Body Dissatisfaction in Adolescent Boys

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Body dissatisfaction is a significant mental health symptom present in adolescent girls and boys. However, it is often either disregarded in adolescent boys or examined using assessments that may not resonate with males. The present study addresses these issues, examining the manifestation, etiology, and correlates of 3 facets of body dissatisfaction in adolescent boys. Adolescent male twins aged 16- to 17-years-old from the Swedish Twin Study of Child and Adolescent Development were included along with a female comparison group: 915 monozygotic and 671 dizygotic same-sex twins. Body dissatisfaction was defined using measures of height dissatisfaction, muscle dissatisfaction, and the body dissatisfaction subscale of the Eating Disorder Inventory (EDI-BD). We examined the prevalence of body dissatisfaction, whether the facets of body dissatisfaction were phenotypically and etiologically distinct, and associations with specific externalizing and internalizing symptoms. For boys, muscle dissatisfaction scores were greater than height dissatisfaction scores. Results also indicated that height and muscle dissatisfaction were phenotypically and etiologically distinct from the EDI-BD. Unique associations were observed with externalizing and internalizing symptoms: muscle dissatisfaction with symptoms of bulimia nervosa and the EDI-BD with internalizing symptoms, body mass index, and drive for thinness. The facets of body dissatisfaction were also largely distinct in girls and unique between-sex associations with externalizing and internalizing symptoms emerged. Overall, male-oriented aspects of body dissatisfaction are distinct from female-oriented aspects of body dissatisfaction. To capture the full picture of male body dissatisfaction, multiple facets must be addressed.

Keywords: body dissatisfaction, muscle dissatisfaction, height dissatisfaction, adolescence

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Body dissatisfaction, referring to the negative evaluation of one's body, is a concerning mental health symptom afflicting both adolescent girls and boys. Body dissatisfaction tends to onset during adolescence; it has been estimated that 49 to 84% of adolescents experience body dissatisfaction (Dion et al., 2015), with this dissatisfaction increasing over time (Bucchianeri, Arikian, Hannan, Eisenberg, & Neumark-Sztainer, 2013). Body dissatisfaction is associated with poor psychological health and well-being for both sexes (Cafri, Strauss, & Thompason, 2002; Griffiths et al., 2017; Olivardia, Pope, Borowiecki, & Cohane,

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2004); yet, there is a paucity of studies investigating body dissatisfaction among adolescent boys compared with girls (Murray et al., 2017). Because body dissatisfaction among males is understudied, the present study aims to further knowledge regarding adolescent male body dissatisfaction prevalence, etiology, and correlations with symptoms of externalizing and internalizing disorders.

Body Dissatisfaction in Boys

Up to 80% of boys report body dissatisfaction (Tiggemann, Martins, & Churchett, 2008). Important distinctions exist between body dissatisfaction observed in adolescent girls and boys: girls almost exclusively report wanting to be smaller and thinner, whereas some boys want to be thinner and others desire to be bigger (i.e., muscular; Calzo et al., 2015; Dakanalis, Favagrossa, et al., 2015; Dion et al., 2016). Boys also tend to be more dissatisfied when their body mass index (BMI) is below or above average; girls tend to be dissatisfied when their BMI is average or above average (Calzo et al., 2012; Dion et al., 2015). Despite these and other validated distinctions, male-specific measures of body dissatisfaction were nearly nonexistent until the last few decades (Dakanalis, Timko, et al., 2015; Murray et al., 2017; Ralph-Nearman & Filik, 2018; Tylka, Bergeron, & Schwartz, 2005). Thus, female-centric assessment measures that are typically thinness-oriented broad measures of body dissatisfaction (i.e., dissatisfaction with one's body as a whole or overall body dissatisfaction, focusing on a desire to lose weight or be smaller) were applied to males.

The three central aspects of body dissatisfaction for adult males that have been described in the literature include muscularity, height, and body fat dissatisfaction (Bergeron & Tylka, 2007; Tylka et al., 2005), are not typically captured by thinness-oriented broad measures of body dissatisfaction. These three facets emulate the male societal ideal (i.e., tall, lean, or muscular) and are likely interrelated (Bergeron & Tylka, 2007). Specifically, in service of conforming to the male ideal, adolescent boys may desire to lower their body fat while simultaneously increasing their muscularity. This leads to both a "drive for leanness," referring to a desire for the absence of body adiposity, and a "drive for muscularity," which refers to a preoccupation with increasing muscle (Griffiths, Murray, & Touyz, 2013a). Indeed, up to 82% of adolescent boys want to be more muscular (Tiggemann et al., 2008), with greater than 90% reporting exercising to increase muscularity, and more than two thirds report making dietary changes to increase muscle size or tone (Eisenberg, Wall, & Neumark-Sztainer, 2012). Muscularity and height are also the two most important factors identified by teenage boys in defining the ideal male body (Jones, 2001). Thus, muscularity and height may be particularly important facets of body dissatisfaction for adolescent boys that drive distinct behaviors.

Negative Correlates of Body Dissatisfaction

Broad Body Dissatisfaction

A number of negative health constructs are significantly associated with broad body dissatisfaction (i.e., how dissatisfied one is with his or her body as a whole or overall dissatisfaction) in adolescent boys and girls including stress (Murray, Rieger, & Byrne, 2015), low self-esteem and depression (Choi & Choi, 2016; Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006; Richard, Rohrmann, Lohse, & Eichholzer, 2016), anxiety (Dakanalis, Favagrossa, et al., 2015), suicidal ideation (Crow, Eisenberg, Story, & Neumark-Sztainer, 2008), eating disorders (Stice, 2002), and reduced quality of life (Griffiths et al., 2017). However, there is a complex bidirectional relationship between certain negative outcomes and body dissatisfaction. For example, whereas depressive symptoms predict body dissatisfaction in early adolescence and early adulthood, body dissatisfaction predicts depressive symptoms in middle adolescence (Sharpe et al., 2017). Further, in boys specifically, internalizing symptoms at age 11–12 years predicted body dissatisfaction 1 year later whereas the opposite was true for girls (Patalay, Sharpe, & Wolpert, 2015).

Externalizing symptoms are also associated with broad body dissatisfaction. For example, 7 to 8% of boys and girls with attention-deficit-hyperactivity disorder (ADHD) had body dissatisfaction scores over 2 *SD*s above the mean of those without ADHD (Mikami et al., 2010). The hallmark features of ADHD, impulsivity and inattention, could indirectly lead to increased body dissatisfaction via weight status. Impulsivity may lead to rash decisions regarding eating behaviors (Thamotharan, Lange, Zale, Huffhines, & Fields, 2013) whereas inattention could cause difficulty attending to satiety cues (Davis, Levitan, Smith, Tweed, & Curtis, 2006). Both of these may lead to increased BMI and, indeed, adolescents with ADHD are more likely to be overweight or obese compared with those who do not have ADHD (Halfon, Larson, & Slusser, 2013). Alternatively, stimulant treatment may result in weight changes (Hasnain & Vieweg, 2013) that negatively affect body image in boys yet positively impact body image in girls (e.g., weight loss).

Robust bidirectional associations also exist between substance use and broad measures of body dissatisfaction: adolescents who are dissatisfied with their bodies are significantly more likely to use substances and those who use substances are more likely to be dissatisfied with their bodies (Marti, Stice, & Springer, 2010; Peñas-Lledó, Sancho, & Waller, 2002; Stice & Shaw, 2003). Those who are body dissatisfied may turn to substances as a means of coping with the negative affect generated by the body dissatisfaction similar to the escape theory of binge eating (Heatherton & Baumeister, 1991). For males, broad body dissatisfaction has a bidirectional relation with anabolic steroids. Adolescent boys who viewed themselves as underweight or overweight were significantly more likely to use anabolic steroids compared with boys who viewed themselves as about the right weight (Jampel, Murray, Griffiths, & Blashill, 2016). Male adolescents who used or contemplated using anabolic steroids also endorsed more body image concerns than nonusers (Jenssen & Johannessen, 2015), perhaps in pursuit of changing their body. Alternatively, as implied in theory underlying cognitive behavior therapy for eating disorders (Fairburn, Cooper, & Shafran, 2003), engaging in an extreme weight control behavior, such as steroid use, could increase overevaluation of shape and/or weight resulting in body dissatisfaction. Given that males tend to engage in externalizing behaviors more frequently than females (Carragher et al., 2014), further study into the association between externalizing symptoms and body dissatisfac-

tion in adolescent boys may uncover additional unique associations.

Height Dissatisfaction

Although less frequently addressed in the literature, height dissatisfaction is associated with a higher drive for muscularity (Tylka et al., 2005), depression (Bergeron & Tylka, 2007), more physical appearance comparison, lower self-esteem, and lower appearance self-esteem (Tiggemann et al., 2008; Tylka et al., 2005). In boys aged 6 to 14 years, lower height gains over time were associated with higher scores on the drive for thinness and bulimia subscales of the Eating Disorder Inventory for Children 3 years later (Gardner, Stark, Friedman, & Jackson, 2000). Thus, height dissatisfaction is a vital construct to evaluate when considering male body dissatisfaction and is essential in providing a complete picture of male body image (Bergeron & Tylka, 2007).

Muscle Dissatisfaction

Muscle dissatisfaction, or muscularity-oriented body image concerns (Lavender, Brown, & Murray, 2017; Murray et al., 2017), in boys is associated with depression, low self-esteem, and anxiety (McCabe, Ricciardelli, & Banfield, 2001; McCreary & Sasse, 2000), social physique anxiety (Brunet, Sabiston, Dorsch, & McCreary, 2010), perceived peer pressure and body shame (Mustapic, Marcinko, & Vargek, 2015) as well as with dieting, bulimic symptoms, and general eating pathology (Bratland-Sanda & Sundgot-Borgen, 2012; Murray et al., 2017; Rodgers, Ganchou, Franko, & Chabrol, 2012). Interestingly, there is a unique association between depressive symptoms and low self-esteem and drive for muscularity in adolescent boys, which is not observed in girls (McCreary & Sasse, 2000). Finally, longitudinal studies have found high levels of muscularity concern predict later disordered eating behavior (Hoffmann & Warschburger, 2017).

In terms of externalizing behaviors, performance- and appearance- enhancing drug use among adolescent boys (Cafri, van den Berg, & Thompson, 2006; Calzo et al., 2015; McCabe & Ricciardelli, 2004) and more positive attitudes about and intentions to use illegal substances (Zelli, Lucidi, & Mallia, 2010) are associated with muscularity-oriented body image concerns. Specifically, adolescent boys who had concerns about muscularity were at increased risk for illicit drug use (Calzo et al., 2016) and those who had concerns about their muscularity and used performance- and appearance-enhancing drugs were more likely to engage in frequent binge drinking (Neumark-Sztainer, Paxton, Hannan, Haines, & Story, 2006).

Risk for Body Dissatisfaction

Personality (MacNeill, Best, & Davis, 2017), BMI (Duchin et al., 2015), late pubertal development (de Guzman & Nishina, 2014), cognitive styles (Griffiths, Murray, & Touyz, 2013b), and gender dysphoria (Becker et al., 2018) may play a role in the etiology and/or maintenance of body dissatisfaction in boys. Genetic factors also influence body dissatisfaction: heritabilities range from 38 to 63% and are estimated to be lower for males than females (Trace, Baker, Peñas-Lledó, & Bulik, 2013). We are aware of only one genetic study to date that has assessed muscle dissatisfaction in young adult men and estimated heritability to be 42% (Raevuori, Keski-Rahkonen, Rose, Rissanen, & Kaprio, 2006).

Sociocultural factors also play a role in the development of body dissatisfaction in adolescent boys. Specifically, the sociocultural theory of body dissatisfaction—or The Tripartite Influence Model (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999), which has been modified for men (Stratton, Donovan, Bramwell, & Loxton, 2015; Tylka, 2011), posits that media, peers, and parents influence the development of body dissatisfaction. More specifically, Western society's "masculine ideal of lean muscularity" (Leon, Fulkerson, Perry, Keel, & Klump, 1999, p. 194) may influence adolescent boys' body dissatisfaction similar to how the ultrathin body ideal influences girls (McCabe & Ricciardelli, 2004; Murray et al., 2017). Messages about the ideal male body may also be transmitted by peers and parents through conversations, modeling, and teasing or modeling of appearance-related attitudes and behaviors (Tatangelo, McCabe, Mellor, & Mealey, 2016). Internalization of the masculine ideal and appearance comparison behavior may result in body dissatisfaction and muscle dysmorphia symptoms in boys (Barcaccia et al., 2018; Klimek, Murray, Brown, Gonzales Iv, & Blashill, 2018). However, although societal shifts focused on body acceptance for females may be countering the ultrathin body ideal for girls, sociocultural pressure for males is stable: thinness-oriented body dissatisfaction gradually decreases across time (cross-sectionally) in females whereas muscularity-oriented body image concerns in males does not (Karazsia, Murnen, & Tylka, 2017). Overall, much less is known about the etiology and maintenance of body dissatisfaction in males compared with females.

Current Study

Body dissatisfaction is a mental health concern for adolescent boys, yet little is known about its manifestation, etiology, and correlates. Moreover, many questions remain unanswered about aspects of body dissatisfaction that may be considered more male-oriented (e.g., muscularity). The purpose of the present study was to explore height, muscle, and broad body dissatisfaction in adolescent boys, and compare with an adolescent female group. We addressed the following aims: (a) examine mean scores for height, muscle, and broad body dissatisfaction in a sample of 16- to 17-year-old Swedish twins; (b) evaluate the phenotypic associations between height, muscle, and broad body dissatisfaction; (c) evaluate the genetic associations between height, muscle, and broad body dissatisfaction; and (d) examine the association between specific externalizing and internalizing symptoms and these facets of body dissatisfaction.

Method

Participants

The current study included twins from the Swedish Twin Study of Child and Adolescent Development (TCHAD; Lichtenstein, Tuvblad, Larsson, & Carlström, 2007). TCHAD includes 1,480 twin pairs born between May 1985 and December 1986 who were recruited through the National Swedish Medical Birth Registry. Participants have been followed since 1994 and four assessment waves have been completed. Only twins who participated in Wave 3 (when the twins were 16- to 17-years-old and the variables of

interest were assessed) were included in the present study. Approximately 82% of all twins contacted participated in Wave 3 (Lichtenstein et al., 2007). Attrition in TCHAD did not significantly impact parental self-reports of education, unemployment, or neighborhood crime rate (Lichtenstein et al., 2007). However, families that did not participate in TCHAD tended to live in more ethnically diverse neighborhoods. Hyperactivity-impulsivity was also significantly elevated in twins lost to follow-up at Wave 3 (Lichtenstein et al., 2007).

Zygosity of twins was determined based on computer algorithms applied to a standard set of questions about the twins' physical similarity to one another and the frequency with which other people confuse them with each other. The algorithms were obtained from a discriminant analysis of 106 same-sex pairs where zygosity had been determined by typing 16 polymorphic DNA markers (Lichtenstein et al., 2007). The current sample includes 428 monozygotic (MZ) and 312 dizygotic (DZ) same-sex male twins and a comparison sample of 487 MZ and 359 DZ same-sex female twins. Karolinska Institutet ethics committee approved data collection (02–071; TCHAD). This study was declared exempt human subjects research approved by the University of North Carolina Institutional Review Board.

Measures

Twins and parents identified through the National Swedish Medical Birth Register were mailed study questionnaires. Because of the population-based nature of the register, all information was assessed via self-report.

Body dissatisfaction. Height dissatisfaction was assessed with the item: "I'm happy with my height." Muscle dissatisfaction was assessed with the item: "I would like to be more muscular." Response options were: never, rarely, sometimes, often, very often, or always. For both, item responses were scored such that a score of zero reflected no dissatisfaction and a score of five indicated complete dissatisfaction (thus, height dissatisfaction was reverse scored for analyses). The eight-item body dissatisfaction subscale of The Eating Disorder Inventory-2 (Garner, 1991) was used as a measure of broad body dissatisfaction (EDI-BD) and scored according to the EDI manual where higher scores indicate greater body dissatisfaction.

Externalizing and internalizing symptoms. The Youth Self Report (YSR) was used to examine internalizing and externalizing symptoms (YSR 11–18 years; Achenbach, 1991). Items inquire about problems experienced over the 6 months before survey completion and are rated on a 3-point scale regarding their presence. We included the two broad factors, internalizing problems (YSR-internalizing) and externalizing problems (YSR-externalizing), from the YSR. The reliabilities of the internalizing and externalizing factors were .90 and .84, respectively.

The Conners-Wells Adolescent Self-Report Scale: Short Form (CASS; Conners et al., 1997) was used to measure symptoms of ADHD. The CASS yields three subscales, oppositional problems (CASS-opposition), cognitive problems/inattention (CASS-inattention), and hyperactivity (CASS-hyperactivity), and an ADHD index (CASS-ADHD) that is distinct from subscale scores and assesses probable ADHD diagnosis. Items are scored on a Likert scale (4-Point, 0-3) ranging from *not true at all* to *very much true* with higher scores reflecting increased pathology. Alphas for the current sample were estimated between .75 and .80 for all subscales.

Eating disorder symptoms were measured using the EDI drive for thinness (EDI-DT; i.e., excessive concern with dieting, preoccupation with weight and an extreme pursuit of thinness) and bulimia (EDI-B: i.e., tendency toward episodes of binge eating with a single item asking about the impulse to induce vomiting after binge eating) subscales. The EDI has been translated and validated on a Swedish female population (Nevonen, Clinton, & Norring, 2006). Previous confirmatory factor analyses indicated that the original EDI factor solution reflected a reasonable fit and that reliabilities were acceptable for the current sample (Baker et al., 2009). To address engagement in specific weight loss behaviors, lifetime purging for weight loss purposes and dieting were queried. Items were coded dichotomously to indicate whether the participant had or had not ever engaged in purging behaviors for weight loss purposes or dieting behaviors.

Tobacco, alcohol, and illicit substance use were also assessed. Participants reported smoking frequency based on the following response options: (0) never used, (1) tried it, (2) only sometimes/once in a while/only on weekends or at parties, and (3) daily or almost daily use. For alcohol use, participants indicated whether or not they had used alcohol in the past month and whether they ever experienced alcohol intoxication. Finally, participants reported whether they had ever used illicit drugs in their lifetime (yes/no).

Body mass index (BMI). Self-reported height and weight were used to calculate BMI. Consistent with previous TCHAD studies (Yilmaz et al., 2017), we used age- and sex- specific means and *SD*s from a sample of Swedish children born in 1981 to remove values 6 *SD*s above or below the mean for height and log(weight; Werner & Bodin, 2006). Sex-adjusted BMI *z*-scores (BMIz) were then created.

Statistical Analysis

Analyses were completed with SAS Version 9.4 (SAS Institute Inc., 2004) and applied to males and females separately. Girls were included for comparison purposes. For Aim 1, descriptive statistics for body dissatisfaction were calculated.

To examine the phenotypic association between height and muscle dissatisfaction (i.e., male-oriented dissatisfaction) and the items that comprise the EDI-BD (i.e., female-oriented body dissatisfaction), a canonical correlation analysis was applied (Aim 2). This analysis assessed the association between the variable *sets*. Here, the two sets of variables are male-oriented body dissatisfaction and female-oriented body dissatisfaction. The canonical correlation analysis parsimoniously describes the number and nature of the independent relationships that exist between these two sets of variables.

The maximum number of canonical correlations generated is equal to the number of measures in the smaller set—here, this would be two: the number of measures in the height and muscle dissatisfaction set. The size of each correlation indicates the strength of the association between the pair of canonical variates, which are latent variables that represent the multiple measures in our two variable sets and are linear combinations (or weighted sums) of the original measures. Canonical correlations are created from the shared variance of the two variable sets. The first pair of canonical variates maximizes the correlation between the two sets.

The next pair of variates is constructed from the residuals and maximizes the correlation between them. Thus, the canonical correlations provide information as to whether the male-oriented and female-oriented body dissatisfaction sets are phenotypical distinct and whether the EDI-BD (in)adequately represents height and muscle dissatisfaction (i.e., a small observed correlation).

Aim 3 evaluated the genetic association between body dissatisfaction facets, using a Cholesky twin model (see Figure 1) applied with the program Mx (Neale, 1997). Data were treated as ordinal, and a raw data approach was used. The Cholesky model decomposes the variance of each variable (here, muscle dissatisfaction, height dissatisfaction, and EDI-BD) and estimates the genetic (A; cumulative impact of many genes, heritability), common environmental (C; environments that make twins similar), and unique environmental (E; environments that make twins dissimilar including measurement error) influences for each trait as the proportion of variance accounted for by A (a^2), C (c^2), and E (e^2). The Cholesky decomposition also provides estimates of the genetic (r_a), common environment (r_c), and unique environment (r_e) correlations, which reflect the extent to which the traits share genetic and environmental factors.

The Cholesky model places importance on the ordering of the variables. The model provides information on the overlap between the first variable's genetic factors with the second and third variables, the overlap between the second variable's genetic and environmental factors with the third variable, as well as the residual estimates for the third variable not accounted for by the first and second variables. To determine how much of the genetic and environmental variance for EDI-BD is accounted for by height and muscle dissatisfaction and to evaluate residual genetic and environmental estimates for EDI-BD not shared with height or muscle dissatisfaction, the variables were entered in the following order: height dissatisfaction, muscle dissatisfaction, and EDI-BD.

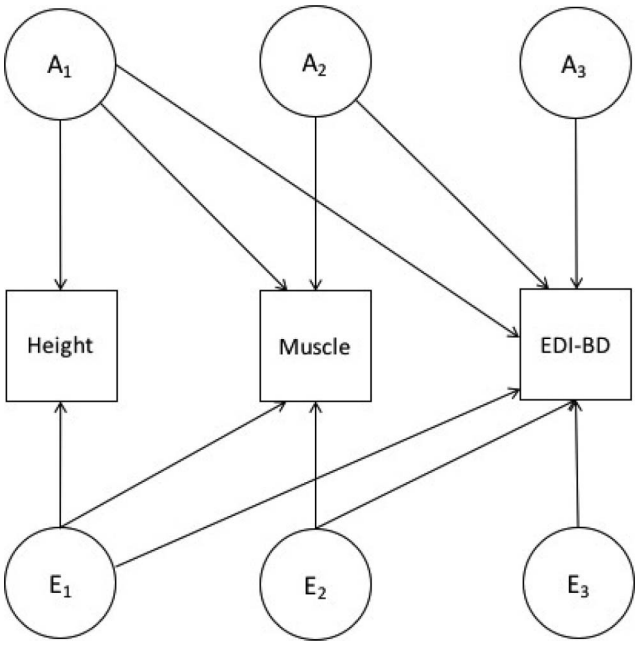

Figure 1. Genetic and unique environmental multivariate Cholesky model. Common environment, or C, paths are not shown, but would be reflected as the A and E paths are. Height = height dissatisfaction; muscle = muscle dissatisfaction; EDI-BD = Eating Disorder Inventory Body Dissatisfaction Subscale.

The fit of the full ACE model, which estimates A, C, and E for each trait, as well as r_a, r_c, and r_e was compared with two nested models, the AE (all common environmental effects are set to zero) and CE (all genetic effects are set to zero) models, using the difference in twice the negative log-likelihood of the models, which is distributed as a χ^2. A significant change in χ^2 indicates a significantly worse fitting model and the model is rejected. Model fit was also assessed with the Akaike's Information Criterion (AIC). Models with lower AIC values indicate a better balance between parsimony and goodness of fit. Models with fewer parameters are preferable if they do not result in a significantly worse fit because of parsimony; thus, the model with lowest AIC is retained as the best-fitting model.

Aim 4 evaluated the associations between specific externalizing and internalizing symptoms and body dissatisfaction. We first explored sex-specific correlations between height dissatisfaction, muscle dissatisfaction, and the EDI-BD with all variables of interest described above (e.g., the EDI, YSR, CASS, substance use, and BMIz). Correlation results were used as a guide for Aim 4 analyses such that those variables with an observed correlation $>.10$ with body dissatisfaction, which corresponds to at least a small effect (Cohen, 1992), were included in follow-up analyses. BMIz was included as a covariate when a correlation of $>.10$ was observed with body dissatisfaction. Next, generalized linear models were applied using the PROC GLIMMIX procedure, which allows for the use of ordinal (i.e., height and muscle dissatisfaction) and continuous (i.e., EDI-BD) outcomes as well as categorical and continuous independent variables. A repeated measures statement was applied to the model to correct for the nonindependence of the twin data. In this procedure, βs and *SE*s are adjusted to account for the relatedness of the twins. Because of the number of potential variables included in the models, a p value $< .01$ was used to determine significance.

Results

Aim 1: Prevalence of Height, Muscle, and General Body Dissatisfaction

Descriptive information is provided in Table 1.

Boys. Boy's body dissatisfaction scores (*M* [*SD*]) were as follows: muscle dissatisfaction = 3.0 (1.7), height dissatisfaction = 1.1 (1.4), and the EDI-BD = 2.0 (3.5). For height dissatisfaction, 67% of boys reported low dissatisfaction (scores of never or rarely), whereas, for muscle dissatisfaction, 79.3% of boys reported intermediate to severe dissatisfaction (scores of sometimes/often or very often/always).

Girls. Mean scores were as follows (*M* [*SD*]): muscle dissatisfaction = 2.2 (1.6), height dissatisfaction = 2.0 (1.7), and EDI-BD = 5.6 (6.0). Similar to boys, a majority of girls reported intermediate to severe muscle dissatisfaction (66%). However, 50% of girls reported low height dissatisfaction and 50% reported intermediate to severe height dissatisfaction. Significant sex differences were observed between boys and girls for all measures (see Table 1).

Table 1
Mean Scores and Prevalence[a] (%) for Body Dissatisfaction

Body dissatisfaction	Mean (*SD*)	Range	Low dissatisfaction frequency (%)	Intermediate dissatisfaction frequency (%)	Severe dissatisfaction frequency (%)
Height dissatisfaction[b]					
Total Sample	1.52 (1.60)	0–5	57.43 (n = 904)	29.00 (n = 455)	14.00 (n = 215)
Boys	1.12 (1.41)	0–5	67.44 (n = 497)	25.00 (n = 183)	8.00 (n = 57)
Girls	2.00 (1.70)	0–5	49.00 (n = 407)	33.00 (n = 272)	19.00 (n = 158)
Muscle dissatisfaction[b]					
Total Sample	2.53 (1.64)	0–5	27.50 (n = 430)	43.51 (n = 681)	29.00 (n = 454)
Boys	3.00 (1.70)	0–5	21.00 (n = 153)	42.30 (n = 310)	37.00 (n = 267)
Girls	2.23 (1.60)	0–5	33.20 (n = 277)	44.43 (n = 371)	22.40 (n = 187)
EDI-BD[b]					
Total Sample	4.00 (5.30)	0–24	—	—	—
Boys	2.01 (3.53)	0–21	—	—	—
Girls	5.60 (6.00)	0–24	—	—	—

Note. EDI-BD = Eating Disorder Inventory-Body Dissatisfaction. Percentages may not equate 100% because of rounding error.
[a] Height and muscle dissatisfaction scores categorized for comparison with previous study (Raevuori, Keski-Rahkonen, Bulik, et al., 2006). Low dissatisfaction = Score of never or rarely; Intermediate dissatisfaction = Score of sometimes or often; Severe dissatisfaction = Score of very often or always. [b] Significant mean difference between boys and girls, all ps $< .01$.

Aim 2: Phenotypic Association Between the Three Facets of Body Dissatisfaction

Boys. The canonical correlation analysis (see Table 2) resulted in two significant correlations: $r_1 = .32$ (eigenvalue = .11, $F = 6.49$, $p < .001$) and $r_2 = .18$ (eigenvalue = .03, $F = 3.46$, $p = .002$), indicating there are two pairs of canonical variates, one for each correlation. We refer to the first pair of variates as Male-Focused-1 for the height/muscle dissatisfaction variables and Female-Focused-1 for the EDI-BD variables. The second pair of variates are similarly defined: Male-Focused-2 and Female-Focused-2. Although the canonical correlations are significant, only 6.9% of the variance in the Male-Focused canonical variates was explained by the Female-Focused canonical variates whereas only 3.7% of the Female-Focused canonical variates was explained by the Male-Focused canonical variates.

The correlations between the measure items and their canonical variates provide information regarding how the canonical variates are related to the measured variables (see Table 2). For the first canonical correlation, the Male-Focused-1 variate is primarily defined by the height dissatisfaction measure (indicated by reverse coding of the question "I'm happy with my height"). This variate is correlated ($r_1 = .32$) with the Female-Focused-1 variate defined by the EDI-BD items, "I think my stomach is the right size," "I'm happy with my body," "I think my hips look good enough," and "I think my thighs look good enough," perhaps describing general

Table 2
Results From Canonical Correlation Analysis Between Height and Muscle Dissatisfaction and EDI-BD for Boys and Girls

	Boys		Girls	
	First canonical correlation .32	Second canonical correlation .18	First canonical correlation .34	Second canonical correlation .14
Correlation (r)	Correlation of variables with their first canonical variate	Correlation of variables with their second canonical variate	Correlation of variables with their first canonical variate	Correlation of variables with their second canonical variate
	Male-focused			
Height/muscle dissatisfaction items				
Height dissatisfaction	.95	−.32	.79	−.62
Muscle dissatisfaction	.38	.92	.62	.79
	Female-focused			
EDI-BD items				
Belly too big	.50	.24	.65	.31
Thighs fat	.44	.02	.55	.22
Stomach right size	.71	.12	.71	.00
Happy with body	.70	.47	.82	.39
Thighs too wide	.11	.15	.29	.51
Thighs good enough	.74	.02	.77	.03
Butt too big	.36	.22	.43	.55
Hips good enough	.77	−.45	.78	−.10

Note. EDI-BD = Eating Disorder Inventory-Body Dissatisfaction scale.

body disapproval. For the second canonical correlation, the muscle dissatisfaction measure is strongly and positively correlated with the Male-Focused-2 variate, whereas the height dissatisfaction variate is negatively and moderately associated. This variate is limitedly correlated ($r_2 = .18$) with the Female-Focused-2 variate defined by the items, "I'm happy with my body" and "My hips are good enough." For this second set of canonical variates (Male-Focused-2 and Female-Focused-2), the correlations of the EDI-BD items with the Female-Focused-2 variate are only moderate suggesting that muscle dissatisfaction is not well captured by the EDI-BD items. In summary, the first canonical correlation appears to be tapping into broader body dissatisfaction (e.g., height, happy with my body), whereas the second canonical correlation shows a weak association between muscle dissatisfaction and some EDI-BD items. However, overall, there is limited phenotypic overlap in height and muscle dissatisfaction and the EDI-BD.

Girls. Two significant canonical correlations were obtained: $r_1 = .34$ (eigenvalue = .13, $F = 7.34$, $p < .001$) and $r_2 = .14$ (eigenvalue = .02, $F = 2.22$, $p = .031$). Approximately 6% of the variance in the Male-Focused canonical variates was explained by the Female-Focused canonical variates and only 5% of the Female-Focused canonical variates was explained by the Male-Focused canonical variates. Unlike boys, the Male-Focused-1 and Male-Focused-2 variates were defined by both the height and muscle dissatisfaction measures. Thus, the Male-Focused-1 variate may be considered more broad or generalized dissatisfaction versus specific to height dissatisfaction, as it is in boys. Similar to boys, however, height dissatisfaction was negatively correlated with the Male-Focused-2 variate. The Female-Focused-1 variate in girls exhibits a correlation pattern with the EDI-BD items that is similar to the pattern seen in boys. However, the moderate correlations of the EDI-BD thighs and buttocks items with the Female-Focused-2 variate indicate dissatisfaction with specific body parts versus broad body disapproval. In summary, the first canonical correlation appears to be tapping into broad or general body dissatisfaction whereas the second canonical correlation seems to show a weak relationship between muscle dissatisfaction and thigh or buttocks dissatisfaction. Overall, the results indicate that height and muscle dissatisfaction may not be distinct facets of body dissatisfaction for girls, yet they are distinct from the EDI-BD.

Aim 3: Genetic Association Between the Three Facets of Body Dissatisfaction

Based on χ^2 change and AIC, the AE model was the best-fit model for both boys and girls (see Table 3). Genetic and environmental correlations and the proportion of phenotypic variance accounted for by genetic and unique environmental factors are shown in Table 4.

Boys. Height and muscle dissatisfaction and the EDI-BD were moderately heritable at approximately 50%. All remaining variance was attributable to unique environmental factors.

The genetic and unique environmental correlations observed between height and muscle dissatisfaction were estimated at $r_a = .05$ and $r_e = .10$, respectively, suggesting little etiological overlap between these facets of body dissatisfaction. The genetic correlations estimated between height dissatisfaction and muscle dissatisfaction with broad body dissatisfaction was moderate and significant. Specifically, for height dissatisfaction and EDI-BD, $r_a = .44$, and for muscle dissatisfaction and EDI-BD, $r_a = .30$. Taken together, 26% of the total heritability for EDI-BD was accounted for by genetic factors shared with height and muscle dissatisfaction. Overlap was also observed in unique environmental factors between height dissatisfaction and EDI-BD with an estimated correlation of $r_e = .31$. However, the unique environmental correlation between muscle dissatisfaction and EDI-BD was not significant. Taken together, 10% of the total unique environmental variance for EDI-BD was accounted for by height and muscle dissatisfaction.

Table 3
Multivariate Cholesky Model-Fitting Results

Model	−2lnL	*df*	χ^2 diff (*p*)	AIC
ACE				
Boys	6831.10	2148	—	2535.10
Girls	9934.56	2458	—	5018.60
AE				
Boys	**6831.64**	**2154**	**.60 (.99)**	**2523.64**
Girls	**9939.30**	**2458**	**5.00 (.58)**	**5011.30**
CE				
Boys	6851.00	2154	20.00 (.003)	2542.75
Girls	9975.84	2464	41.30 (<.01)	5048.00

Note. χ^2 diff (*p*) = chi-square difference between full model and submodel and the associated *p*-value; AIC = Akaike Information Criterion. 2lnL = difference in twice the negative log-likelihood of the models. Best-fit model bolded.

Genetic factors accounted for a majority of the phenotypic association between height dissatisfaction and muscle dissatisfaction and EDI-BD (see Table 4). Specifically, genetic factors accounted for 60% of the phenotypic association between height dissatisfaction and EDI-BD and for 73% of the phenotypic association between muscle dissatisfaction and EDI-BD. Unique environmental factors contributed to the remaining phenotypic association.

Girls. The three facets of body dissatisfaction were moderately heritable in girls ranging from 49 to 68%. Similar to boys, little etiological overlap was observed for height dissatisfaction and muscle dissatisfaction. However, genetic correlations between height dissatisfaction and muscle dissatisfaction with EDI-BD were moderate and significant: $r_a = .36$ and $r_a = .26$, respectively. Together, 19% of the total heritability for EDI-BD was accounted for by genetic factors shared with height and muscle dissatisfaction. The unique environmental correlation between muscle dissatisfaction and EDI-BD was also significant. Findings indicate that 9% of the total unique environmental effects for EDI-BD are accounted for by environmental factors shared with height and muscle dissatisfaction. Finally, similar to boys, genetic factors accounted for a majority of the phenotypic association between height and muscle dissatisfaction and EDI-BD. Overall, there is limited etiological overlap between height dissatisfaction, muscle dissatisfaction, and EDI-BD in both girls and boys.

Aim 4: Associations With Specific Externalizing and Internalizing Symptoms

Because externalizing and internalizing symptom variables may be correlated with one another, we explored multicollinearity between the independent variables using PROC GLM in SAS.

Table 4
Genetic and Environmental Correlations and Proportion of Phenotypic Association Accounted for by Genetic and Environmental Factors

Body dissatisfaction	Boys				Girls			
	Correlations		% of phenotypic association accounted for		Correlations		% of phenotypic association accounted for	
	r_a	r_e	A	E	r_a	r_e	A	E
HD-MD	.05 [−.20, .28]	.10 [−.07, .26]	28	72	.01 [−.18, .17]	.01 [−.13, .15]	33	67
HD-BD	.44 [.24, .63]	.31 [.13, .47]	60	40	.36 [.22, .50]	.10 [−.03, .21]	57	43
MD-BD	.31 [.10, .50]	.10 [−.02, .30]	73	27	.24 [.09, .38]	.26 [.24, .31]	87	13

Note. r_a = genetic correlation; r_e = unique environment correlation; A = additive genetic factors; E = unique environmental factors; HD = height dissatisfaction; MD = muscle dissatisfaction; BD = broad body dissatisfaction (EDI-BD).

Externalizing, internalizing, and BMIz measures were included as independent variables to obtain tolerance statistics. For all independent variables, tolerance values were greater than .10 (range: .20 to .93) indicating a variance inflation factor less than 10 (range: 1. 0 to 4.0). The bivariate correlations also indicate that no phenotypic correlation was greater than .80, with a vast majority averaging around .20. As described above, only those symptoms that showed a correlation of >.10 with the respective facet of body dissatisfaction were included in the regression models (online supplementary material Table 1). Variables that were not included in the models are indicated by dashes in Tables 5 and 6.

Boys. There were no significant associations between externalizing or internalizing symptoms with height dissatisfaction. Regarding muscle dissatisfaction, YSR-externalizing and EDI-B were significant. EDI-BD had the most significant associations: BMIz, YSR-externalizing, YSR-internalizing, CASS-opposition, and EDI-DT (see Table 5).

Girls. No significant associations emerged between externalizing or internalizing symptoms with height or muscle dissatisfaction. BMIz, YSR-internalizing, and EDI-DT were significantly associated with EDI-BD (see Table 6).

Post hoc analyses. Given the possibility of bidirectional relationships, there may be differential associations between specific facets of body dissatisfaction and externalizing and internalizing symptoms. Thus, we examined post hoc the association between body dissatisfaction and externalizing and internalizing outcomes. In brief, we completed a principal components analysis with a varimax rotation, in boys and girls separately, to reduce the externalizing and internalizing symptom data. Components with an eigenvalue greater than one were retained. Next, we conducted

Table 5
Fixed Effects Results From Generalized Linear Models of Associations Between Externalizing and Internalizing Symptoms and Body Dissatisfaction for Boys

Independent variables	Height dissatisfaction		Muscle dissatisfaction		EDI-BD	
	F value (*df* = 248)	Odds ratio (95% CI)	*F* value (*df* = 245)	Odds ratio (95% CI)	*F* value (*df* = 223)	*B*[a] (95% CI)
Covariate						
BMI	—	—	—	—	**6.40**	**.34 [.10, .60]**
Symptomatology						
YSR-externalizing	—	—	**10.20**	**1.20 [1.03, 1.13]**	**8.10**	**−.10 [−.14, −.03]**
YSR-internalization	3.00	1.04 [1.00, 1.10]	3.72	1.04 [1.00, 1.10]	**10.00**	**.10 [.30, .14]**
CASS-opposition	.04	1.10 [.93, 1.17]	1.73	.93 [.84, 1.04]	**5.01**	**.16 [.02, .30]**
CASS-inattention	1.34	.94 [.86, 1.04]	.30	1.03 [.93, 1.14]	1.11	.07 [−.06, .21]
CASS-hyperactivity	—	—	.40	1.02 [.95, 1.10]	2.00	−.06 [−.15, .03]
CASS-ADHD	4.10	1.10 [1.00, 1.20]	.01	1.00 [.93, 1.10]	1.51	.06 [−.04, .16]
EDI-DT	1.00	1.10 [.95, 1.20]	—	—	**80.00**	**.70 [.53, .84]**
EDI-B	—	—	**8.00**	**1.30 [1.10, 1.50]**	—	—
Dieting[b]	1.00	2.00 [.72, 5.30]	—	—	**31.10**	**4.00 [2.50, 5.25]**
Alcohol intoxication[b]	—	—	.43	1.14 [.77, 2.00]	—	

Note. 95% CI = 95% confidence interval; YSR = Youth Self-Report; CASS = Conners-Wells Adolescent Self-Report Scale; ADHD = attention-deficit-hyperactivity disorder; EDI-DT = Eating Disorder Inventory drive for thinness subscale; EDI-B = Eating Disorder Inventory bulimia subscale; BMI = body mass index; EDI-BD = Eating Disorder Inventory body dissatisfaction subscale. Dashes indicate that the respective predictor was not included in the regression model because the bivariate correlation with body dissatisfaction was less than .10 (see text for details). Significant ($p < .01$) results bolded.

[a] Because broad body dissatisfaction is a continuous outcome, odds ratios are not obtained. The unstandardized regression coefficient is provided by PROC GLIMMIX. [b] For all categorical variables the reference group is the "zero" group, reporting the absence of the symptom.

Table 6
Fixed Effects Results From Generalized Linear Models of Associations Between Externalizing and Internalizing Symptoms and Body Dissatisfaction for Girls

Independent variables	Height dissatisfaction		Muscle dissatisfaction		EDI-BD	
	F value (*df* = 278)	Odds ratio (95% CI)	*F* value (*df* = 232)	Odds ratio (95% CI)	*F* value (*df* = 212)	*B*[a] (95% CI)
Covariate						
BMI	—	—	—	—	**35.11**	**1.23 [.82, 1.65]**
Symptomatology						
YSR-externalizing	.20	1.01 [1.00, 1.05]	1.00	1.02 [.98, 1.10]	.18	−.02 [−.10, .07]
YSR-internalization	.70	1.01 [1.00, 1.04]	.63	1.01 [1.00, 1.04]	**13.24**	**.11 [.05, .17]**
CASS-opposition	1.84	1.10 [1.00, 1.20]	1.50	.93 [.83, 1.05]	2.10	−.20 [−.41, .06]
CASS-inattention	.04	1.00 [.93, 1.10]	.34	1.03 [.94, 1.12]	1.70	.11 [−.06, .30]
CASS-hyperactivity	—	—	.34	1.02 [.96, 1.10]	—	—
CASS-ADHD	.40	1.02 [1.00, 1.20]	1.10	1.04 [.97, 1.10]	2.00	.10 [−.04, .22]
EDI-DT	4.23	1.05 [1.00, 1.10]	3.62	1.01 [1.00, 1.11]	**165.40**	**.70 [.60, .81]**
EDI-B	.11	1.00 [.85, 1.12]	.01	1.01 [.86, 1.20]	.20	.07 [−.30, .42]
Dieting[b]	—	—	2.00	1.50 [.96, 2.50]	.82	.50 [−.60, 1.60]
Purge[b]	—	—	—	—	.03	−.15 [−2.0, 2.0]
Smoking[b,c]	—	—	.50	—	1.00	—
Alcohol intoxication[b]	—	—	3.00	1.50 [.94, 2.40]	0	.03 [−.92, 1.0]

Note. 95% CI = 95% confidence interval; YSR = Youth Self-Report; CASS = Conners-Wells Adolescent Self-Report Scale; ADHD = attention-deficit-hyperactivity disorder; EDI-DT = Eating Disorder Inventory drive for thinness subscale; EDI-B = Eating Disorder Inventory bulimia subscale; BMI = body mass index. Dashes indicate that the respective predictor was not included in the regression model because the bivariate correlation with body dissatisfaction was less than .10 (see text for details). Significant ($p < .01$) results bolded.
[a] Because broad body dissatisfaction is a continuous outcome, odds ratios are not obtained. The unstandardized regression coefficient is provided by PROC GLIMMIX. [b] For all categorical variables the reference group is the "zero" group, reporting the absence of the symptom. [c] The regular smoking variable has four categories. Because there is no significant association between smoking and body dissatisfaction, results are not presented for each smoking category.

general linear models with each component entered as the dependent variable, the three facets of body dissatisfaction as independent variables, and BMIz as a covariate.

Four components were retained for boys: (a) "externalizing-internalizing" (i.e., CASS-ADHD, CASS-opposition, CASS-inattention, CASS-hyperactivity, YSR-externalizing, YSR-internalizing); (b) "substance use" (i.e., alcohol use, alcohol intoxication, illicit drug use, smoking); (c) "restriction" (i.e., diet behaviors, EDI-DT); and (d) "bulimia" (i.e., purging behaviors, EDI-B). Significant associations were observed with the externalizing-internalizing and restriction components only. Height dissatisfaction $F(1, 175) = 17.12$, $p < .01$ (B: .10; 95% confidence interval, CI [.03, .15]), muscle dissatisfaction $F(1, 175) = 17.12$, $p < .01$ (B: .11; 95% CI [.06, .16]), and EDI-BD $F(1, 175) = 13.10$, $p < .01$ (B: .05; 95% CI [.02, .07]), were significantly associated with the externalizing-internalizing component. The EDI-BD $F(1, 175) = 162.00$, $p < .01$ (B: .14; 95% CI [.12, .16]) and BMIz $F(1, 175) = 33.40$, $p < .01$ (B: .23; 95% CI [15, .30]), were associated with the restriction component. For girls, there were three components: (a) "externalizing-internalizing"; (b) "substance use"; and (c) "disordered eating" (i.e., diet behaviors, purging behaviors, EDI-DT, EDI-B). Height dissatisfaction $F(1, 183) = 9.60$, $p < .01$ (B: .08; 95% CI [.03, .13]) and EDI-BD $F(1, 183) = 7.62$, $p < .01$ (B: .02; 95% CI [.01, .04]) were significantly associated with the externalizing-internalizing component. EDI-BD $F(1, 183) = 182.44$, $p < .01$ (B: .09; 95% CI [.08, .10]) was associated with the disordered eating component.

Discussion

We examined the manifestation, etiology, and correlates of body dissatisfaction in adolescent boys and evaluated a female comparison group. To date, most studies have focused on broad measures of thinness-oriented body dissatisfaction (e.g., EDI-BD) and do not include specific facets of body dissatisfaction that may resonate more uniquely with boys (Murray et al., 2017). In particular, height and muscle dissatisfaction have been largely overlooked despite being previously described as central aspects of male body dissatisfaction. Body dissatisfaction was evident in our adolescent boy sample. However, we observed limited phenotypic and etiological overlap between height and muscle dissatisfaction with broad body dissatisfaction as assessed with the EDI-BD as well as body dissatisfaction-specific correlates.

In boys, muscle dissatisfaction was more prevalent than height or general body dissatisfaction. Approximately 37% of the boys reported severe muscle dissatisfaction, whereas 8% reported severe height dissatisfaction. This is slightly higher than findings in young adult males (ages 22–27) where 30% of males reported high degrees of muscle dissatisfaction (Raevuori et al., 2006). In addition, 79.3% of adolescent boys reported at least intermediate muscle dissatisfaction. This could be related to bodily changes surrounding puberty in addition to sociocultural pressures for leanness/muscularity (Bergeron & Tylka, 2007). Muscle mass increases with puberty (Wheeler, 1991) and, thus, with age, the male body moves closer to the current ideal shape for a man. As such, growing adolescent boys may idealize not only the bodies observed in their action figures (Murray et al., 2017; Pope, Oli-

vardia, Gruber, & Borowiecki, 1999) but also the bodies of adult males who are more muscular (falling prey to upward social comparisons). This same pattern was not true for girls: approximately 20% of girls reported severe height dissatisfaction and 20% reported severe muscle dissatisfaction. Height dissatisfaction mean scores were also significantly greater in girls compared with boys; however, the clinical impact of a mean difference of .88 is unclear. In regard to broad body dissatisfaction as measured by the EDI-BD, the mean in adolescent boys was half of that observed in girls which is often interpreted to indicate adolescent boys do not experience body dissatisfaction as much as girls (McCabe & Ricciardelli, 2004). However, the difference is likely because of the inability of the EDI-BD to adequately capture all pertinent aspects of male body dissatisfaction.

Indeed, height dissatisfaction and muscle dissatisfaction are phenotypically distinct from broad body dissatisfaction: less than 10% of the variance in height/muscle body dissatisfaction was explained by the EDI-BD and vice versa in boys. The associations between the items comprising the EDI-BD and height and muscle dissatisfaction were also limited. These findings, in combination with the prevalence of height and muscle dissatisfaction observed, provides further evidence that the EDI-BD is a poor representation of body dissatisfaction in boys and that height dissatisfaction and muscularity-oriented body image concerns are distinct facets of body dissatisfaction. Results were similar for girls indicating that the EDI-BD is a poor representation of height and muscle dissatisfaction. However, height dissatisfaction and muscularity-oriented body image concerns may be representative of broader body image concerns for girls.

Results from the twin modeling extend these findings indicating that, not only are height and muscle dissatisfaction phenotypically distinct from broad body dissatisfaction, they are also *etiologically* distinct. Although heritability estimates were moderate for the facets of body dissatisfaction in both sexes, the etiological overlap observed was small. For boys, 26 and 10% of the genetic and unique environmental factors, respectively, were shared between height and muscle dissatisfaction with broad body dissatisfaction. Thus, 64% of the genetic and environmental factors contributing to broad body dissatisfaction are distinct from height and muscle dissatisfaction. Overlap for girls were even lower such that 75% of the factors contributing to broad body dissatisfaction are distinct.

There were varied associations between negative correlates and muscle dissatisfaction and the EDI-BD yet no significant associations with height dissatisfaction. This indicates that there are body dissatisfaction facet-specific correlates. For example, although externalizing symptomatology as assessed by the YSR was significantly associated with both muscle dissatisfaction and broad body dissatisfaction, albeit in opposite directions, muscle dissatisfaction and the EDI-BD also had unique associations. Specifically, there was a positive association between EDI-B and muscle dissatisfaction and positive associations were observed with YSR-internalizing, CASS-opposition, EDI-DT, dieting behaviors, and BMIz with EDI-BD.

The unique associations observed with muscle dissatisfaction and the EDI-BD may parallel the fact that some adolescent boys desire to be bigger whereas others desire to be thinner. Adolescent boys desiring to be bigger and experiencing muscularity-oriented body image concerns may engage in behaviors associated with the pursuit of muscularity. For example, to increase muscle mass, boys may overeat or vacillate between under- and over- eating (Griffiths et al., 2013a; Lavender et al., 2017). This cycle, similar to that observed in bulimia nervosa, may increase the risk for binge eating and compensatory behaviors, especially if more calories are being consumed than expended. In contrast, broad body dissatisfaction as assessed with the EDI-BD may reflect those males desiring to be thinner or to lose weight. In both our adolescent boy and girl groups, positive associations emerged between BMIz and aspects of restrictive eating pathology and broad body dissatisfaction—an observation that is commonly observed in girls (Dion et al., 2015; Haynos, Watts, Loth, Pearson, & Neumark-Sztainer, 2016). The fact that YSR-externalizing symptomatology was *inversely* associated with the EDI-BD in boys as it was in girls suggests that measures of broad body dissatisfaction, which are typically female-oriented, may adequately capture the 30 to 50% of adolescent boys who, similar to body-dissatisfied girls, desire to lose weight (Dion et al., 2016; McCabe & Ricciardelli, 2004). However, broad body dissatisfaction does not adequately capture the unique associations observed with muscularity-oriented body image concerns. Confirming these findings all facets of body dissatisfaction were significantly associated with the combined symptom component of externalizing and internalizing symptoms in boys whereas only EDI-BD and BMIz were significantly associated with the combined symptom component of restrictive eating pathology.

For girls, there were no significant associations observed between specific externalizing and internalizing symptoms with height dissatisfaction or muscle dissatisfaction. Further, limited associations emerged between the combined symptom principal components and body dissatisfaction. This could suggest that while height and muscle dissatisfaction are present in girls, this dissatisfaction is not the result of or associated with negative correlates. Of note, these findings contrast previous studies that indicate significant associations between body dissatisfaction and ADHD symptomatology in adolescence (Mikami et al., 2010). It is possible these associations only exist at the diagnostic-level and/or that after accounting for additional negative correlates; the association is no longer significant.

The manifestation, etiology, and correlates of two hypothesized central components of male body dissatisfaction, height and muscle dissatisfaction, are distinct from a measure of thinness-oriented broad body dissatisfaction in adolescent boys (and girls). Further, unique negative correlates emerged across the three facets of body dissatisfaction within- and between-sex. Despite the fact that girls reported higher levels of some aspects of body dissatisfaction compared with boys (e.g., EDI-BD, height dissatisfaction), a number of negative correlates were associated with this body dissatisfaction in boys. This confirms previous work indicating that although females have higher body dissatisfaction scores than boys, the strength of the associations between body dissatisfaction and impairment does not significantly differ between the sexes (Griffiths et al., 2017). In light of our findings, we can conclude that there is clear value to the use of broad, thinness-oriented measures of body dissatisfaction for adolescent boys. However, assessments of body dissatisfaction in males must include a variety of measures to capture the full spectrum of body dissatisfaction and any potential negative correlates. Regarding girls, height and muscle dissatisfaction specifically, while present, may not represent dis-

tinct, core components of body dissatisfaction associated with distress.

This study must be considered within the context of its limitations. First, the study was cross-sectional, so we are unable to determine the casual associations between externalizing and internalizing symptomatology and body dissatisfaction. Second, our assessment for height and muscle dissatisfaction included a single item. Although a multi-item construct that queried dissatisfaction and behaviors used to counter this dissatisfaction (e.g., weight-lifting) would have been ideal, it is not possible to capture detailed information on all types of attitudes and behaviors because of participant burden in large-scale, population-based studies. Relatedly, height dissatisfaction may be qualitatively different from muscle and broad body dissatisfaction. The fact that there are few actions available to change height and, thus, counteract height dissatisfaction may, in part, explain why no negative correlates were significantly associated with height dissatisfaction. Third, although symptom-level information was obtained, clinical diagnoses were not. These findings may not generalize to clinic diagnoses. Fourth, hyperactivity-impulsivity was significantly elevated in twins lost to follow-up at Wave 3. This could have impacted our results in regard to ADHD symptoms.

In summary, these results indicate that measures of female-oriented body dissatisfaction (e.g., EDI-BD) inadequately capture body dissatisfaction in adolescent boys. In fact, body dissatisfaction in adolescent boys is complex—approximately 50% of boys want to be thinner and 50% wanting to be bigger (McCabe & Ricciardelli, 2004). This study provides empirical support (Reilly, Anderson, Schaumberg, & Anderson, 2014) for the distinctiveness of this split as most facets of body dissatisfaction assessed showed unique associations with externalizing and internalizing symptoms, and results from the canonical correlation analysis and twin modeling indicate that they are phenotypically and etiologically distinct. Future longitudinal studies including younger and older cohorts are needed to address the: (a) importance of these aspects of body dissatisfaction across development and unique developmental predictors between the sexes (e.g., athletics); (b) directionality with externalizing and internalizing symptoms; (c) the underlying mechanisms between the unique etiologies and associations observed; (d) and should include an assessment of body fat dissatisfaction and address body dissatisfaction across the gender-identity spectrum.

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