	Y	N	Y	C	Y	C	Y	C	9	5	Moderate
Kong & Harris (2015)	Y	Y	Y	Y	Y	Y	Y	N	Y	C	Y	Y	Y	Y	12	2	High
Loosemore et al. (1989)	Y	Y	C	Y	N	N	Y	N	Y	C	C	C	C	C	5	9	Low
Reinking & Alexander (2005)	Y	Y	C	N	N	N	Y	N	C	C	C	C	Y	C	4	10	Low
Robinson & Ferraro (2004)	Y	Y	Y	N	Y	Y	Y	N	Y	C	Y	Y	Y	Y	11	3	High
Smith, Wright & Winrow (2010)	Y	Y	Y	Y	N	N	Y	N	Y	C	C	Y	Y	C	8	6	Moderate
Soulliard et al. (2021)	Y	Y	Y	Y	Y	Y	Y	N	Y	C	Y	Y	Y	Y	12	2	High
Soulliard et al. (2019)	Y	Y	Y	Y	Y	Y	Y	N	Y	C	Y	Y	Y	Y	12	2	High
Warren, Stanton & Blessing (1990)	Y	Y	C	Y	Y	Y	Y	N	Y	C	Y	C	Y	C	9	5	Moderate
Wiggins & Moode (2000)	Y	Y	C	Y	N	N	Y	N	Y	C	C	C	C	C	5	9	Low

Note. Y: Yes; N: No; C: Cannot tell. 'Yes' count: 0-5 (low quality), 6-10 (moderate), 11-14 (high quality)

Summary of quality analysis

A strength of the studies was that they all addressed a clearly focused issue (body image) and recruited participants in an acceptable way. Nine studies received a 'cannot tell' rating for whether the groups were measured to minimise bias, due to unclear definitions of groups. 'Non-athletes' were the poorest defined group, which was problematic for comparisons since there is a possibility that they included athletes ($n=8$) (Arroyo et al., 2008; Di Bartolo & Shaffer, 2002; Filaire et al., 2007; Iacolino et al., 2017; Loosemore et al., 1989; Reinking & Alexander, 2005; Warren, Stanton & Blessing, 1990; Wiggins & Moode, 2000). Another study (Hale et al., 2013) included a poorly defined group of competitive athletes (≤ 3 competitions), which clearly could include non-athletes competing in zero competitions. Since this was clearly a heterogeneous group, it was excluded from analysis and only their comparator group of expert bodybuilders (≥ 10 competitions) was compared with non-athletes.

Whilst 17 studies included reliability and/or validity data on the measure used, only 12 received a 'yes' rating on the accuracy of outcome measure used. This is because five did not use the most up-to-date version of the EDI (see Appendix C). Three studies received a 'can't tell' since they did not provide reliability or validity data on the measure used (Arroyo et al., 2008; Filaire et al., 2007; Furnham, Titman & Sleeman, 1994).

The majority of studies controlled for confounding variables and took this into account in their analysis ($N = 14$). However, a weakness of all studies was that they were not longitudinal. A strength of all studies was the reporting of interpretable results. However, except for one study (Benau, Wiatrowski & Timko, 2020), the remaining studies received a 'cannot tell' rating for the precision of results, due to not reporting confidence intervals. Nine studies received a 'cannot tell' rating for whether results were 'believable' due to poorly reporting statistics (e.g., reporting lots of statistics but not pictorially presenting them) and/or majorly unequal group comparisons (Dinucci et al., 1994; Furnham, Titman & Sleeman,

1994; Reinking & Alexander, 2005). Nine studies received a 'cannot tell' regarding whether they could be applied to the local population due to unclear comparator groups ($N = 7$), and/or unequal comparator groups ($N = 3$). The majority supported their findings with previous research ($N = 18$) with the exception of two studies (Loosemore et al., 1989; Wiggins & Moode, 2000). The majority of studies ($N = 12$) received 'cannot tell' ratings for whether results were implicated in practice. This was due to flaws including small sample sizes, unequal sample size comparisons, and minimal consideration of confounding variables.

Appendix E

Table E1

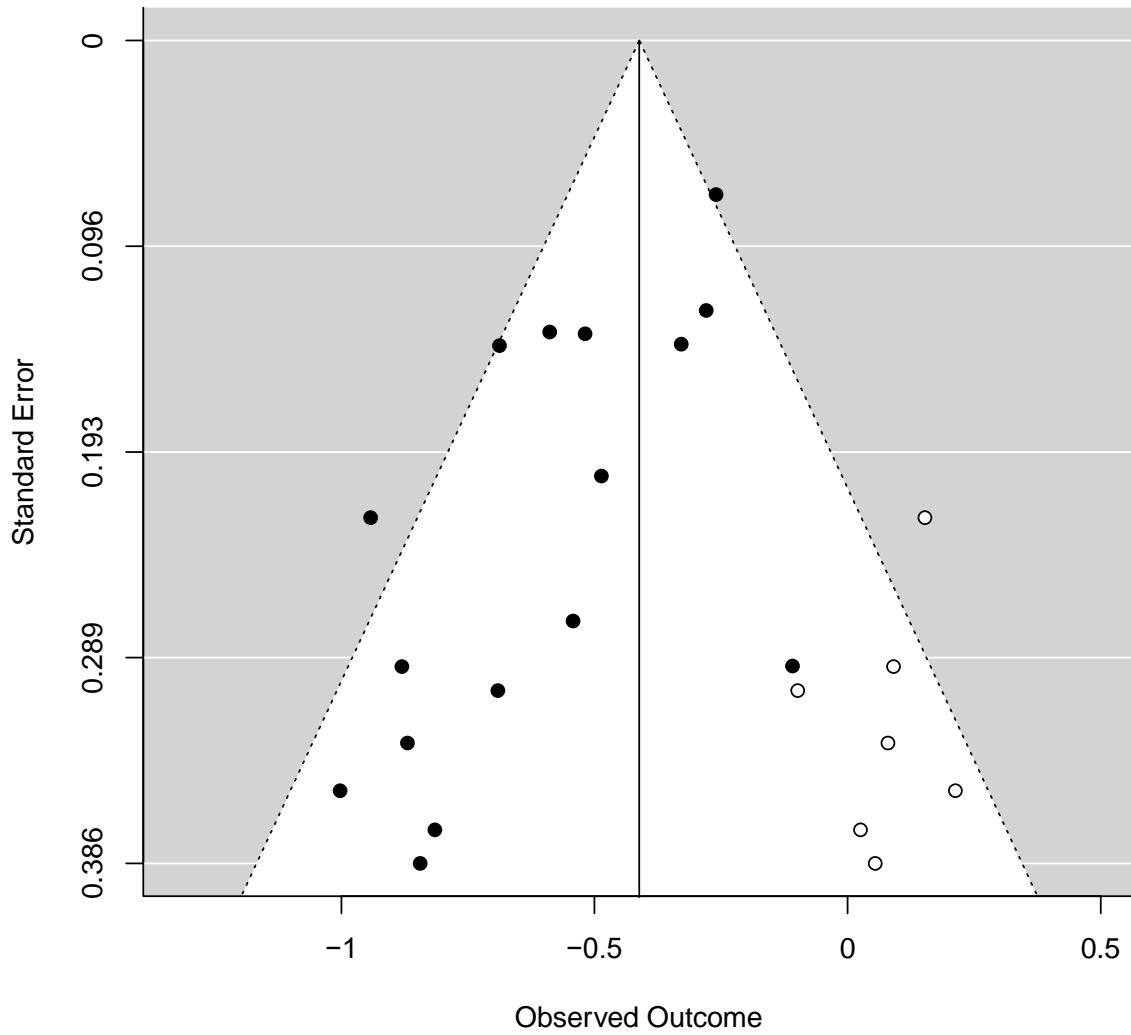
Impact of removal from random effect meta-analyses of: a) outliers; and b) low quality papers

a) Outliers only removed						
Comparison	K	N	Weighted mean effect size g [95% CI]^a	Q	I²	Eggers
Competitive athletes vs. non-athletes	15	3073	-0.42 [-0.59 - -0.25], <i>p</i> < .0001	67.246, <i>p</i> < .0001	77.96%	<i>P</i> = .135
Competitive athletes vs. Non-competitive athletes	4	601	-0.15 [-0.32 – 0.03], <i>p</i> = .0983	0.055, <i>p</i> = .9970	0%	<i>P</i> = .185
Lean athletes vs non-lean athletes	-	-	-	-	-	-
Lean athletes vs non-athletes	-	-	-	-	-	-
Non-lean athletes vs non-athletes	-	-	-	-	-	-
b) Low quality studies only removed						
Comparison	K	N	Weighted mean effect size g [95% CI]^a	Q	I²	Eggers
Competitive athletes vs. non-athletes	12	2767	-0.35 [-0.43 - -0.27], <i>p</i> < .0001	65.689, <i>p</i> < .0001	83.25%	<i>P</i> = .079
Competitive athletes vs. Non-competitive athletes	5	646	0.20 [-0.51 – 0.90], <i>p</i> < .0001	25.444, <i>p</i> < .0001	93.22%	<i>P</i> = .252
Lean athletes vs non-lean athletes	5	537	0.24 [0.07 – 0.42], <i>p</i> = .0064	20.143, <i>p</i> = .0005	80.14%	<i>P</i> = .745
Lean athletes vs non-athletes	2	171	-0.72 [-1.04 - -0.40], <i>p</i> < .0001	2.200, <i>p</i> = .1380	54.54%	N/A
Non-lean athletes vs non-athletes	5	617	-0.47 [-0.93 - -0.01], <i>p</i> = .0466	40.067, <i>p</i> < .0001	83.45%	<i>P</i> = .008

Appendix F

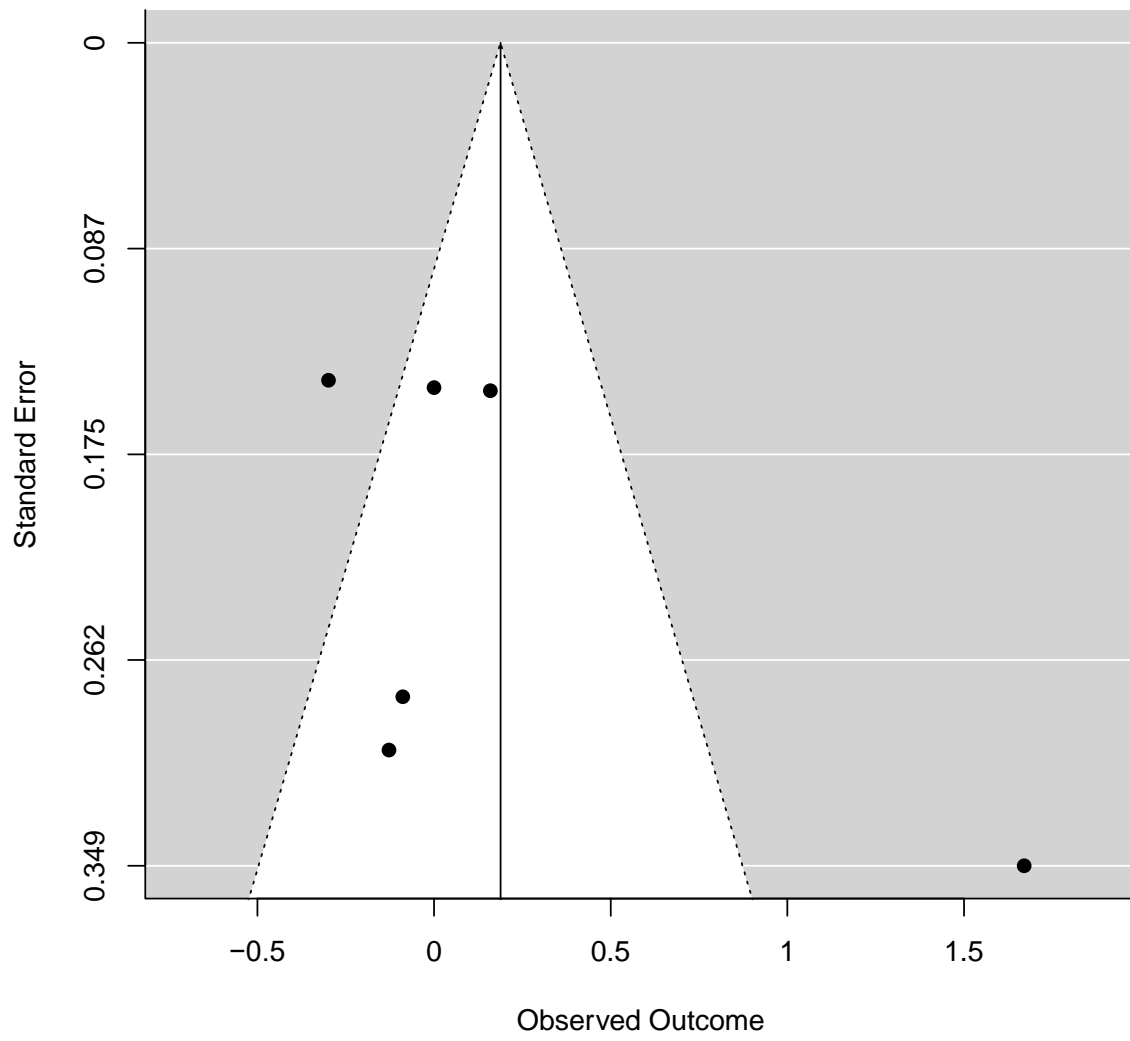
Funnel Plots

Competitive athletes versus non-athletes

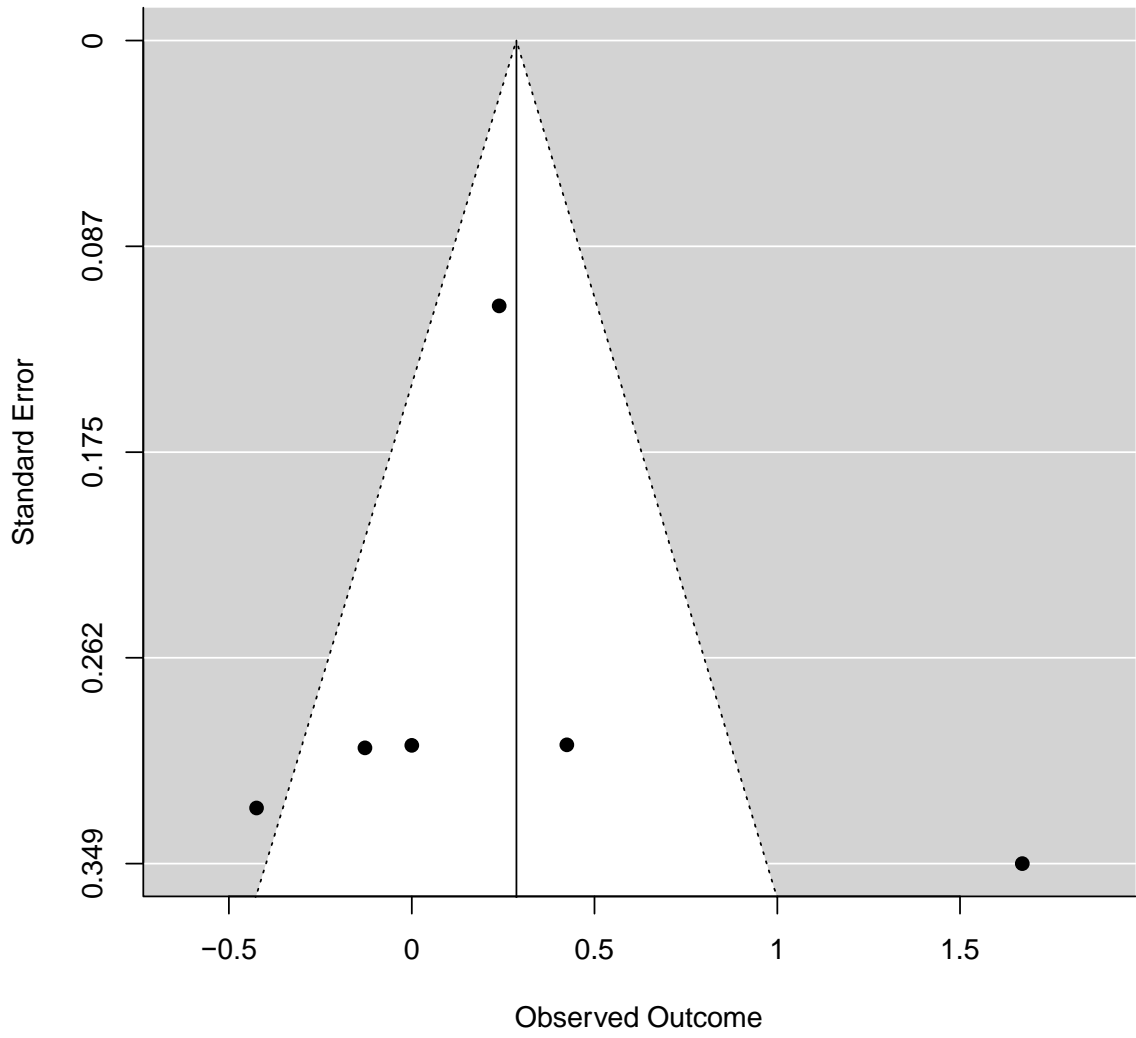


Note. Trim and fill has been applied, represented by the clear white circles.

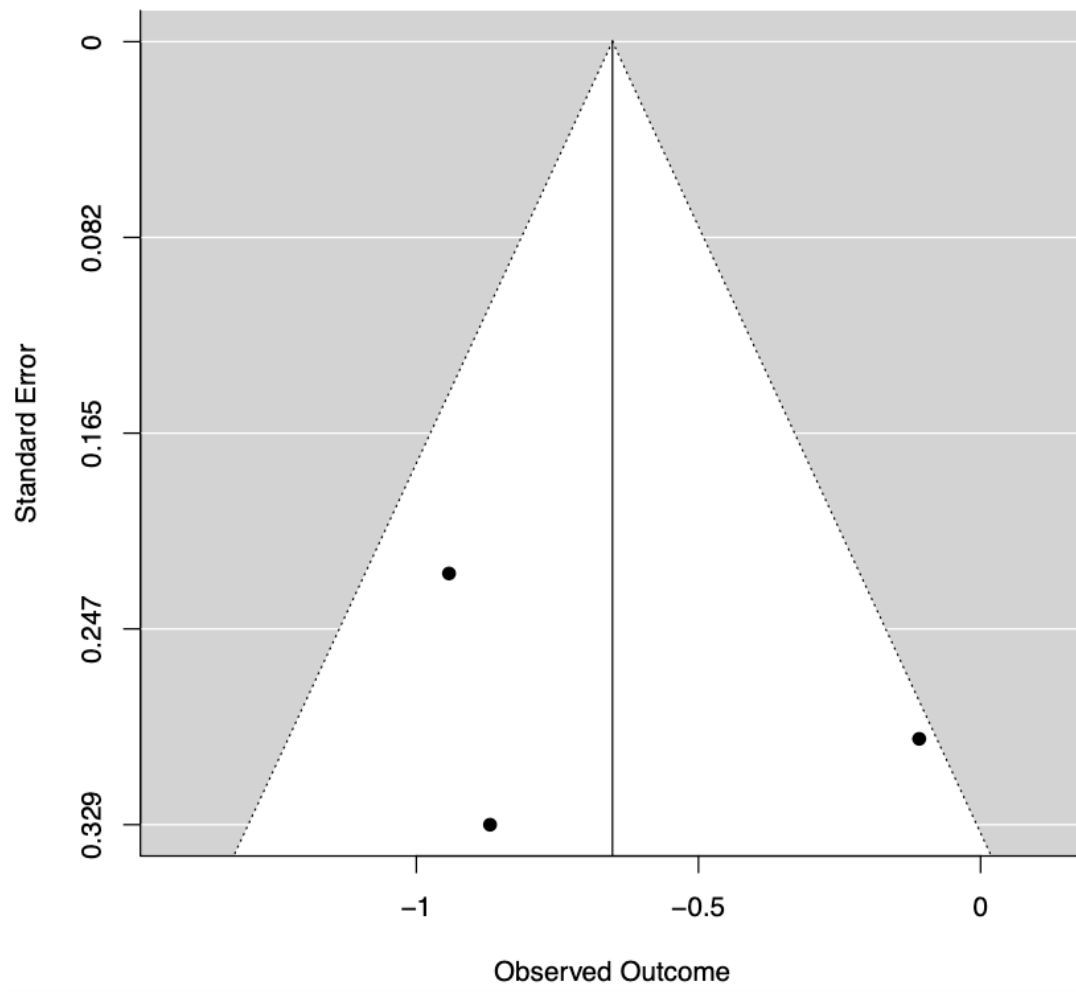
Competitive athletes versus non-competitive athletes



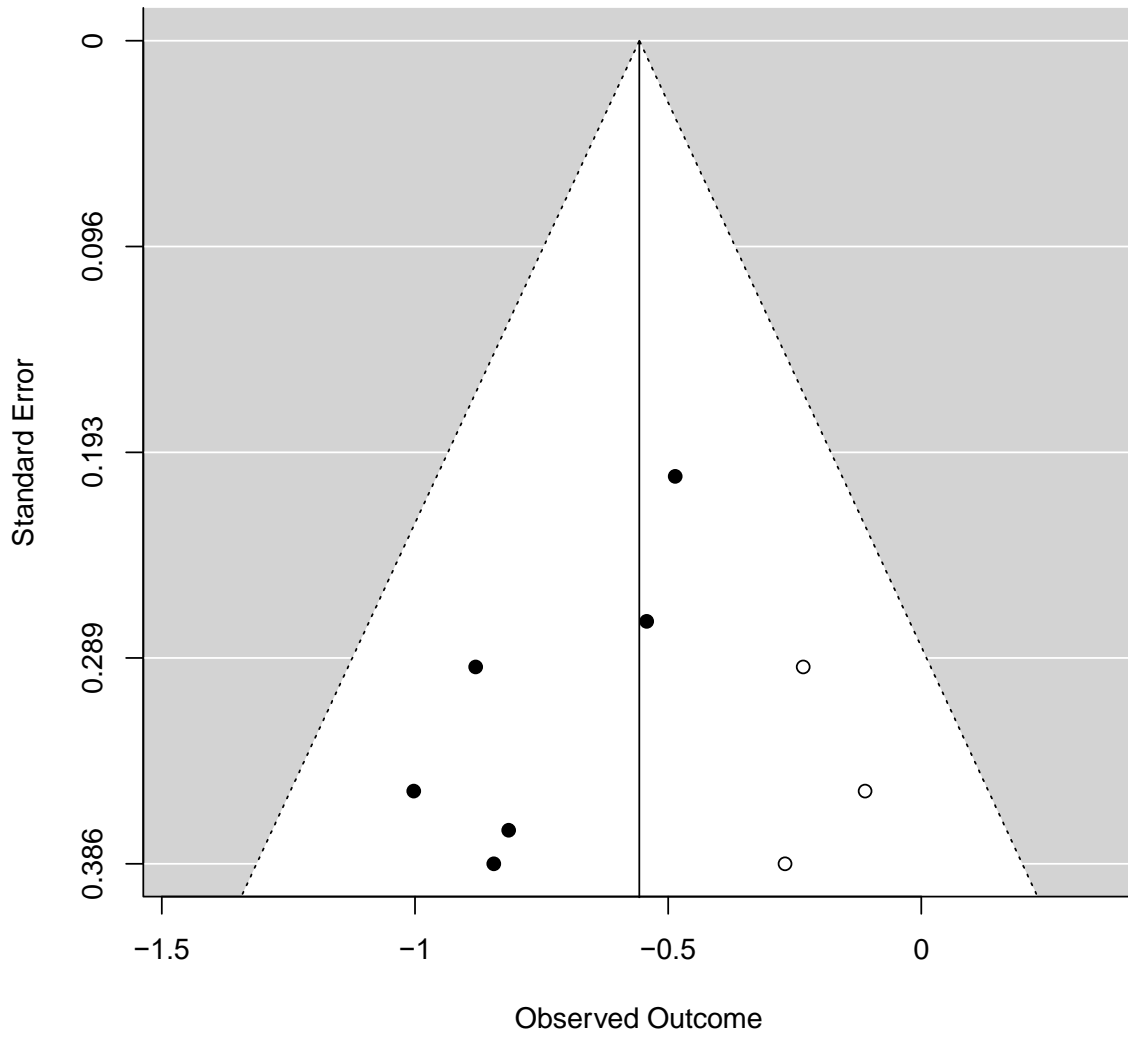
Lean athletes versus non-lean athletes



Lean athletes versus non-athletes



Non-lean athletes versus non-athletes



Note. Trim and fill has been applied, represented by the clear white circles.

Part II: Research Report

Psychological links between body image concerns and eating pathology among athletes and non-athletes: A longitudinal mediational study

Abstract

Objective: Body image in sports is complex. Individuals can have multiple body images (social and sporting), and competition level may impact findings. This research aimed to determine whether sporting and social body image concerns predicted eating disorder (ED) psychopathology, and whether the link differed according to sport engagement (competitive sports engagers, non-competitive sports engagers, and sports non-engagers). The potential mediating role of self-esteem and social anxiety were also explored.

Design: This longitudinal mediational study collected data at three time-points over six months.

Methods: A community sample (510 adults, aged 18-71 and majority female) completed online measures of sports demographics, ED psychopathology, body image (social; sporting), self-esteem and social anxiety at time 1. Answers from the sports demographic questionnaire were used to sort participants into sport engagement group. The self-esteem and social anxiety measures were completed again at three months. Eating disorder psychopathology and body image measures were collected a further three months later.

Results: Competitive sports engagers had better body image and lower social anxiety than the other two groups. Social body image and appearance-related sporting body image separately predicted ED psychopathology. The mediational analyses were not significant.

Conclusions: Engaging in sports competitively may be beneficial for improving body image and social anxiety. However, positive appearance-related sporting body image may pose a risk factor for ED psychopathology six months later for individuals.

Recommendations are made for engaging in sporting competition in ways that enhance wellbeing.

Key words: body image; eating disorder; self-esteem; social anxiety; athletes; sport

Practitioner points

- Healthy individuals might be encouraged to engage in sports competitively to improve body image (both in social and sporting contexts) and reduce social anxiety.
- However, positive appearance-related sporting body image might be a risk factor for eating disorders. Encouraging individuals to focus on their body's functionality might mitigate against this risk.
- Sports engagers should be made aware of relevant support services and prevention programmes, such as the Body Project.
- Referral pathways between psychological support services and sports clubs/gyms should be created, and coaches trained to help identify eating disorder-related concerns.

Psychological links between body image concerns and eating pathology among athletes and non-athletes: A longitudinal mediational study

Introduction

Regular participation in physical activity is important for physical and psychological health. As such, the National Health Service (NHS) recommends a minimum of 2.5 hours of such activity per week (NHS, 2019; 2021). 'Physical activity' is defined as any bodily movement produced by skeletal muscles that results in expending energy, and examples range from unstructured recreation to exercise and sport (Caspersen et al., 1985). Physical activity has been associated with decreased risk of depression and mental disorders in healthy adults and in those with chronic diseases (Bernard et al., 2015; Mammen & Faulkner, 2013; Pedersen & Saltin, 2015). Researchers have found a dose-response relationship between physical activity and reductions in mental illness, with even low doses of physical activity having such benefits (Bernard et al., 2018; Teychenne et al., 2020).

Whilst the terms 'physical activity' and 'exercise' are often used interchangeably, 'exercise' is a distinct term to describe structured, repetitive bodily movement, aimed at improving or maintaining physical fitness (Caspersen et al., 1985; Dasso, 2019). Exercise improves physiological, immunological and psychological function, including reducing anxiety, depression and stress (Jayakody et al., 2014; Mikkelsen et al., 2017).

Sports participation and mental wellbeing

'Sports' can be defined as a particular type of exercise, whereby participants adhere to a set of rules and a clear goal exists (Khan et al., 2012). Sports vary widely, with differences in intensity of training/competition level and sports type (e.g., lean/non-lean; team sports/individual sports). Athletes are a specific subset of sports

engagers, defined as individuals who, due to “special training or natural talent”, are fit to “compete in a physically demanding sport” (Kent, 2006). Distinction between athletes and exercisers is usually based on their intent of exercise, volume of exercise and higher competition levels. For example, Mckinney et al. (2019) define exercisers as engaging in >2.5 hours activity per week, aimed at maintaining health and fitness, while athletes invest more time into training and the intent of exercise is purposeful, directed towards a competition goal (Mckinney et al., 2019).

Studies have found improved psychological and social health in those participating in sports, above and beyond other forms of physical activity (e.g. improved self-esteem, social interaction and reducing depressive symptoms) (Eime et al., 2013). Conversely, disengaging from sports (e.g., due to retirement, injury) can represent a significant risk to an individual’s mental health (Jewett et al., 2019). For example, the Covid-19 lockdown forced sports clubs and competitions to close, which increased the risk of social isolation and mental health difficulties for some individuals (Reardon et al., 2020).

There is a common assumption that athletes are protected from mental health difficulties (Jewett et al., 2019). However, prevalence rates of forms of mental difficulties (e.g., eating disorders, mood and personality disorders, substance abuse) are similar in the general population and elite athletes (Gulliver et al., 2015; Rearden et al., 2019). Regarding athletes, additional factors in competitive sports (versus non-competitive sports) may limit the potential advantages for mental health (e.g., coach pressures, intense training, injury risks, performance failure) (Beckner & Record, 2016; Hammond et al., 2013; Reardon et al., 2019). Conversely, for those competing at lower competition levels or recreational levels, many positive outcomes have been identified (e.g. improved self-esteem and reduced stress) (Eime et al., 2013; Jewett et al., 2014).

Body image concerns in sports

In sport and exercise psychology research, body image has received increasing attention (Sabiston et al., 2019). The term 'body image' encompasses a variety of constructs, ranging from 'negative body image' (e.g., body dissatisfaction) to 'neutral body image' to 'positive body image' (e.g., body appreciation). Whilst negative body image involves negatively evaluating one's own body, positive body image refers to one having protective attitudes, and neutral body image identifies that there is limited emphasis on body image (Perry et al., 2019; Stice & Shaw, 2002; Tylka & Wood-Barcalow, 2015). The experience of body image is largely explained by appearance-related pressures from society (e.g., from parents, peers, media) for certain body ideals (Frederick & Reynolds, 2021). Such body ideals vary, such as an ideal for thinness, muscularity, and/or a specific body shape (Culbert et al., 2015).

Overall, engaging in sports can protect individuals from body image concerns (Burgon et al., 2023). However, the concept of body image in sporting populations is complex, and numerous factors can increase the risk of body image concerns in such individuals (e.g., pressures from coaches, performance-related pressures, sports uniforms, regular anthropometric measurements) (Burgon et al., 2023). Gender differences may also exist, such as women aiming for leanness and men desiring muscularity (Cordes et al., 2016). Those engaging in lean sports (i.e., where a thin physique is believed to maximise performance) may also report more body image concerns than those engaging in non-lean sports (sports not reliant on thin physique for success, such as rugby), due to increased pressure toward low body weight (Burgon et al., 2023).

Higher competition levels may explain differences in body image across sports populations, but the relationship is complex (Beckner & Record, 2016). Some reviews

have found less body dissatisfaction in competitive athletes versus non-athletes (Burgon et al., 2023; Karrer et al., 2020). However, others have highlighted higher sporting competition levels as a risk factor for body image concerns (DiBartolo & Shaffer, 2002; Hoag, 2012; Kato et al., 2011; Robinson & Ferraro, 2004). Other factors such as sport type and coach pressures may explain differences in findings, whilst contributing factors may include the demands for physical perfection, weight standard requirements and performance in competitive athletes (Beckner & Record, 2016; Petrie & Greenleaf, 2007). Athletes are also constantly pressured to fit their sport's stereotypical athletic body, and if they fail to meet such standards, then it can result in body dissatisfaction (Sundgot-Borgen & Torsveit, 2010). Moreover, athletes report specific weight-related pressures from coaches and parents (e.g., to lose weight), which can intensify to psychological violence or neglect by coaches and parents (Boudreault et al., 2022).

The complexity of body image in sports is further demonstrated by the notion that sports engagers have multiple body images (de Bruin et al., 2011). Specifically, social body image refers to body evaluation in the context of daily life, whilst sporting body image refers to an individual's evaluation of body image in a sporting environment (de Bruin et al., 2011). For example, Russell (2004) found that women rugby players positively interpreted their body shape during their sport, as a tool for successful performance (sporting body image). However, they felt their athletic bodies failed to meet westernised ideals outside of that context (social body image). For some sports (e.g., rugby), the perfect body for sports performance may not match society's standards of beauty, which may lead to greater body dissatisfaction (Russell, 2004). On the other hand, aesthetic (e.g., gymnasts) and endurance athletes (e.g., runners) may have fewer body image concerns in daily life compared with other sports, since

their sporting bodies fit the leaner cultural ideal (Torstveit et al., 2008). Aesthetic athletes are often lean since their sports emphasise physical beauty and their appearance is judged (e.g., gymnasts, figure skating) (McFee, 2013). Endurance athletes (e.g., runners, swimmers) are those who expend sustained effort over a long period of time who may work towards leanness, believing their lower body weight will maximise performance (Bassett et al., 2000; Mancine et al., 2020).

Body image-Eating Disorder psychopathology link in sports

Numerous studies have shown that body image concerns in those participating in sports are a potential risk factor for an eating disorder (ED) (Petrie & Greenleaf, 2007; 2012). Athletes who do not fit the ideal body type for their sport may feel pressured to use exaggerated methods to achieve such a body image (e.g., restricting their nutritional intake), which can result in disturbed eating attitudes/behaviours and development of an ED (Sundgot-Borgen & Torsveit, 2010). Whilst higher competition level is a risk factor for body dissatisfaction, it also places athletes at greater risk of eating disorders compared with non-competitive sporting populations (Petrie & Greenleaf, 2007; 2012). However, there are mixed findings on the body image-ED psychopathology relationship. Fairburn et al. (2003) suggest that negative body image drives ED psychopathology. However, research is mixed, with some researchers finding that body dissatisfaction does not predict disordered eating and others finding disordered eating predicts body dissatisfaction (Krentz & Warschburger, 2013; Neves et al., 2017).

Psychological modelling of the link between body image and ED psychopathology in sports

Since body image is related to ED psychopathology in sporting populations in complex ways, there is a need to understand the psychological mediators that may

explain this link. Such understanding of mediators helps to target psychological interventions. Various factors have been found to mediate the body image-ED psychopathology relationship, including body image flexibility, negative emotions, self-esteem and depression (Brechan & Kvalem, 2015; Heywood & McCabe, 2006; Sandoz et al., 2013). However, there is limited research specific to sporting populations, with most focus on two psychological factors (self-esteem; social anxiety) that may play a role in the body image-ED psychopathology link.

Self-esteem in sporting populations

Self-esteem can be defined as one's sense of self-worth, reflecting positive or negative attitudes towards oneself (Rosenberg, 1965). Self-esteem may be particularly relevant in sports due to individuals deriving their self-esteem from sports performance, which can lead to fluctuations in self-esteem (Johnson, 1994). Numerous studies have shown the positive benefits of sport participation for increasing positive self-esteem (Kipp, 2017; Laborde et al., 2016). Factors such as competition level may impact self-esteem. However, findings are mixed, with some studies reporting that competition in sports increases self-esteem and others finding higher self-esteem in non-competitive females vs competitive females (Bowker et al., 2003; D'Anna et al., 2015).

Social anxiety in sporting populations

Social anxiety may also be an important psychological factor in sporting populations since individuals competitively engaging in sports may experience increased social anxiety, as they can be required to perform under stressful pressures (Correia & Rosado, 2018; Mesagno et al., 2012; Üstün & Yapıcı, 2019). The term 'social anxiety' encapsulates many different constructs, two of which may be particularly relevant when researching body image in sport:

A *fear of negative evaluation* refers to a fear that the social self will be negatively judged by others (Moscovitch, 2009). Fear of negative evaluations is particularly relevant to sporting populations, since it can emerge in situations where performance is being judged by others (as is often the case in sports) (Dogan, 2018). Individuals engaging in sports where performance and/or appearance is judged by others (e.g., coaches, judges, peers) may be vulnerable to both fear of negative evaluations and social appearance anxiety (Dogan, 2018; Mesagno et al., 2012; Sagar et al., 2007).

Social appearance anxiety differs to fear of negative evaluation, as it focuses on one's fears specific to one's appearance rather than more general fears (Hart et al., 2008). Thus, social appearance anxiety merits consideration in its own right (Levinson & Rodebaugh, 2011). Researchers have found that sports engagement reduces social appearance anxiety (Duyan et al., 2022). However, the extent of this reduction may depend on an individual's aims for sport engagement. For example, individuals going to the gym to 'lose weight' had higher social appearance anxiety than those going to 'keep fit' (Alemdag et al., 2016).

To summarise, sports participation may impact self-esteem and social anxiety (specifically fear of negative evaluations; social appearance anxiety). However, the findings are mixed and complex, depending on differences in measurements used and differing sports-related factors (e.g., competition level; aim of sport engagement; sport type). To develop an explanatory model, the body image-ED psychopathology link will be explored as a mediator model (via self-esteem and social anxiety). Self-esteem and social anxiety links to ED psychopathology will also be explored.

Do body image concerns predict self-esteem, fear of negative evaluations and social appearance anxiety?

There is evidence that body dissatisfaction predicts self-esteem for both general and sporting populations (Cruz-Sáez et al., 2020; Dooley et al., 2015; Wichstrøm & Von Soest, 2016). Other researchers have found evidence that body dissatisfaction is positively related to fear of negative evaluations and social appearance anxiety in the general population, but research on sporting populations is lacking (Menatti et al., 2015; Turel et al., 2018). Taken together, body dissatisfaction has been linked to self-esteem, fear of negative evaluations and social appearance anxiety, though research in sporting populations is limited.

Do self-esteem, fear of negative evaluations and social appearance anxiety predict eating disorder psychopathology?

Low self-esteem and social anxiety (both fear of negative evaluations and social appearance anxiety) have been associated with developing disordered eating/eating disorders in the general population and in athletes (Heimberg et al., 2014; Levinson et al., 2013; Menatti et al., 2014; Nordin-Bates et al., 2016). For sports engagers, individuals with low self-esteem may act in ways to try and increase self-esteem, such as restrictive dieting for the 'perfect body' image (Arthur-Cameselle & Quatromoni, 2011). Similarly, those who fear others are judging them generally (fear of negative evaluation) and specific to their body (social appearance anxiety) may engage in ED behaviours (e.g., food restriction; purging) aimed at reducing their fears of judgment from others (Menatti et al., 2015; Turel et al., 2018). Taken together, self-esteem, fear of negative evaluations and social appearance anxiety have been linked to ED psychopathology, though research in sporting populations is limited.

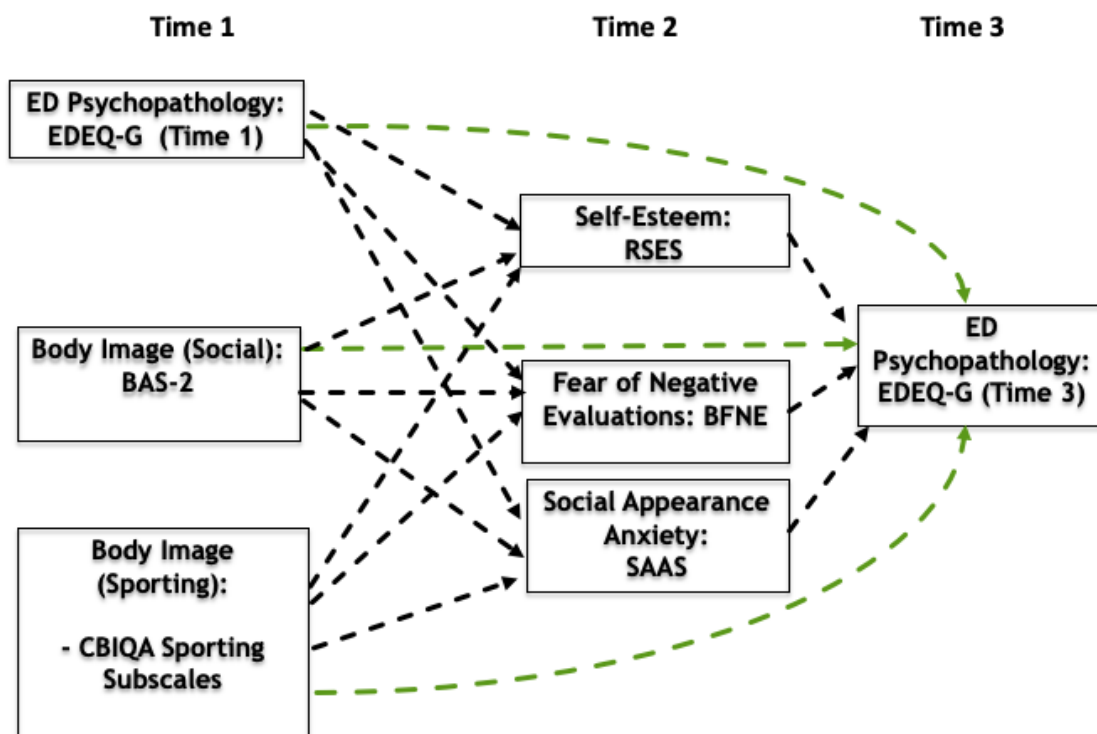
To conclude, sporting individuals may have multiple body images (social; sporting). Factors such as competition level may explain differences in findings regarding body image and eating concerns in sports populations. A longitudinal study is warranted, since there are few longitudinal studies exploring the body image to eating disorder (ED) psychopathology link, particularly in sporting populations.

Research has alluded to self-esteem, fear of negative evaluations and social appearance anxiety mediating the relationship between body image and ED psychopathology. Since findings are lacking in the sporting population, a mediational model exploring this potential association across sporting and non-sporting individuals is warranted.

The resulting mediation model is as follows:

Figure 1

Hypothesised mediation model



Note. The dotted lines represent hypothesised relationships.

Aims and Hypotheses

The primary aim is to determine whether body image concerns (social; sporting) at time 1 will predict ED psychopathology six months later for competitive sports engagers, non-competitive sports engagers, and sports non-engagers (aim 1).

The secondary aim is to test the potential mediating role of self-esteem and social anxiety (fear of negative evaluation and social appearance anxiety) at three months in that relationship (aim 2).

Hypotheses

1. There will be significant differences between competitive sports engagers, non-competitive sports engagers and sports non-engagers across the baseline measures (body image, eating disorder psychopathology, self-esteem, fear of negative evaluations, social appearance anxiety).
2. Higher body image concerns (Social; Sporting) will predict ED psychopathology six months later, over and above ED psychopathology at time 1 (aim 1).
3. The body image-ED psychopathology relationship over six months will be mediated by low self-esteem, high fear of negative evaluation by others and high social appearance anxiety, all measured at the three-month point (aim 2).

Method

Ethical issues

Ethical approval was granted by the University of Sheffield Research Ethics Committee by three independent scientific reviewers (including a statistical expert) from the Psychology department (Appendix A). The British Psychological Society's (BPS) guidance on ethics and online research was adhered to throughout (Oates et al., 2021). Participants were given the chance to win one of three £50 gift vouchers, which was thought to be a proportionate and non-coercive reward. All participants

provided informed consent after reading the information sheet (Appendices B-C). Participants were provided with the emails of the researchers should they have any concerns or queries. Participants were told they had the right to withdraw at any time-point during or after the study. At the end of the questionnaires at each time-point, information on support services relevant to the study (e.g., eating disorder charity) were provided (Appendix D).

The study was pre-registered with the Open Science Framework and can be accessed here:

https://osf.io/shpcn/?view_only=af5b6019e53b4438a7c98eee016f2991.

Four alterations in the registered protocol were made. An additional hypothesis (hypothesis 1) was added to further explore our research aims, and the target sample size was increased following a reanalysis of sample size using Cohen's (1992) table. 'Non-athletes' was added to the title of the paper to make it clear that exploration of the body image-ED link was not limited to athletes only. Finally, 'Body dissatisfaction' was replaced with 'body image concerns' to capture the different constructs of body image. 'Athletic' body image was replaced with 'sporting' to reflect the sample consisting of sports engagers, some of whom would not be considered 'athletes'.

Data security

Participants were required to provide their email address so that future questionnaires could be sent out. Email addresses were stored separately from the questionnaire data to ensure anonymity. Instead, participants were provided with a unique identifier number to help researchers collate their questionnaire. Data were collected and stored via Qualtrics. Data were password-protected and entered into statistical software, which was stored on a secure server.

Design

This mediational study used a quantitative longitudinal design over six months. Data were collected at three time-points to examine the hypothesised model. We collected measures for eating disorder psychopathology, body image (social and sporting body image), self-esteem, fear of negative evaluations and social appearance anxiety at time 1. At time 2 (three months), measures of potential mediators (self-esteem, fear of negative evaluations, social appearance anxiety) were collected. A further three months later (at six months overall), eating psychopathology and body image measures were readministered (Table 1).

Table 1

Study questionnaires administered at the different timepoints

Questionnaires administered	Time 1 (baseline)	Time 2 (3 months)	Time 3 (6 months)
Sports Demographic Questionnaire	✓		
EDEQ	✓		✓
BAS-2	✓		✓
CBIQA	✓		✓
RSES	✓	✓	
BFNE	✓	✓	
SAAS	✓	✓	

Note. Ticks show that the questionnaire was administered at that time point.

EDEQ = Eating Disorder Examination Questionnaire; CBIQA = Contextual Body Image Questionnaire for athletes; BAS-2 = Body Appreciation Scale 2; RSES = Rosenberg Self-Esteem Scale; BFNE = Brief Fear of Negative Evaluation Scale; SAAS = Social Appearance Anxiety Scale.

Participants

An a priori sample size calculation was undertaken using Cohen's (1992) table.

For the most complex analysis (hypothesis 2) (a hierarchical linear regression with six predictors, and assuming a medium effect size, 80% power, and $p = .05$), the required sample size was 97 participants per group ('competitive sports engagers', 'non-competitive sport engagers', 'sports non-engagers), resulting in a total sample of 291. The anticipated attrition rate is 35%, thus the current study aimed to recruit 150 participants per group and a total of 448 participants.

A community sample was obtained via social media and in local gyms and sports clubs. Inclusion criteria were adults aged 18+ who were fluent in English (to avoid translation issues confounding results). Exclusion criteria included people diagnosed with an eating disorder or who have been in current or recent eating disorder treatment (<12 months). Sports participation was not part of the inclusion criteria, since the study compared sports engagers and sports non-engagers.

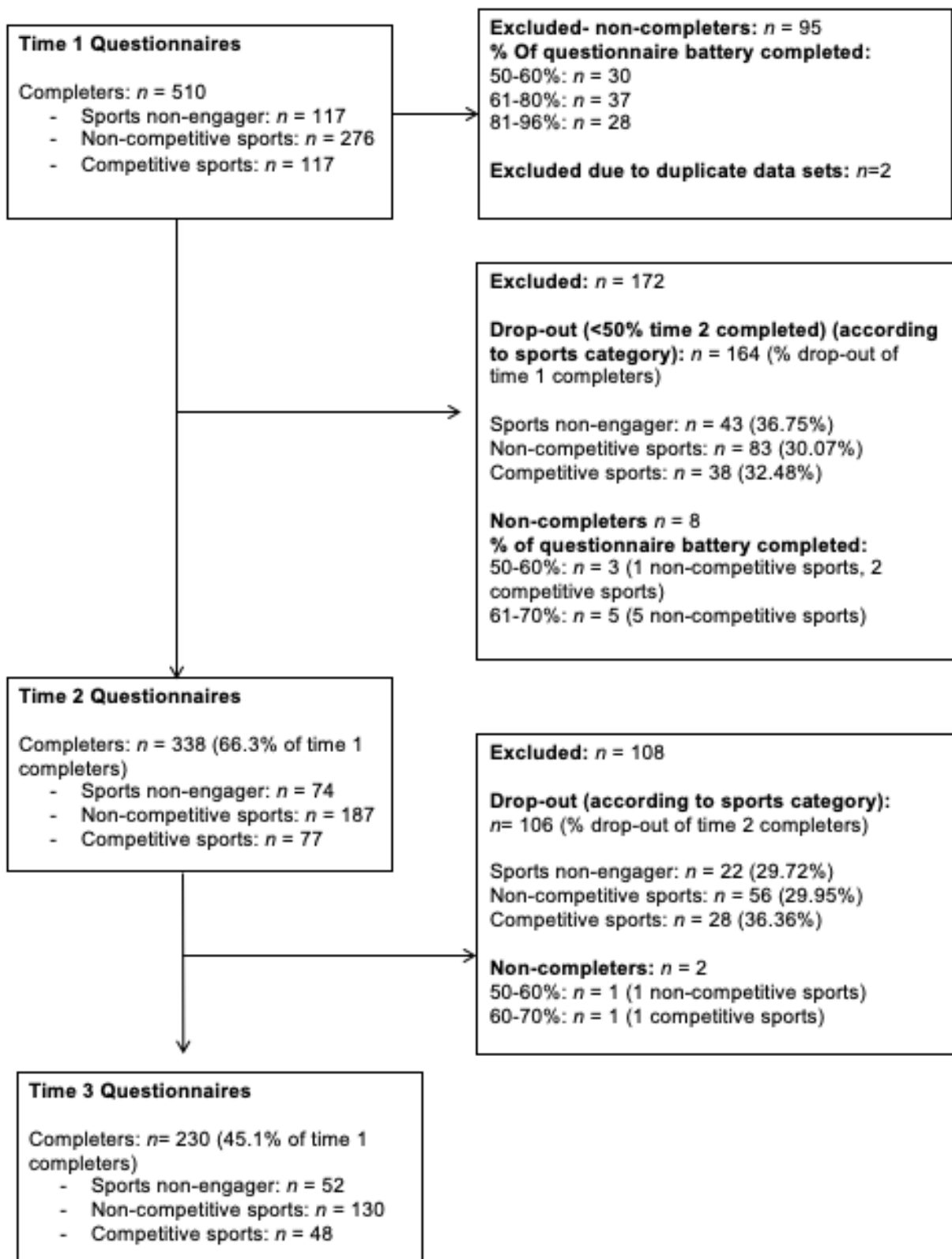
Of the 510 participants who consented and participated at baseline (time 1), 338 (66.3%) completed at time 2 (three months post-baseline) and 230 (45.1% of time 1 sample) completed the final time-point (Time 3 – six months post-baseline) (Figure 2). The first author retrospectively sorted participants into sports category (competitive sports engagers, non-competitive sports engagers, sports non-engagers) based on their answers to the sports demographic questionnaire (detailed below).

Procedure

The study was advertised online through social media streams (Facebook, Instagram). Participants were required to follow the link contained within the advertisement, which directed them to the information sheet (Appendix B) and Consent Form (Appendix C) on Qualtrics. If deemed eligible by the system, they were automatically administered the online questionnaire battery at time 1 (see Table 1 outlining the study procedure).

Figure 2

Participant attrition across the three time points



Participants who completed all questionnaires at time 1 were sent an email three months later with a link to complete time 2 measures (RSES, BFNE, SAAS). Participants who did not complete the questionnaires within four weeks of being sent the time 2 questionnaires were excluded and their time 2 data omitted. At Time 3 (six months after time 1), participants who completed all questionnaires at time 1 and time 2 were emailed a link to complete the EDEQ, BAS-2 and CBIQA. Participants were given two weeks to complete their final questionnaires, and their time 3 data was excluded if they missed the deadline. Following completion, participants received a debrief form (Appendix E).

Measures

Table 1 specifies the questionnaires that were administered at the different time-points.

Sports demographic questionnaire

The sports demographic questionnaire (Appendix F) was designed by the current researchers. It was informed by previous studies that explored sporting activity levels, body dissatisfaction and eating disorders (Hopkinson & Lock, 2004; Kong & Harris, 2015). This included demographic information (age, gender, height, weight). It also contained questions relating to their participation in sport and competition level (type of sport, hours per week of training, competition level). Answers on the 'sports demographic questionnaire' were used to split the sample into 'competitive sports engagers', 'non-competitive sports engagers' and 'sports non-engagers'.

- 'Sports non-engagers' were those who participated in exercise for < 2.5 hours per week and/or those who score 0 ('I never prioritise training') or 1 ('I rarely prioritise training') on '*Where would you rate your training in relation to other priorities (e.g., socialising/work/family)?*'. 2.5 hours was selected in accordance

with NHS (2019) guidelines for physical activity.

The remainder were categorised as sports engagers. They were then further categorised based off their answers regarding *competition level*:

- 'Non-competitive sports engagers' fulfilled all of the following criteria: (a) participated in exercise for ≥ 2.5 hours per week, (b) score 0 ('I don't compete')-1 ('I compete recreationally') for '*What is your competition level (please circle)?*'
- 'Competitive sports engagers' fulfilled all of the following: (a) participated in exercise for ≥ 2.5 hours per week, (b) score 2-5 in response to '*What is your competition level (please circle)?*'

Contextual Body Image Questionnaire for Athletes (CBIQA)

The CBIQA was developed by de Bruin et al. (2011) to assess differences in body image for athletes when in sport compared with out of sport. The CBIQA was administered to measure sporting body image. It uses a 7-point Likert scale and has been validated for use in sports (de Bruin 2011; Stewart et al. 2021). The CBIQA includes two contexts (sport and daily life) and four dimensions within each (Appearance, Muscularity, Thin-Fat Self, Thin-Fat Others). Scale scores are obtained by dividing the sum of item-scores by the total number of items of the scale (Appendix G). Research has confirmed the psychometric validity of the CBIQA and suggests that it captures variance discrete from the thin-ideal internalisation (Stewart et al., 2021).

Body Appreciation Scale 2 (BAS-2)

The BAS-2 (Tylka & Wood-Barcalow, 2015) is a psychometrically sound positive body image measure derived from the original BAS (Appendix H). The BAS-2 was administered to measure social body image. It consists of 10 items rated on a 5-point Likert scale (1=*never*, 5=*always*). A total score is derived by computing all 10 items and dividing by the number of items in the measure ($N = 10$). Higher scores

indicate higher body appreciation (more positive social body image). The BAS-2 showed internal consistency, test-retest reliability and construct validity in a community and college sample of men and women (Tylka & Wood-Barcalow, 2015).

Eating Disorder Examination Questionnaire (EDEQ)

The EDEQ (Fairburn & Beglin, 2008) is a 28-item self-report questionnaire to assess eating disorder (ED) psychopathology (Appendix I). It uses a 7-point Likert scale (0-6), with higher scores reflecting severity of ED. Frequencies of key ED behaviours (objective binge eating, self-induced vomiting, laxative misuse, excessive exercise) are taken in addition to attitudinal subscales (dietary restraint, weight concerns, shape concerns, eating concerns). To obtain subscale scores, ratings for the relevant items are added together and divided by the total number of items forming the subscale. A 'global' score (EDEQ-G) is the sum of the four subscale scores divided by number of subscales. The EDEQ has validity and good psychometric properties (Mond et al. 2004). Internal consistency has proven good for both clinical and general populations (Berg et al., 2012; Luce & Crowther, 1999; Peterson et al., 2007).

Rosenberg Self-Esteem Scale (RSES)

The RSES (Rosenberg, 1965) is a 10-item self-report questionnaire to assess levels of self-esteem (Appendix J). Items are rated on a 4-point scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). Five items are reverse scored. All item responses are totalled to provide an overall score, with higher scores reflecting higher self-esteem. The RSES is widely used and has strong psychometric properties (Schmitt & Allik, 2005; Sinclair et al., 2010).

Brief Fear of Negative Evaluation Scale (BFNE)

The BFNE (Leary, 1983) assesses fear of negative evaluation by others (Appendix K). It is a 12-item version that is highly correlated to the original Fear of

Negative Evaluation Scale (Leary, 1983). Items are rated on a Likert scale ranging from 1 (*not at all characteristic of me*) to 5 (*extremely characteristic of me*). Four items are reverse scored. Items are totalled to provide an overall score, with higher scores indicating higher fear of negative evaluation. It has been shown to have excellent test-retest reliability and inter-item reliability (Van der Molen et al., 2014). The BFNE is also frequently used due to its brevity (Rodebaugh et al., 2004).

Social Appearance Anxiety Scale (SAAS)

The SAAS (Hart et al., 2008) assesses anxiety about being negatively evaluated by others because of one's overall appearance, including body shape (Appendix L). It is a 16-item measure rated on a Likert scale ranging from 1 (not at all) to 5 (extremely). One item is reverse scored. Items are totalled to provide an overall score, with higher scores indicating higher social appearance anxiety. Research on its psychometric properties has demonstrated high test-retest reliability, good internal consistency, good factor validity, and divergent validity in college men and women (Hart et al., 2008; Levinson & Rodebaugh, 2011).

Data analysis

Statistical analyses were conducted using IBM SPSS Statistics Software, Version 27. Binary logistic regression analyses were used to determine whether there was any difference in time 1 scores between those who did or did not participate at time 2 and time 3. One-way ANOVAs were conducted to determine any baseline differences at time 1 between competitive sports engagers, non-competitive sports engagers and sports non-engagers for ED psychopathology (EDEQ-G), social body image (BAS-2) and sporting body image (four CBIQA sporting subscales) (hypothesis 1). Internal consistency of each scale used in this study was also reported, as Cronbach's *alpha*.

A hierarchical linear multiple regression examined whether social body image (BAS-2) and sporting body image (the four CBIQA sporting subscales) predicted ED psychopathology at time 3 (EDEQ-G), above and beyond the effect of eating disorder psychopathology at time 1 (EDEQ-G) (hypothesis 2). The predictors were entered in two blocks: i) EDEQ-G time 1 scores and ii) BAS-2 and the four CBIQA sporting subscale scores (Appearance, Muscularity, Thin-Fat self, Thin-fat other). Except for the CBIQA sporting appearance subscale, the remaining three CBIQA sporting subscale scores (muscularity; thin-fat self; thin-fat other) were converted for the regression analyses, since their scoring differs substantially (Myers et al., 2012). For the CBIQA sporting appearance subscale, the higher the score, the more beautiful a person perceives themselves. The remaining subscale scores use a score of 4 on a Likert scale for the most positive rating, with higher and lower scores each indicating different patterns of poor body appearance. Thus, the converted subscale scores used in the regression were calculated by subtracting 4 from the raw score and taking the absolute score (any negative scores were converted to positive numbers by omitting the negative sign), meaning that a higher score indicated more negative body image.

Mediation analyses were conducted to determine whether RSES scores (self-esteem), FNE scores (fear of negative evaluations) and SAAS scores (social appearance anxiety) at three months were mediators of the predictive relationship between ED psychopathology and body image concerns (social, sporting) at time 1 and ED psychopathology at six months (hypothesis 3). First, a multiple linear regression was conducted to determine whether subscale scores at three months (RSES, SAAS, BFNE) predicted ED psychopathology (EDEQ-G) at six months. Significant findings from this analysis were then built into the model for the mediation analysis, using the PROCESS module in SPSS.

Results

Sample characteristics

A total of 510 participants, aged 18 to 71 completed all time 1 questionnaires. The majority of participants were female ($n = 400$) followed by male ($n = 108$) with only one individual identifying as non-binary and one preferring not to say (Table 2).

Table 2

Gender split by sport categorisation.

		Sports non- engagers ($n = 117$)	Non-competitive sports engagers ($n = 276$)	Competitive Sports Engager ($n = 117$)	Total ($n = 510$)
Gender	Male	$n = 23$	$n = 44$	$n = 41$	$n = 108$
	Female	$n = 94$	$n = 232$	$n = 74$	$n = 400$
	Non-binary	-	-	$n = 1$	$n = 1$
	Prefer not to say	-	-	$n = 1$	$n = 1$
	Total	$n = 117$	$n = 276$	$n = 117$	$n = 510$
Age		M: 34.87 (12.68)	M: 34.59 (9.68)	M: 31.97 (10.54)	M: 34.05 (10.65)
BMI (Time 1)		M: 26.86 (7.74)	M: 23.90 (3.68)	M: 22.59 (3.00)	M: 24.28 (5.03)

Note. M: Mean (Standard Deviation). One sports non-engager did not report an age.

The most popular sports that participants engaged in were running ($n = 344$), hiking ($n = 210$) and gym going (weights) ($n = 192$). The least popular sports were

gymnastics ($n = 7$) and dance ($n = 14$) (see Appendix M for further information on sample sport types). Examples of 'other sports' that were not available as tick boxes within the questionnaire included pole fitness, golf, climbing/bouldering, and archery.

Drop-out rates

Sports non-engagers had slightly higher non-completion rates from time 1 to time 2 compared with the competitive sports and non-competitive sports engagers. Competitive sports engagers had slightly higher non-completion rates than sports non-engagers and non-competitive sports engagers from time 2 to time 3.

Attrition analysis

For the attrition analysis, an individual was considered a participant once they had completed $\geq 50\%$ of the questionnaire battery at time 2 or time 3. There were 19 variables at time 1 (age; BMI; eight CBIQA subscales; five EDEQ subscales; BAS; RSES; BFNE; SAAS) that could have impacted whether or not participants dropped out. These 19 variables at time 1 were compared across participants who did or did not participate at time 2 and at time 3, to determine predictors of attrition.

Binary logistic regression analyses showed a significant difference in time 1 scores between those who participated and did not participate at time 2 ($\chi^2 = 41.63$, $df = 18$; $p < .001$). Higher CBIQA sporting muscularity scores ($p = .033$), higher EDEQ weight concern scores ($p = .042$), lower BFNE scores ($p = .010$) and younger age ($p = .016$) were all associated with dropout at time 2.

There was also a difference in time 1 scores between those who did and did not drop out at time 3 ($\chi^2 = 31.28$, $df = 18$; $p = .027$). Higher EDEQ weight concern scores ($p = .049$), higher SAAS scores ($p = .038$) and lower BFNE scores ($p = .010$) were all associated with drop-out at time 3.

Descriptive statistics

Table 3 presents the means and standard deviations for the baseline study variables across the sample. Scores on EDEQ, BAS-2, RSES, BFNE and SAAS were comparable to other non-clinical populations (Carey et al., 2019; Leary, 1983; Levinson & Rodebaugh, 2011; Sinclair et al., 2010; Tylka & Wood-Barcalow, 2015). CBIQA non-clinical norms are only available for female samples, so are not directly comparable with the current sample. Cronbach's *alpha* values are also included and demonstrate strong to excellent internal consistency for each of the baseline measures at time 1.

Table 3

Descriptive statistics and Cronbach's alpha for measures at time 1 for the whole sample.

Baseline Measure	Total Sample			Range	Cronbach's alpha α
	<i>N</i>	Mean	SD		
Age	668	34.13	10.81		-
BMI	538	24.36	5.18		-
EDEQ Restraint	561	1.64	1.45	0 – 6.00	0.802
EDEQ Eating Concern	538	1.22	1.29	0 – 6.00	0.809
EDEQ Shape Concern	538	2.62	1.65	0 – 6.00	0.910
EDEQ Weight Concern	538	2.28	1.56	0 – 6.00	0.821
EDEQ Global Score	538	1.94	1.28	0 - 5.65	0.880
CBIQA sporting appearance	577	3.94	0.91	1.00 – 7.00	0.860
CBIQA sporting muscularity	577	3.43	0.92	1.00 – 6.33	0.851
CBIQA sporting thin-fat self	577	4.85	0.88	2.00 – 7.00	0.944
CBIQA sporting thin-fat other	577	4.33	0.84	1.00 – 7.00	0.906
BAS-2	575	3.18	0.80	1.10 – 5.00	0.941
RSES	530	28.08	6.04	10.00 – 40.00	0.912
BFNE	522	39.96	11.40	12.00 – 60.00	0.928
SAAS	510	39.09	16.00	16.00 – 80.00	0.960

Note. BMI = Body Mass Index; EDEQ = Eating Disorder Examination Questionnaire; CBIQA = Contextual Body Image Questionnaire for athletes; BAS-2 = Body Appreciation Scale 2; RSES = Rosenberg Self-

Esteem Scale; BFNE = Brief Fear of Negative Evaluation Scale; SAAS = Social Appearance Anxiety Scale. Cronbach's alpha was calculated for EDEQ Global Score using the EDEQ subscales.

Hypothesis 1

There will be significant differences between competitive sports engagers, non-competitive sports engagers and sports non-engagers across the baseline measures (body image, eating disorder psychopathology, self-esteem, fear of negative evaluations, social appearance anxiety).

To explore whether there were differences between competitive sports engagers, non-competitive sports engagers and sports non-engagers on the time 1 subscales, a series of one-way ANOVAs were conducted (see Table 4). ANOVAs were selected since they are robust to violations of normality and therefore violation of Levene's test of homogeneity can be accommodated (Kirk, 2012). The acceptable significance level was set at $p < .05$. Effect sizes (partial η^2) of 0.01 indicated a small effect, 0.06 a medium effect, and 0.14 a large effect. Significant differences were observed between the groups on all the measures except EDEQ-G scores and RSES scores. All significant comparisons were of small to medium effect size (partial η^2). Post-hoc tests (using the Bonferroni correction for multiple comparisons) showed a pattern of significant differences between pairs of groups. The majority of significant pairwise differences were between the competitive sports engagers and the other two groups.

The overall pattern shows that competitive sports engagers had generally more positive body image (social and sporting) than the other groups, and a lower level of social anxiety. There were very few differences between the non-competitive sports engagers and sports non-engagers. EDEQ-G scores did not differ between the groups and is the dependent variable in subsequent analyses. Thus, no further group differences were examined, and the sample was treated as a whole for later analyses.

Table 4

Mean baseline scores (Time 1 measures) and standard deviations for participants across the conditions, with one-way ANOVA statistics.

Baseline Measure	Group			ANOVA		
	Competitive Sports Engager (n = 117) M (SD)	Non-competitive Sports Engager (n = 276) M (SD)	Sports non-engager (n = 117) M (SD)	F	p	Partial eta ² (np ²)
EDEQ Global Score	1.79 (1.37)	2.00 (1.25)	1.97 (1.24)	1.076	.342	0.004
CBIQA sporting appearance	4.20 (1.02) ^{a***; b*}	3.83 (0.78) ^{a***}	3.82 (1.10) ^{b*}	7.430	<.001	0.028
CBIQA sporting muscularity	3.77 (0.85) ^{a***; b***}	3.38 (0.83) ^{a***}	3.19 (1.05) ^{b***}	13.471	<.001	0.050
CBIQA sporting thin-fat self	4.69 (0.88) ^{b*}	4.85 (0.79)	4.97 (1.05) ^{b*}	3.047	.048	0.012
CBIQA sporting thin-fat other	4.17 (0.79) ^{b***}	4.27 (0.72) ^{c*}	4.58 (1.02) ^{b***; c*}	8.512	<.001	0.032
BAS-2	3.40 (0.83) ^{a*; b***}	3.17 (0.74) ^{a*}	2.99 (0.90) ^{b***}	7.608	<.001	0.029
RSES	28.58 (6.34)	27.97 (5.96)	27.55 (6.02)	0.865	.422	0.003
BFNE	37.02 (11.19) ^{a*; b*}	40.57 (11.53) ^{a*}	41.77 (10.92) ^{b*}	5.841	.003	0.023
SAAS	37.19 (15.27) ^{b*}	38.41 (15.59)	42.61 (17.24) ^{b*}	3.945	.020	0.015

Note. M = Mean; SD = Standard Deviation; ns = not significant

EDEQ = Eating Disorder Examination Questionnaire; CBIQA = Contextual Body Image Questionnaire for athletes; BAS-2 = Body Appreciation Scale 2; RSES = Rosenberg Self-Esteem Scale; BFNE = Brief Fear of Negative Evaluation Scale; SAAS = Social Appearance Anxiety Scale. Same superscripts represent significant differences: ^a competitive vs non-competitive sports engagers; ^b competitive sports vs sports non-engager; ^c non-competitive sports vs non-engager (***) significant at $p < .001$ level; * significant at $p < .05$ level).

Hypothesis 2

Higher body image concerns (Social; Sporting) will predict ED psychopathology six months later, over and above ED psychopathology at time 1 (aim 1).

For the longitudinal analyses, missing data (due to participant drop-out/ participants missing the deadline for response) were excluded and the analysis was conducted on participants who completed all time 1, 2 and 3 measures ($n = 230$).

Bivariate correlations

Table 5 presents the Pearson's correlations (r , 2-tailed) between the time 1 measures, as well as with the outcome variable (EDEQ Global score) at time 3. All the correlations were significant, except that EDEQ Restraint scores at time 1 were not significantly correlated with time 1 CBIQA daily muscularity, CBIQA daily thin-fat others and CBIQA sporting muscularity subscales. The BFNE was also not significantly correlated with the CBIQA daily thin-fat other subscale. All time 1 subscales were correlated with time 3 eating disorder psychopathology.

Table 5

Correlations between all time 1 measures and with the outcome variable (EDEQ Global score) at time 3.

		EDEQ Global (T3)	CBIQA daily appearance (T1)	CBIQA daily muscularity (T1)	CBIQA daily thin fat self (T1)	CBIQA daily thin fat others (T1)	CBIQA sporting appearance (T1)	CBIQA sporting muscularity (T1)	CBIQA sporting thin fat self (T1)	CBIQA Sporting thin fat others (T1)	BAS-2 (T1)	EDEQ Restraint (T1)	EDEQ Eating Concern (T1)	EDEQ Shape Concern (T1)	EDEQ Weight Concern (T1)	EDEQ Global (T1)	RSES (T1)	BFNE (T1)	SAAS (T1)
EDEQ Global (T3)		--																	
		230																	
CBIQA daily appearance (T1)	Pearson's r	-.347***	--																
	N	230	605																
CBIQA daily muscularity (T1)	Pearson's r	-.181**	.295***	--															
	N	230	605	605															
CBIQA daily thin fat self (T1)	Pearson's r	.467***	-.381***	-.277***	--														
	N	230	605	605	605														
CBIQA daily thin fat others (T1)	Pearson's r	.212**	-.201***	-.127**	.661***	--													
	N	230	605	605	605	605													
CBIQA sporting appearance (T1)	Pearson's r	-.329***	.641***	.374***	-.445***	-.208***	--												
	N	230	577	577	577	577	577												
CBIQA sporting muscularity (T1)	Pearson's r	-.153*	.263**	.630***	-.242**	-.111**	.400***	--											
	N	230	577	577	577	577	577	577											
CBIQA sporting thin fat self (T1)	Pearson's r	.465***	-.312***	-.218**	.781***	.519***	-.467***	-.205***	--										
	N	230	577	577	577	577	577	577	577										
CBIQA Sporting thin fat others (T1)	Pearson's r	.183**	-.182**	-.187**	.595***	.754***	-.275**	-.198**	.645***	--									
	N	230	577	577	577	577	577	577	577	577									
BAS-2 (T1)	Pearson's r	-.607***	.671***	.322**	-.500***	-.225***	.585***	.304**	-.423***	-.211***	--								
	N	230	575	575	575	575	575	575	575	575	575								
EDEQ Restraint (T1)	Pearson's r	.561***	-.182**	-.023	.205**	.072	-.154**	-.044	.200**	.089*	-.261***	--							
	N	230	561	561	561	561	561	561	561	561	561	561							
EDEQ Eating Concern (T1)	Pearson's r	.645***	-.307***	-.112**	.379**	.262**	-.276**	-.145**	.337**	.230**	-.451***	.500***	--						
	N	230	538	538	538	538	538	538	538	538	538	538	538						
EDEQ Shape Concern (T1)	Pearson's r	.747***	-.441***	-.243**	.558**	.279**	-.446***	-.262**	.504**	.264**	-.676***	.525***	.718***	--					
	N	230	538	538	538	538	538	538	538	538	538	538	538	538					
EDEQ Weight Concern (T1)	Pearson's r	.754***	-.426***	-.209**	.551**	.316**	-.412**	-.236**	.507**	.282**	-.613***	.507***	.722***	.910***	--				
	N	230	538	538	538	538	538	538	538	538	538	538	538	538	538				
EDEQ Global (T1)	Pearson's r	.793***	-.403***	-.173**	.503**	.274**	-.381***	-.206**	.462**	.256**	-.593***	.731***	.845***	.929***	.923***	--			
	N	230	538	538	538	538	538	538	538	538	538	538	538	538	538	538			
RSES (T1)	Pearson's r	-.495***	.566***	.202**	-.343**	.195**	.459**	.225**	-.318**	-.149**	.733***	-.261***	-.492***	-.604***	-.581***	-.569***	--		
	N	230	530	530	530	530	530	530	530	530	530	530	530	530	530	530	530		
BFNE (T1)	Pearson's r	.331***	-.421***	-.179**	.249**	.064	-.333**	-.219**	.238**	.096*	-.530***	.182**	.374**	.512**	.470**	.453**	-.609**	--	
	N	230	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	
SAAS (T1)	Pearson's r	.481***	-.497***	-.182**	.375**	.253**	-.378**	-.225**	.354**	.249**	-.582***	.299**	.530**	.633**	.617**	-.609**	-.699**	.654**	--
	N	230	510	510	510	510	510	510	510	510	510	510	510	510	510	510	510	510	510

Note. *** Correlation significant at the <.001 level (2-tailed). ** Correlation significant at the 0.01 level (2-tailed); * correlation is significant at the 0.05 level (2 tailed)
T1 = Time 1; T3 = Time 3.

Hierarchical regression (Body image- ED psychopathology link).

Since the correlational analysis revealed all the time 1 baseline scores were associated with EDEQ-G at time 3, a hierarchical regression was conducted with EDEQ-G scores at time 3 as the dependent variable, to determine the most parsimonious set of predictors of eating pathology. EDEQ-G scores at Time 1 were entered first, to ensure that any effects of body image measures were over and above the impact of ED psychopathology. BAS-2 and the four CBIQA sporting subscales were entered in the second block of the regression.

Table 6 shows that, as expected, EDEQ-G scores at Time 1 predicted EDEQ-G scores at Time 3. Adding the body image variables (BAS-2; CBIQA sporting subscales) in block 2 explained a small but significant additional 3% of the variance in ED psychopathology at time 3. This was due to significant effects of BAS-2 and CBIQA Sporting Appearance scores.

Table 6Hierarchical regression model of EDEQ-G scores at time 3 ($n = 230$)

	R	R^2	R^2 Change	B	SE	β	t
Step 1	0.79	0.63***	0.63				
EDEQ-G (T1)				0.77	0.04	0.79	19.67***
Step 2	0.81	0.66**	0.03**				
EDEQ-G (T1)				0.65	0.05	0.68	12.21***
BAS-2				-0.31	0.09	-0.21	-3.58***
CBIQA sporting Appearance				0.18	0.07	0.13	2.50*
CBIQA sporting muscularity [§]				-0.07	0.08	-0.04	-0.94
CBIQA Sporting thin-fat self [§]				0.12	0.09	0.08	1.26
CBIQA sporting thin-fat other [§]				0.08	0.10	0.04	0.80

Note. Statistical significance: * $p < .05$; ** $p < .01$; *** $p < .001$. [§] indicates subscales using the converted scores (as described above).

T1 = time 1. EDEQ-G = Eating Disorder Examination Questionnaire Global Subscale; CBIQA = Contextual Body Image Questionnaire for athletes; BAS-2 = Body Appreciation Scale 2.

Hypothesis 3

The body image-ED psychopathology relationship over six months will be mediated by low self-esteem, high fear of negative evaluation by others and high social appearance anxiety, all measured at the three-month point (aim 2).

Initially, the necessary predictions between the independent variable and dependent variable were established. A multiple linear regression tested whether any of the potential mediators at time 2 (RSES, BFNE, SAAS) predicted EDEQ-G scores at time 3. RSES and SAAS significantly predicted time 3 EDEQ-G scores [$R^2 = 0.26$, $F(3, 225) = 26.66$, $p < .001$]. Lower RSES [$B = -0.06$, $SE = 0.02$, $t(3,225) = 3.70$, $p <$

.001] and higher SAAS scores at time 2 [$B = 0.02$, $SE = 0.007$, $t(3,225) = 2.65$, $p = .009$] predicted higher EDEQ-G Time 3 scores. BFNE did not significantly predict EDEQ-G time 3 scores ($p = .844$).

The next step was to determine whether the significant independent variables at Time 1 (EDEQ-G, BAS-2, CBIQA sporting appearance) still had predictive power for the Time 3 EDEQ-G scores, once the hypothesised Time 2 mediators (RSES, SAAS) were taken into account. A mediation analysis using the PROCESS macro in SPSS was conducted for each predictor separately, with the remaining two predictors entered as covariates. Table 7 shows the mediational analyses for the different independent variables.

For EDEQ-G scores at Time 1, the effect on EDEQ-G scores at Time 3 remained significant when the potential mediators were considered, and the total mediated effects for RSES and SAAS at Time 2 were non-significant (as the 95% confidence intervals crossed zero). Therefore, there was no mediation effect of self-esteem or social appearance anxiety. The same pattern was found when the CBIQA sporting appearance score or the BAS-2 score were used as the independent variable predicting EDEQ-G at Time 3, with no mediator effects of RSES and SAAS. Therefore, there was no mediation effect (at three months) of the hypothesized variables on the relationships between body image/ED psychopathology and ED psychopathology over the six-month time period.

Table 7

Results of the mediator analysis, testing hypothesised factors in explaining links between time 1 measures (EDEQ-G, CBIQA sporting appearance, BAS-2) and time 3 EDEQ-G (n = 230)

Predictor	Step		<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>LLCI</i>	<i>ULCI</i>	
EDEQ-G (T1)	1	ED psychopathology (EDEQ-G T1)>ED psychopathology (EDEQ-G T3) + mediators (RSES, SAAS T2) in the model	0.67	0.52	12.91	<.001			
	2	ED psychopathology (EDEQ-G T1)>Self-esteem (RSES T2)	-0.44	0.28	-1.54	.126			
		ED psychopathology (EDEQ-G T1)>Social Appearance Anxiety (SAAS T2)	2.68	0.77	3.48	<.001			
	3	Self-esteem (RSES T2)>ED psychopathology (EDEQ-G T3)	-0.01	0.01	-0.79	.432			
		Social Appearance Anxiety (SAAS T2)>ED psychopathology (EDEQ-G T3)	<-0.01	0.01	-0.74	.462			
	4	ED psychopathology (EDEQ-G T1)>ED psychopathology (EDEQ-G T3)	0.67	0.05	13.18	<.001			
	5	ED psychopathology (EDEQ-G T1)>Self-esteem (RSES T2)>ED psychopathology (EDEQ-G T3)	0.01	0.01			-0.01	0.02	
		ED psychopathology (EDEQ-G T1)>Social Appearance Anxiety (SAAS T2)>ED psychopathology (EDEQ-G T3)	-0.01	0.02			-0.04	0.03	
				<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>		
	CBIQA Sporting Appearance (T1)	1	Sporting body image (CBIQA Sporting Appearance T1)>ED psychopathology (EDEQ-G T3) + mediators (RSES, SAAS T2) in the model	0.15	0.07	2.14	.034		
2		CBIQA Sporting Appearance (T1)>Self-Esteem (RSES T2)	0.39	0.39	0.99	.322			
		CBIQA Sporting Appearance (T1)> Social Appearance Anxiety (SAAS T2)	-1.36	1.06	-1.28	.201			
3		Self-Esteem (RSES T2)> ED psychopathology (EDEQ-G T3)	-0.01	0.01	-0.79	.432			

			<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>		
		Social Appearance Anxiety (SAAS T2)>ED psychopathology (EDEQ-G T3)	<-0.01	0.01	-0.74	.462		
	4	CBIQA Sporting Appearance (T1)>ED psychopathology (EDEQ-G T3)	0.15	0.07	2.16	.032		
	5	CBIQA Sporting Appearance (T1)>Self-esteem (RSES T2)>ED psychopathology (EDEQ-G T3)	<-0.01	0.01			-0.03	0.01
		CBIQA Sporting Appearance (T1)>Social Appearance Anxiety (SAAS T2)>ED psychopathology (EDEQ-G T3)	0.01	0.01			-0.02	0.03
			<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>		
BAS-2 (T1)	1	Social Body image (BAS-2 T1)>ED psychopathology (EDEQ-G T3) + mediators (RSES, SAAS T2) in the model	-0.31	0.10	-3.08	.002		
	2	Social Body image (BAS-2 T1)>Self-esteem (RSES T2)	4.28	0.48	8.90	<.001		
		Social Body image (BAS-2 T1)>Social Appearance Anxiety (SAAS T2)	-7.80	1.30	-5.99	<.001		
	3	Self-Esteem (RSES T2)> ED psychopathology (EDEQ-G T3)	-0.01	0.01	-0.79	.432		
		Social Appearance Anxiety (SAAS T2)>ED psychopathology (EDEQ-G T3)	<-0.01	0.01	-0.74	.462		
	4	Social Body image (BAS-2 T1)>ED psychopathology (EDEQ-G T3)	-0.33	0.09	-3.81	<.001		
	5	Social Body image (BAS-2 T1)>Self-esteem (RSES T2)>ED psychopathology (EDEQ-G T3)	-0.04	0.05			-0.15	0.06
		Social Body image (BAS-2 T1)> Social Appearance Anxiety (SAAS T2)>ED psychopathology (EDEQ-G T3)	0.03	0.05			-0.06	0.12

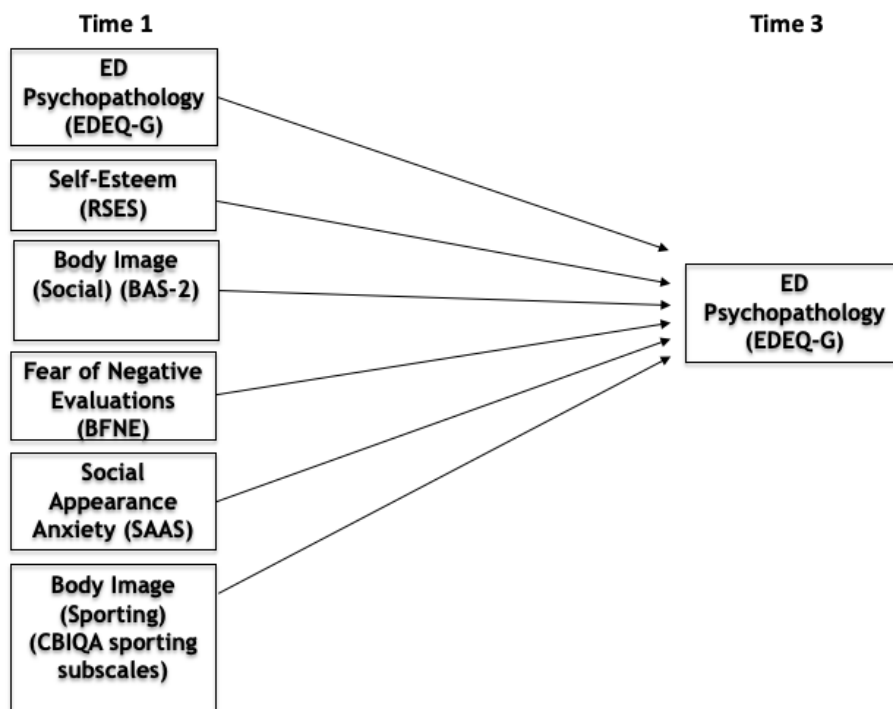
Note. EDEQ-G = Eating Disorder Examination Questionnaire Global Subscale; CBIQA = Contextual Body Image Questionnaire for athletes; BAS-2 = Body Appreciation Scale 2; RSES = Rosenberg Self-Esteem Scale; SAAS = Social Appearance Anxiety Scale. T1= Time 1; T2= Time 2; T3= Time 3. Step 1: Direct effect = with mediators in the model; Step 4= Total effect (without mediators in the model). LLCI = Lower Limit Confidence Interval; UCLI = Upper Limit Confidence Interval.

Post hoc analysis.

Since there was no mediation effect, a multiple linear regression checked whether RSES, SAAS and BFNE (all taken at time 1) predicted EDEQ-G scores at time 3. The multiple linear regression also included the body image and eating disorder psychopathology measures from time 1 (Figure 3). CBIQA sporting appearance, BAS-2 and EDEQ-G at time 1 predicted EDEQ-G at time 3 [$R^2 = 0.66$, $F(9, 220) = 47.40$, $p < .001$]. However, RSES, SAAS and BFNE at time 1 did not significantly predict EDEQ-G at time 3 ($p > .05$).

Figure 3

Multiple linear regression for all baseline measures and EDEQ-G at time 3.



Discussion

The primary aim was to determine whether body image concerns (social; sporting) at time 1 would predict ED psychopathology six months later for competitive

sports engagers, non-competitive sports engagers, and sports non-engagers. The secondary aim was to test the potential mediating role of self-esteem and social anxiety (fear of negative evaluation and social appearance anxiety) at three months in that relationship.

Findings relative to predictions

Recruitment was successful regarding the overall sample size analysis and retention was good. Similar to previous research on body image and eating disorders, the sample consisted of a majority of younger females. The average BMI was on the upper end of the 'healthy weight' range (NHS, 2022). Drop-out rates were similar from time 1 to time 2 and time 2 to time 3. Whilst 55% of the initial time 1 completers dropped out, drop-out rates according to sports group were fairly similar. Factors associated with drop-out at time 2 and/or time 3 included demographic factors (younger age), psychological factors (lower fears of negative evaluation; higher social appearance anxiety), and ED psychopathology (higher weight concern and higher muscularity-related sporting body image).

The first hypothesis was that there would be significant differences between competitive sports engagers, non-competitive sports engagers and sports non-engagers across the baseline measures (body image, eating disorder psychopathology, self-esteem, fear of negative evaluations, social appearance anxiety) (aim 1). The hypothesis was supported. Specifically, competitive sports engagers generally had more positive social and sporting body image and lower levels of social anxiety than the other groups.

The second hypothesis was that higher body image concerns (Social; Sporting) would predict ED psychopathology six months later, over and above ED psychopathology at time 1 (aim 1). Again, this hypothesis was supported in part.

Specifically, social body image and the appearance-related sporting body image subscale predicted ED psychopathology six months later. However, three of the sporting body image subscales did not predict ED psychopathology.

The third hypothesis was that the body image-ED psychopathology relationship over six months would be mediated by low self-esteem, high fear of negative evaluation by others and high social appearance anxiety, all measured at the three-month point (aim 2). However, this hypothesis was not supported. The mediation analysis was not significant for any of the hypothesised mediators.

Comparison of findings to previous research

The finding that poor social body image predicted higher ED psychopathology across the whole sample mirrors extensive findings that body image is a risk factor for ED psychopathology (Askew et al., 2020; Petrie & Greenleaf, 2007; 2012). The finding that competitive sports engagers had more positive body image compared with non-athletes mirrors previous findings (Burgon et al., 2023; Karrer et al., 2020). The relationship between higher competition levels and differences in body image is complex and has produced mixed findings in the past (Beckner & Record, 2016). The current study provides support for competitive sports engagers having better body image (both sporting and social) than non-competitive sports engagers.

The finding that lower appearance-related sporting body image concerns (rather than poorer body image) predicted higher ED psychopathology contrasts with previous theories focused on sporting populations (Petrie & Greenleaf, 2007; 2012). However, Petrie and Greenleaf did not account for sporting body image, which may explain the contrasting finding.

Few longitudinal studies exist that explore whether different types of body image predict ED psychopathology. Since social body image and sporting body image

separately predicted ED psychopathology here, there is support for the notion that two separate body images exist (social; sporting) (de Bruin et al., 2011). Moreover, previous research on the two different body images has largely been focused on adolescent populations. This research extends the findings to adult populations, and shows evidence that the two body images (social, sporting) may predict later ED psychopathology.

Finally, this study was the first to incorporate self-esteem and social anxiety factors into the body image-ED psychopathology link in sports. Whilst there was no overall mediation, higher social appearance anxiety and lower self-esteem were associated with higher ED psychopathology across the sample.

Current findings and their relation to psychological theory

No psychological mediators were significant. However, the overall findings might be explained by other psychological factors. The finding that competitive sports engagers had better social and sporting body image might be due to their body image better matching Westernised body image ideals (e.g., runners, who were the largest sporting group here) (Torstveit et al., 2008).

Moreover, competitive athletes might judge their body based on its functionality. Body functionality incorporates everything that a body is capable of doing, not only in contexts such as recovering from an illness, but also on its physical capacities (e.g., walking, stretching) (Alleva et al., 2015). Sports participation has been associated with better body functionality due to promoting appreciation of the body and its functional abilities (Soulliard et al., 2019). Notably, the competitive sports engagers had better body image than non-competitive sports engagers. Competing and setting personal goals (e.g., a personal best) might encourage people to think more functionally about their bodies, rather than purely aesthetically.

Whilst increasing body functionality can reduce eating disorder risk (Linardon, 2021), findings might not generalise when considering sporting body image specifically. In this study, higher self-ratings of appearance in a sporting context were linked to greater ED psychopathology. In a sporting context, people may experience a polarisation over time towards thinner ideals by comparing themselves to more 'athletic' bodies rather than the general westernised ideals (Stoyel et al., 2021). Moreover, maintaining the 'athletic' body image might become increasingly hard with age, leaving individuals to engage in ED behaviours (e.g., restrictive eating) as a means of achieving the harder ideal. Thus, within sporting contexts, the short-term benefit of positive body image related to exercise might have negative consequences over time (increased ED psychopathology risk).

Limitations and future directions for research

Several limitations should be noted. The longitudinal analysis was under-powered, given that only 230 participants of the initial 510 participants (time 1) completed all time 1, 2 and 3 measures, compared to the sample size calculation indicating that 291 completers would be needed to be fully powered (see Method). The Social Appearance Anxiety Scale could have been replaced or supplemented with the Social Physique Anxiety measure, which considers evaluation specific to one's body structure and composition and which therefore might be more relevant here (Hart et al., 1989). The sporting body image measure (CBIQA) required participants to evaluate their body image in a sporting context, which may have been difficult for some sports non-engagers who partake in no physical activity.

Whilst the categorisation of sports category was based on previous research, there could have been heterogeneity within the samples. Competitive sports engagers could have included athletes ranging from local competitions to elite status. Moreover,

the aim of sport engagement was not measured (e.g., for weight loss or for health). The aim may be important, since those motivated by appearance-related factors to engage in sports may be more prone to body image dissatisfaction and/or eating disorder psychopathology (Panão & Carraça, 2020). Future research should consider recruiting across competition levels, and explore differences in body image/ED psychopathology according to aim of sports engagement.

Future studies could recruit different samples to elucidate whether the body image- ED psychopathology link exists. Future research should consider individuals across all genders and gender identities, and individuals engaging in other sports types since the current sample were majority female with some sports underrepresented (e.g., gymnastics). Differences in the body image-ED psychopathology link in athletes should be compared across ethnicities, given that not all individuals of different ethnicities strive for westernised ideals. Finally, across eating disorder groups, exercise can be normal or compulsive (e.g., used as a form of emotional avoidance). Therefore, future research should consider whether these findings are generalisable to ED groups.

Clinical implications

Healthy individuals might be recommended to partake in sports, particularly competitive sports, due to their association with more positive body image (social and sporting) and reduced social anxiety. However, this is not an unequivocal recommendation. For example, better appearance-related sporting body image can increase risk of ED psychopathology six months later. Competitive sporting individuals (and their support network of coaches, family and peers) might be encouraged to celebrate the athlete's body's functional capabilities rather than aesthetics (e.g., that they have strong legs for running rather than 'chunky legs').

Since social comparisons in sports might also explain the sporting body image-ED psychopathology link, it is possible that partaking in lower-level competitions (e.g., Parkruns) could be better. Once individuals become more elite athletes, the social comparisons may become more polarised to thinner ideals, resulting in higher drive to engage in ED psychopathology. Similarly, those with eating disorders might be discouraged from competitive sports participation until remission, due to the potential for sports participation to increase drive for thinness.

Finally, individuals experiencing body image concerns should be encouraged to access support as soon as possible, due to the role of such concerns as a risk factor for ED psychopathology. The Body Project prevention programme might be particularly useful, since it explores beliefs about the thin ideal (Stice et al., 2012). Moreover, psychological support services should be made clear to individuals by their sports clubs, coaches and gyms. Sports clubs and gyms could be recommended to set up referral links to psychological support for their members experiencing body image difficulties and/or ED psychopathology. To support this, efforts should be made to help coaches identify ED-related concerns, and to avoid making comments that might enhance those concerns (Boudreault et al., 2022).

Conclusions

This longitudinal study contributes to understanding of the relationship between poor body image and ED psychopathology over time, and across sporting subsamples (competitive, non-competitive and sports non-engagers). Poor social body image and better appearance-related sporting body image predicted ED psychopathology for the whole sample. This finding might be explained by social comparison theory and polarisation of the thin-ideal in a sporting context. Recommendations have been made for engaging in sporting competition in ways that

enhance wellbeing, and future research has been suggested to develop these findings into other specific target populations, including diverse gender, age, ethnicities, sports types, and eating-disordered individuals. Finally, the psychological mechanisms that explain the body image- ED psychopathology link remain unclear, suggesting a need for further consideration of how body image has its impact on ED psychopathology over time.

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Appendices

Appendix A

Ethical approval



Downloaded: 04/11/2021
Approved: 04/11/2021

Rachel Burgon
Registration number: 200183770
Psychology
Programme: PSYR09 Clinical Psychology

Dear Rachel

PROJECT TITLE: Exploring the association between sporting activity levels, body dissatisfaction (athletic ideal; social ideal) and eating disorder psychopathology.

APPLICATION: Reference Number 043866

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 04/11/2021 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 043866 (form submission date: 29/10/2021); (expected project end date: 14/05/2023).
- Participant information sheet 1098271 version 2 (29/10/2021).
- Participant consent form 1098273 version 1 (22/10/2021).

If during the course of the project you need to [deviate significantly from the above-approved documentation](#) please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Department Of Psychology Research Ethics Committee
Ethics Administrator
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: <https://www.sheffield.ac.uk/rs/ethicsandintegrity/ethicspolicy/approval-procedure>
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.6710661/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Administrator (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

Appendix B

Information Sheet

A study of sporting levels, body image and eating behaviours



You are being invited to take part in a research project. Before you decide whether to take part, it is important to understand why the research is being done and what it consists of. Please read the following information carefully and ask any questions that you have with the contact details provided.

This is a study looking at body dissatisfaction across differing sporting levels and whether this is related to eating behaviours in the general population.

Who can take part?

To be eligible for this study, you must be 18 years or over and be able to read and write in English. You must not be diagnosed with an eating disorder nor had treatment for an eating disorder within the past 12 months. If you do not match these criteria, then you cannot take part.

Do I have to take part?

No, it is your decision whether you wish to take part. If you decide to take part, you will be asked to sign a consent form.

What will happen if I take part?

The entire study will be completed online via smart phone, tablet or computer device. You will be asked to complete anonymous questionnaires. They should take approximately 25 minutes to complete at three separate time points. If you consent to taking part, you will be taken to a link to fill out online questionnaires. These contain questions that will explore your body image, eating behaviour, self-esteem and perceived evaluations from others.

Three months later, questionnaires on self esteem and perceived evaluations from others will be automatically sent to you. Three months following that, further questionnaires on body image and eating behaviour will then be automatically sent to you to complete. You will then be debriefed on the study. Further instructions about the different questionnaires will be provided prior to completion.

What will happen with my information?

Participation is voluntary and you can withdraw at any time with no negative consequences and without giving an explanation.

Your personal information (e.g. email address), will be kept safe and secure and will only be accessed by the researcher.

The results of the current research will be written up and submitted as a doctoral thesis for the Clinical Psychology Doctorate (DClinPsy) at the University of Sheffield. The study will be submitted

for publication in a scientific journal. Individual participant information will not be included and your data will remain anonymous.

General Data Protection Regulations (GDPR):

New Data protection legislation came into effect in the UK on 25 May 2018. The following section details further information on how your personal information within this research will be used and managed.

The University of Sheffield will be responsible for looking after your information as Data Controller for the study. We must have a basis in the law to be able to use your personal information as part of the research project. The basis is 'a task in the public interest'. Since we are collecting some sensitive information (data about you and your health), we have applied an additional condition in law: the use of your data is 'necessary for scientific or historical research purposes'.

Further information about how and why the University uses your information, and your legal rights can be accessed via the University's Privacy Notice:

<https://www.sheffield.ac.uk/govern/data-protection/privacy/general>.

What if there is a problem?

Below are the contact details of the researcher. This research has been ethically approved by the University of Sheffield Research Ethics Committee.

If you feel that there is a problem at any time during the study or you wish to make a complaint about the way the study has been carried out, please contact:

Rachel Burgon on rburgon1@sheffield.ac.uk (Lead Researcher) or you can email a.sinha@sheffield.ac.uk or leave a telephone message with Amrit Sinha, Research Support Officer on: 0114222 6650 and he will ask Rachel to contact you.

Alternatively, you can contact the other researcher involved in the project: Professor Glenn Waller, (Lecturer and Researcher at the University of Sheffield), on g.waller@sheffield.ac.uk

If you feel your enquiry/complaint has not been handled to your satisfaction, you can contact the Research Director, Dr Jaime Delgadillo, on j.delgadillo@sheffield.ac.uk

Consent

I agree to take part in this study according to the information provided here

Appendix C

Consent Form

Consent Form

Title of project: Exploring the association between sporting activity levels, body dissatisfaction (*athletic ideal; social ideal*) and eating disorder psychopathology.



Name of Researcher: Rachel Burgon

Participant identification number:

<i>Please tick the appropriate boxes</i>	Yes	No
Taking Part in the Project		
I have read and understood the project information sheet or the project has been fully explained to me. <i>(If you will answer No to this question please do not proceed with this consent form until you are fully aware of what your participation in the project will mean.)</i>	<input type="checkbox"/>	<input type="checkbox"/>
I have been given the opportunity to ask questions about the project.	<input type="checkbox"/>	<input type="checkbox"/>
I agree to take part in the project. I understand that taking part in the project will include completing questionnaires at two separate time points.	<input type="checkbox"/>	<input type="checkbox"/>
I understand that my taking part is voluntary and I can withdraw from the study without giving any reason and without there being negative consequences for choosing to withdraw.	<input type="checkbox"/>	<input type="checkbox"/>
How my information will be used during and after the project		
I understand my personal details such as name, phone number, address and email address etc. will not be revealed to people outside the project.	<input type="checkbox"/>	<input type="checkbox"/>
I understand and agree that my words may be quoted in publications, reports, web pages, and other research outputs. I understand that I will not be named in these outputs unless I specifically request this.	<input type="checkbox"/>	<input type="checkbox"/>
I understand and agree that other authorised researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form.	<input type="checkbox"/>	<input type="checkbox"/>
I understand and agree that other authorised researchers may use my data in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.	<input type="checkbox"/>	<input type="checkbox"/>
I give permission for the data collected from the questionnaires that I provide to be stored anonymously and potentially be used for future research and learning	<input type="checkbox"/>	<input type="checkbox"/>
So that the information you provide can be used legally by the researchers		
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.	<input type="checkbox"/>	<input type="checkbox"/>
I agree to take part in the above research project	<input type="checkbox"/>	<input type="checkbox"/>

I consent to taking part in the current study (please tick)

Appendix D

Support Services

If participating in this study has raised any concerns for you, please contact your GP. You can also access the following support:

- **Samaritans** on 116 123 (free 24-hour helpline).
- **MIND** on <https://www.mind.org.uk/>
- **BEAT (Eating Disorders Charity)** helpline on 0808 801 0677. You may also wish to visit their website: <https://www.beateatingdisorders.org.uk/> This includes access to resources, advice and support groups.

Appendix E

Debrief Form

Exploring the association between sporting activity levels, body dissatisfaction (*athletic ideal; social ideal*) and eating disorder psychopathology.

Research has shown that body dissatisfaction is common in the general population. It has also been associated with disordered eating behaviour.

This research aimed to investigate whether body dissatisfaction predicts disordered eating in the sporting population. It also compared those engaging in sports competitively with non-competitive sports people and non-engagers.

You were asked to fill in some background information about yourself and your activity levels. This enabled us to allocate you to either a 'Competitive sports engager', 'Non-competitive sports engager' or 'sports non-engager' group. You were then asked to complete a collection of questionnaires at various time points, including those on body dissatisfaction and eating disorder psychopathology. This was so that we could see whether your answers at time 1, time 2 and time 3 were related to help elucidate whether body dissatisfaction predicts disordered eating behaviours.

We would like to take this opportunity to thank you for participating.

If participating in this study has raised any concerns for you, please contact your GP. You can also access the following support:

- **Samaritans** on 116 123 (free 24-hour helpline).
- **MIND** on <https://www.mind.org.uk/>
- **BEAT (Eating Disorders Charity)** helpline on 0808 801 0677. You may also wish to visit their website: <https://www.beateatingdisorders.org.uk/> This includes access to resources, advice and support groups.
-

If you wish to withdraw your data, please email the researcher listed below and provide the details of the email address you registered with the study. You can withdraw your data up to two weeks after study completion. You do not have to provide a reason with no negative consequences. Your data will be kept securely in password protected files that the researcher will only have access to.

Your details will remain anonymous in the write up of the research.

Contact details of research team:

Rachel Burgon- Lead Researcher (r.burgon1@sheffield.ac.uk)

Professor Glenn Waller- Research Supervisor (g.waller@sheffield.ac.uk)

Amrit Sinha- Research Support Officer (a.sinha@sheffield.ac.uk)

Appendix F

Sport Demographic Questionnaire

Demographics

Participant identifier:

Age: **Gender:**

Height: **Weight:**

Sporting Activity

Please tick the type of sport(s) that you engage with on a weekly basis (*note: this could be more than one sport*) nb. If you attend the gym, please be as specific as possible about the *type of exercise (e.g. HIIT, yoga, combat classes...) please state below the specific sport**

Running* (please indicate mileage/km per week below)	Swimming* (please indicate mileage per week below)	Team Sports*	Gym goer-HIIT*(state type of workouts below)	Weight Category Sports* (Powerlifting, Olympic lifting)	Combat Sports*	Gymnastics	Crossfit
Cycling* (please indicate mileage/km per week below)	Walking/Hiking (excludes commuting)	Other Endurance Sport (not running, cycling, swimming)*	Gym goer-Weights*(state type of workouts below)	Posture/Balance Sports* (e.g. yoga, pilates)	Racket Sports*	Dance	Other

Please expand on * here: (i.e. more info on mileages, specific sport(s))

Is this an individual or team sport/training? Individual/Team

Does your sport require you to be within a particular weight category? Yes/No

How many days per week do you attend the gym/train for your sport?

How many hours per week do you attend the gym/ train for your sport?

What is your competition level (please circle)?

0: I don't compete; 1: I compete recreationally (for fun); 2: I compete locally (competitively) (e.g. regional); 3: I compete nationally (competitively); 4: I compete internationally (competitively); 5: I compete at Olympic/professional level (competitively)

Where would you rate your training in relation to other priorities (e.g. socialising/work/family)?

0: I never prioritise my training over other priorities

1: I rarely prioritise my training over other priorities

2: I sometimes prioritise my training but other activities tend to take priority

3: I try to keep an even balance between my training and other priorities

4: I often prioritise training over other commitments (e.g. often turning down social events in order to train; reducing work hours, sleep duration, housework etc.)

5: I almost always prioritise training over other commitments (e.g. almost always turning down social events in order to train; reducing work hours, sleep duration, housework etc.)

6: I always prioritise training over other commitments (e.g. always turning down social events in order to train; reducing work hours, sleep duration, housework etc.)

Do you have a personal trainer or coach?

Does your coach monitor your body weight?

Are you training for weight loss? Yes/No

Are you training for muscle gain? Yes/No

Are you training for your mental wellbeing? Yes/No

Has Covid affected your abilities to workout?

If so, please explain how (reduced/increased activity, different activity, ability to compete etc.)

Appendix G

Contextual Body Image Questionnaire for Athletes (CBIQA) (de Bruin et al., 2011)

Contextual Body Image Questionnaire

The next questions deal with how satisfied you are with your body and your appearance. There are no true or false answers. Do not think too long about your answers and do not skip any questions.

	In daily life, ... or Concerning my sport, ...	Very ugly	Ugly	Somewhat Ugly	Neither, ugly, nor beautiful	Somewhat Beautiful	Beautiful	Very beautiful
a	I think my appearance is:*	1	2	3	4	5	6	7
b	I think my appearance compared to others is:	1	2	3	4	5	6	7
c	others think my appearance is:	1	2	3	4	5	6	7
	In daily life, ... or Concerning my sport, ...	Much too thin	Too thin	Somewhat too thin	Neither too thin, nor too fat	Somewhat too fat	Too fat	Much too fat
a	I think my body shape is:	1	2	3	4	5	6	7
b	I think my body shape compared to others is:	1	2	3	4	5	6	7
c	others think my body shape is:	1	2	3	4	5	6	7
	In daily life, ... or Concerning my sport, ...	Much too unmuscular	Too unmuscular	Somewhat too unmuscular	Neither too unmuscular, nor too muscular	Somewhat too muscular	Too muscular	Much too muscular
a	I think the muscularity of my body is:	1	2	3	4	5	6	7
b	I think the muscularity of my body compared to others is:	1	2	3	4	5	6	7
c	others think the muscularity of my body is:	1	2	3	4	5	6	7
	In daily life, ... or Concerning my sport, ...	Much too low	Too low	Somewhat too low	Neither too low, nor too high	Somewhat too high	Too high	Much too high
a	I think my body weight is:	1	2	3	4	5	6	7
a	I think my fat percentage is:	1	2	3	4	5	6	7
b	I think my body weight compared to others is:	1	2	3	4	5	6	7
b	I think my fat percentage compared to others is:	1	2	3	4	5	6	7
c	others think my body weight is:	1	2	3	4	5	6	7
c	others think my fat percentage is:	1	2	3	4	5	6	7

a, own perception; b, own perception compared to others; c, perceived opinion of others.

*The original Dutch verb 'vinden' refers to both to think and to feel.

Appendix H

Body Appreciation Scale-2 (BAS-2) (Tylka & Wood-Barcalow, 2015)

Body Appreciation Scale-2

Permission to use this measure is not required.

For each item, the following response scale should be used:

1 = Never, 2 = Seldom, 3 = Sometimes, 4 = Often, 5 = Always.

Directions for participants: Please indicate whether the question is true about you never, seldom, sometimes, often, or always.

- 1. I respect my body.*
- 2. I feel good about my body.*
- 3. I feel that my body has at least some good qualities.*
- 4. I take a positive attitude towards my body.*
- 5. I am attentive to my body's needs.*
- 6. I feel love for my body.*
- 7. I appreciate the different and unique characteristics of my body.*
- 8. My behavior reveals my positive attitude toward my body; for example, I hold my head high and smile.*
- 9. I am comfortable in my body.*
- 10. I feel like I am beautiful even if I am different from media images of attractive people (e.g., models, actresses/actors).*

Scoring Procedure: Average participants' responses to Items 1–10.

Appendix I

Eating Disorder Examination Questionnaire (EDEQ) (Fairburn & Beglin, 2008)



Eating Disorder examination questionnaire (EDE-Q 6.0)

Instructions: The following questions are concerned with the past four weeks (28 days) only.

Please read each question carefully. Please answer all the questions. Thank you.

Questions 1 to 12: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days) only.

	ON HOW MANY OF THE PAST 28 DAYS ...	NO DAYS	1-5 DAYS	6-12 DAYS	13-15 DAYS	16-22 DAYS	23-27 DAYS	EVERY DAY
1	Have you been deliberately trying to limit the amount of food you eat to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
2	Have you gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your shape or weight?	0	1	2	3	4	5	6
3	Have you tried to exclude from your diet any foods that you like in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
4	Have you tried to follow definite rules regarding your eating (for example, a calorie limit) in order to influence your shape or weight (whether or not you have succeeded)?	0	1	2	3	4	5	6
5	Have you had a definite desire to have an empty stomach with the aim of influencing your shape or weight?	0	1	2	3	4	5	6
6	Have you had a definite desire to have a totally flat stomach?	0	1	2	3	4	5	6
7	Has thinking about food, eating or calories made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
8	Has thinking about shape or weight made it very difficult to concentrate on things you are interested in (for example, working, following a conversation, or reading)?	0	1	2	3	4	5	6
9	Have you had a definite fear of losing control over eating?	0	1	2	3	4	5	6
10	Have you had a definite fear that you might gain weight?	0	1	2	3	4	5	6
11	Have you felt fat?	0	1	2	3	4	5	6
12	Have you had a strong desire to lose weight?	0	1	2	3	4	5	6

PAGE 1/3 PLEASE GO TO THE NEXT PAGE



Eating Disorder examination questionnaire (EDE-Q 6.0)

Questions 13-18: Please fill in the appropriate number in the boxes on the right. Remember that the questions only refer to the past four weeks (28 days).

Over the past four weeks (28 days)....

13	Over the past 28 days, how many times have you eaten what other people would regard as an unusually large amount of food (given the circumstances)?	
14	... On how many of these times did you have a sense of having lost control over your eating (at the time you were eating)?	
15	Over the past 28 days, on how many DAYS have such episodes of overeating occurred (i.e. you have eaten an unusually large amount of food and have had a sense of loss of control at the time)?	
16	Over the past 28 days, how many times have you made yourself sick (vomit) as a means of controlling your shape or weight?	
17	Over the past 28 days, how many times have you taken laxatives as a means of controlling your shape or weight?	
18	Over the past 28 days, how many times have you exercised in a "driven" or "compulsive" way as a means of controlling your weight, shape or amount of fat, or to burn off calories?	

Questions 19 to 21: Please circle the appropriate number. Please note that for these questions the term "binge eating" means eating what others would regard as an unusually large amount of food for the circumstances, accompanied by a sense of having lost control over eating.

		NO DAYS	1-5 DAYS	6-12 DAYS	13-15 DAYS	16-22 DAYS	23-27 DAYS	EVERY DAY
19	Over the past 28 days, on how many days have you eaten in secret (i.e. furtively)? ... Do not count episodes of binge eating.	0	1	2	3	4	5	6
		NONE OF THE TIMES	A FEW OF THE TIMES	LESS THAN HALF	HALF OF THE TIMES	MORE THAN HALF	MOST OF THE TIME	EVERY TIME
20	On what proportion of the times that you have eaten have you felt guilty (felt that you've done wrong) because of its effect on your shape or weight? ... Do not count episodes of binge eating.	0	1	2	3	4	5	6
			NOT AT ALL	SLIGHTLY	MODERATELY	MARKEDLY		
21	Over the past 28 days, how concerned have you been about other people seeing you eat? ... Do not count episodes of binge eating.	0	1	2	3	4	5	6

PAGE 2/3 PLEASE GO TO THE NEXT PAGE



Eating Disorder examination questionnaire (EDE-Q 6.0)

Questions 22 to 28: Please circle the appropriate number on the right. Remember that the questions only refer to the past four weeks (28 days).

	ON HOW MANY OVER THE PAST 28 DAYS ...	NOT AT ALL	SLIGHTLY		MODERATELY		MARKEDLY	
22	Has your weight influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
23	Has your shape influenced how you think about (judge) yourself as a person?	0	1	2	3	4	5	6
24	How much would it have upset you if you had been asked to weigh yourself once a week (no more, or less, often) for the next four weeks?	0	1	2	3	4	5	6
25	How dissatisfied have you been with your weight ?	0	1	2	3	4	5	6
26	How dissatisfied have you been with your shape ?	0	1	2	3	4	5	6
27	How uncomfortable have you felt seeing your body (for example, seeing your shape in the mirror, in a shop window reflection, while undressing or taking a bath or shower)?	0	1	2	3	4	5	6
28	How uncomfortable have you felt about others seeing your shape or figure (for example, in communal changing rooms, when swimming, or wearing tight clothes)?	0	1	2	3	4	5	6

What is your weight at present? (Please give your best estimate.): _____

What is your height? (Please give your best estimate.): _____

If female: Over the past three to four months have you missed any menstrual periods?: YES NO

If so, how many?:

Have you been taking the "pill"?: YES NO

Appendix J

Rosenberg Self-Esteem Scale (Rosenberg, 1965)

RSES

Please record the appropriate answer for each item, depending on whether you Strongly agree, agree, disagree, or strongly disagree with it.

- 1 = Strongly agree
- 2 = Agree
- 3 = Disagree
- 4 = Strongly disagree

- ___ 1. On the whole, I am satisfied with myself.
- ___ 2. At times I think I am no good at all.
- ___ 3. I feel that I have a number of good qualities.
- ___ 4. I am able to do things as well as most other people.
- ___ 5. I feel I do not have much to be proud of.
- ___ 6. I certainly feel useless at times.
- ___ 7. I feel that I'm a person of worth.
- ___ 8. I wish I could have more respect for myself.
- ___ 9. All in all, I am inclined to think that I am a failure.
- ___ 10. I take a positive attitude toward myself.

Appendix K

Brief Fear of Negative Evaluations Scale (BFNE) (Leary, 1983)

Brief Fear of Negative Evaluation Scale Leary (1983)

Read each of the following statements carefully and indicate how characteristic it is of you according to the following scale:

- 1 = Not at all characteristic of me
- 2 = Slightly characteristic of me
- 3 = Moderately characteristic of me
- 4 = Very characteristic of me
- 5 = Extremely characteristic of me

- _____ 1. I worry about what other people will think of me even when I know it doesn't make any difference.
- _____ 2. I am unconcerned even if I know people are forming an unfavorable impression of me.
- _____ 3. I am frequently afraid of other people noticing my shortcomings.
- _____ 4. I rarely worry about what kind of impression I am making on someone.
- _____ 5. I am afraid others will not approve of me.
- _____ 6. I am afraid that people will find fault with me.
- _____ 7. Other people's opinions of me do not bother me.
- _____ 8. When I am talking to someone, I worry about what they may be thinking about me.
- _____ 9. I am usually worried about what kind of impression I make.
- _____ 10. If I know someone is judging me, it has little effect on me.
- _____ 11. Sometimes I think I am too concerned with what other people think of me.
- _____ 12. I often worry that I will say or do the wrong things.

Appendix L

Social Appearance Anxiety Scale (Hart et al., 2008)

SOCIAL APPEARANCE ANXIETY SCALE

Directions: Please indicate how characteristic each statement is of you, using the response scale provided.

Not at all	A little	Sometimes	A lot	Extremely
1	2	3	4	5

1. I feel comfortable with the way I appear to others.
2. I feel nervous when having my picture taken.
3. I get tense when it is obvious people are looking at me.
4. I am concerned people would not like me because of the way I look.
5. I worry that others talk about flaws in my appearance when I am not around.
6. I am concerned people will find me unappealing because of my appearance.
7. I am afraid that people find me unattractive.
8. I worry that my appearance will make life more difficult for me.
9. I am concerned that I have missed out on opportunities because of my appearance.
10. I get nervous when talking to people because of the way I look.
11. I feel anxious when other people say something about my appearance.
12. I am frequently afraid I would not meet others' standards of how I should look.
13. I worry people will judge the way I look negatively.
14. I am uncomfortable when I think others are noticing flaws in my appearance.
15. I worry that a romantic partner will/would leave me because of my appearance.
16. I am concerned that people think I am not good looking.

Appendix M

Numbers of participants partaking in the respective sports

	Running	Cycling	Swimming	Hiking	Team Sports	Other Endurance	Gymgoer HIIT	Gymgoer Weights	Weight Category Sport	Posture/ Balance	Combat Sport	Racket Sport	Gymnastics	Dance	Crossfit	Other Sport	No Sport
Competitive sports	87	40	19	33	25	6	13	45	5	29	5	5	4	5	5	7	117
Non-competitive sports	214	66	43	127	13	5	80	124	15	102	8	4	2	5	22	18	276
Sports Non-engager	43	18	13	50	13	3	14	23	5	26	7	8	1	4	3	9	24
Total	344	124	75	210	51	14	107	192	25	157	20	17	7	14	30	34	417

Note. Participants could record more than one activity. Sports non-engagers may have listed sports but had not fulfilled the criteria for sports

engagers.