



# Prevalence and correlates of body dysmorphic disorder in health club users in the presence vs absence of eating disorder symptomology

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## Abstract

**Purpose** Body dysmorphic disorder (BDD) has been consistently linked with eating disorders, however studies that stratify associations between BDD in subjects with and without eating disorder symptomology are sparse. It was, therefore, the aim of this study to assess correlates of BDD (including social media use, motivations for exercise, exercise addiction, and sexuality) stratified by eating disorder symptomology.

**Methods** Cross-sectional study of 1665 health club users recruited online completed a battery of surveys. BDD prevalence rates were calculated and logistic regression models were created in two sub-samples: indicated or no-indicated eating disorder symptomology.

**Results** The key findings showed the prevalence of BDD in participants with indicated-eating disorder symptomology was significantly higher than in participants without indicated-eating disorder symptomology, yielding an odds ratio of 12.23. Furthermore, several correlates were associated with BDD only participants with an absence of eating disorder symptomology (gender, BMI, exercise addiction, exercising for mood improvement, attractiveness and tone), with others being significantly associated with BDD in participants in the presence of indicated eating disorders symptomology (exercising for health and enjoyment, relationship status, and ethnicity).

**Conclusions** This study provides more evidence of the complex relationship that exists between BDD and eating disorders. Furthermore, it is recommended that practitioners working with BDD subjects should screen for eating disorders due to the high morbidity associated with eating disorders.

**Level of evidence** Level III: case-control analytic study.

**Keywords** Eating disorders · Body dysmorphic disorder · Social media · Sexuality · Exercise addiction · Exercise motivation

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## Introduction

Body dysmorphic disorder (BDD) is the ‘preoccupation with one or more perceived defects or flaws in physical appearance that are not observable or appear slight to others’ [1], causing high levels of stress and anxiety that can reduce quality of life and increase prevalence in suicide attempts [2, 3]. Prevalence of BDD has been shown to vary dramatically depending on the population, with prevalence rates ranging from 1.7% at a population level to 20.1% in rhinoplasty surgery patients [4, 5].

Several authors have reported similarities between BDD and eating disorders, with both disorders being disturbances of body image including obsessive compulsive traits [6, 7], with a recent systematic review concluding that BDD and eating disorder subjects share similar levels

of body dissatisfaction [8]. Moreover, both BDD and eating disorders fall into similar positions when plotted on Hollander and Wong's [9] compulsive-impulsive continuum. Another disorder that is similarly placed on this continuum is exercise addiction, a disorder characterized by excessive exercise to an extent, where negative social and physiological symptoms, including training through injury, withdrawal symptoms, and the detriment of important social relationships arise [10]. The links between exercise addiction and eating disorders are well established, with a recent systematic review indicating that subjects with eating disorders are 3.7 times more likely to suffer with exercise addiction than subjects without indicated eating disorders [11].

Although authors have suggested potential links between exercise addiction and BDD [12], primary literature exploring these links is limited. For example, one cross-sectional study found a small adjusted association ( $\beta = 0.13$   $p = < 0.05$ ) between BDD symptomology and obligatory exercise [13]. However, studies expanding on this are sparse. Exercise motivation is also associated with BDD, with appearance (e.g., to increase muscle size) showing stronger associations than other types of exercise motivations (e.g., for health) [14, 15]. Furthermore, associations between sexuality and BDD have been reported, yet have yielded conflicting conclusions depending on gender. For example, one studies of homosexual and bisexual women show that these groups displayed higher levels of BDD symptoms than heterosexual women [13], yet other studies have shown no significant differences [16]. In men, however, there is a general consensus in the literature that homosexual and bisexual men show greater levels of BDD and associated body disturbance issues than heterosexual men, and also show higher risk of eating disordered behaviours [17].

Social media use has been positively associated with feelings of negative body image [18] and indicators of eating disorders [19], possibly because people show the best version of themselves on social media, leading to a more frequent upward comparison of self-appearance with other people on these platforms. There have been limited studies, however, exploring the reasons for social media use, BDD and any relationships with eating disorders.

It is, therefore, the aim of this study to examine the prevalence of BDD in health club users, as this specific population are likely to exercise more and have been explored in similar studies, such as [20], explore associations between BDD and social media use, reasons for exercise, exercise addiction, and sexuality and compare these in participants with indicated vs non-indicated eating disorder symptomology.

Not only will this expand the current understanding of BDD, its relationship with eating disorders, and its relationship with the other correlates described above, it has the potential to inform medical practitioners working with these

populations, including (because of the specific population group of health care users) fitness industry professionals.

## Methods

Participants were recruited via an international group fitness e-newsletter and through Facebook, Instagram and Twitter from 8/4/19 to 31/7/19 and provided informed consent to take part before completing the survey. To be eligible for the study participants were required to be adult ( $> 18$  years) health club users. Participants did not receive any remuneration for completing the survey. Participants were oriented to an online battery of questions, including measures of age, sex, ethnicity, socio-economic status, life-limiting illness status, exercise addiction, leisure-time physical activity frequency, reasons for exercise, eating disorders, BDD, social media use, body mass index (BMI), and sexuality. Ethical approval was obtained from the Anglia Ruskin University Sport and Exercise Sciences Departmental Ethics Panel (ESPGR-03).

## Measures

### BDD

BDD was measured using the Body Dysmorphic Disorder Questionnaire (BDDQ) [15], a questionnaire based on the Diagnostic Statistical Manual for mental disorders-IV (DSM) [21] diagnostic criteria for BDD. Classification of BDD is made based on answering positively to questions one and two, at least one part of question 3 and indicating spending one or more hours each day thinking about their appearance (see Appendix for questions). The questionnaire has excellent reported sensitivity (94%) and specificity (90%) in non-clinical community populations [22].

### Social media use

Social media use was measured using the Social Media Use Integration Scale (SMUIS) [23], a ten-item questionnaire with two sub-scales: social integration and emotional connection and integration into social routines. Each question is scored on a Likert scale of 1–6, with higher scores in each sub-scale indicating higher levels of its respective sub-scale. The SMUIS has been shown to have excellent internal consistency (current study Cronbach's  $\alpha$ : social integration and emotional connection sub-scale  $\alpha = 0.88$ ; integration into social routines sub-scale  $\alpha = 0.81$ ) and good validity across several age ranges [23, 24].

### Reasons for exercise

Reasons for exercise was measured using the Reasons for Exercise Inventory (REI) [25], a 24-item questionnaire with seven sub-scales: weight control, fitness, mood, health, attractiveness, enjoyment, and tone. Each question is scored on a Likert scale of 1–7, with higher scores in each sub-scale indicating higher levels in the respective sub-scale. The REI has been validated across several populations [25, 26] and shows good internal consistency (current study Cronbach's  $\alpha$ : weight control  $\alpha=0.61$ ; fitness  $\alpha=0.83$ ; mood  $\alpha=0.86$ ; health  $\alpha=0.86$ ; attractiveness  $\alpha=0.85$ ; enjoyment  $\alpha=0.82$ ; tone  $\alpha=0.79$ ).

### Exercise addiction

The Exercise Addiction Inventory (EAI) [27] is a six-item questionnaire that assesses each component of Brown's theory of addiction [28] in an exercise context. Each question is scored on a Likert scale of 1–5, with a higher score indicating higher risk of exercise addiction. Subjects who score  $\geq 24$  are classified as 'at risk' of exercise addiction [27]. The EAI has been shown to have good reliability and validity across physically active populations [27, 29, 30] and shows good internal reliability (current study  $\alpha=0.74$ ). The EAI was used as a continuous variable indicting severity of exercise addiction risk, because there are no clinically recognised diagnostic criteria for exercise addiction [1].

### Eating disorder symptomology

Eating disorder symptomology was measured using the Eating Attitudes Test 26 (EAT-26) [31], a 26-item questionnaire scored on a Likert scale of 1–6. A score of  $\geq 20$  is sufficient to be classified as having possible pathological eating behaviours. The EAT-26 has shown excellent internal consistency (current study Cronbach's  $\alpha=0.91$ ) and is validated in athletic populations [32, 33].

### Health club user

Participants were required to answer yes/no to indicate whether they were a current health club user.

### Fitness instructor

Participants were required to answer yes/no to indicate if they were currently a fitness instructor.

### Exercise levels

Participants were required to indicate how many hours per week they participated in exercise (if the subject was a

fitness instructor, this did not include exercise hours as part of work).

### Socio-economic status

Participants were asked if they were homeowners (yes/no) to determine socio-economic status.

### Data analysis

All data were analysed using SPSS Version 26 [34].

BDD prevalence was calculated in the overall sample and stratified according to eating disorder status. Furthermore, an odds ratio (OR) was calculation estimating the risk of BDD in the indicated vs no-indicated eating disorder samples. Logistic regression was used to analyse associations between BDD status and: age, sex, BMI, ethnicity, eating disorder status, homeowner status, relationship status, exercise addiction scores, both subscales of the SMUIS, all subscales of the REI, being a fitness instructor, leisure time physical activity, and sexuality. We tested the bivariate (unadjusted) associations between BDD status and each of these variables, then entered all variables into a multivariable logistic model to test adjusted independent associations in two populations:

1. Indicated-eating disorder symptomology (defined as scoring  $\geq 20$  in the EAT-26)
2. No-indicated eating disorder symptomology (defined as scoring  $< 20$  in the EAT-26)

Any missing data was tested for randomness via Little's MCAR test [35], and if confirmed random, deleted listwise from all regression analyses.

To further explore whether associations varied according to eating disorder status, we repeated the multivariable analysis in a series of logistic regression models adding the interaction term between eating disorder status and each potential correlate in turn.

## Results

A total of 1864 participants completed the questionnaire. Of these, 199 (10.7%) failed to confirm that they were health club users and were excluded from further analysis. Of the remaining 1665 participants, the mean age was 35.7 years ( $SD=10.9$ ), mean self-reported BMI was 23.9  $\text{kg/m}^2$  ( $SD=3.9$ ) and 1428 (85.0%) subjects were female. Full demographic information is shown in Table 1.

The prevalence of BDD in the total sample was 30.5% (95% CI = 28.3–32.7%), 76.7% (95% CI = 71.7%–81.7%) in the population who had an indicated-eating disorder

**Table 1** Demographic information

Variable	Total sample <sup>a</sup>	Indicated eating disorders <sup>a</sup>	No indicated eating disorders <sup>a</sup>
<i>n</i>	1665	279	1386
Age (years)	35.72 (10.92)	33.22 (10.24)	36.22 (10.99)
BMI (kg/m <sup>2</sup> )	23.91 (3.93)	23.26 (4.75)	24.04 (3.73)
Sex (female)	85.00% ( <i>n</i> = 1428)	96.40% ( <i>n</i> = 269)	83.60% ( <i>n</i> = 1159)
Fitness instructor (yes)	42.76% ( <i>n</i> = 712)	36.6% ( <i>n</i> = 102)	44.00% ( <i>n</i> = 610)
Exercise hours for leisure (h/wk)	6.46 (4.04)	7.75 (4.72)	6.19 (3.84)
Life limiting illness (yes)	1.14% ( <i>n</i> = 19)	1.40% ( <i>n</i> = 4)	1.10% ( <i>n</i> = 15)
Self-identified sexuality			
Heterosexual	88.00% ( <i>n</i> = 1477)	90.30% ( <i>n</i> = 251)	89.00% ( <i>n</i> = 1226)
Homosexual	4.62% ( <i>n</i> = 77)	2.20% ( <i>n</i> = 6)	5.20% ( <i>n</i> = 71)
Bisexual	4.50% ( <i>n</i> = 75)	5.80% ( <i>n</i> = 16)	4.30% ( <i>n</i> = 59)
Prefer not to say	2.16% ( <i>n</i> = 36)	1.80% ( <i>n</i> = 5)	1.60% ( <i>n</i> = 22)
Ethnicity			
White	91.23% ( <i>n</i> = 1519)	92.10% ( <i>n</i> = 256)	91.30% ( <i>n</i> = 1263)
Black or African American	0.72% ( <i>n</i> = 12)	1.10% ( <i>n</i> = 3)	0.70% ( <i>n</i> = 9)
Hispanic or Latino	1.62% ( <i>n</i> = 27)	1.10% ( <i>n</i> = 3)	1.70% ( <i>n</i> = 24)
Asian	3.78% ( <i>n</i> = 63)	4.00% ( <i>n</i> = 11)	3.80% ( <i>n</i> = 52)
Relationship status			
Single	28.89% ( <i>n</i> = 481)	34.40% ( <i>n</i> = 96)	27.90% ( <i>n</i> = 385)
In a relationship	32.01% ( <i>n</i> = 533)	34.80% ( <i>n</i> = 97)	31.60% ( <i>n</i> = 436)
Married	37.40% ( <i>n</i> = 630)	29.40% ( <i>n</i> = 82)	39.70% ( <i>n</i> = 548)
Widowed	0.24% ( <i>n</i> = 4)	0.00% ( <i>n</i> = 0)	0.30% ( <i>n</i> = 4)
Other	1.02% ( <i>n</i> = 17)	1.40% ( <i>n</i> = 4)	0.60% ( <i>n</i> = 8)
Homeowner status (yes)	57.36% ( <i>n</i> = 955)	49.10% ( <i>n</i> = 137)	59.00% ( <i>n</i> = 818)
EAT-26 <sup>b</sup> Total	13.40 (12.43)	35.90 (9.47)	8.87 (6.7)
EAI <sup>c</sup> Total	21.23 (4.31)	23.63 (4.55)	20.75 (4.10)
BDD <sup>d</sup> status (indicated/not indicated)*	30.51% ( <i>n</i> = 508)	76.70% ( <i>n</i> = 214)	21.20% ( <i>n</i> = 294)
REI <sup>e</sup> subscales			
Weight control	4.64 (1.27)	5.55 (1.13)	4.46 (1.22)
Fitness	5.88 (0.96)	5.82 (1.17)	5.89 (0.91)
Mood	5.35 (1.36)	5.71 (1.33)	5.27 (1.36)
Health	5.99 (1.02)	5.80 (1.26)	6.03 (0.95)
Attractiveness	4.68 (1.57)	5.46 (1.52)	4.52 (1.53)
Enjoyment	4.55 (1.51)	4.45 (1.76)	4.57 (1.45)
Tone	4.52 (1.51)	4.97 (1.61)	4.43 (1.47)
SMUIS <sup>f</sup> subscales			
Social integration and emotional connection	2.59 (1.12)	2.94 (1.27)	2.52 (1.07)
Integration into social routines	4.11 (1.18)	4.32 (1.21)	4.07 (1.17)

<sup>a</sup>Data is presented as mean (standard deviation), unless otherwise stated<sup>b</sup>EAT-26 = Eating Attitude Test<sup>c</sup>EAI = Exercise Addiction Inventory<sup>d</sup>BDD = Body dysmorphic disorder<sup>e</sup>REI = Reasons for exercise inventory<sup>f</sup>SMUIS = Social Media Use Integration Scale\*Indicates significant differences between indicated vs no-indicated eating disorder samples  $p \leq 0.01$ 

symptomology, and 21.2% (95% CI = 19.1–23.4%) in the population who had no indicated-eating disorder symptomology. Statistical analysis yielded an OR of BDD in

indicated vs no-indicated eating disorder symptomology of 12.23 (95% CI = 9.00–16.61).

The multiple logistic regression model was statistically significant in both populations: in the indicated-eating

disorder symptomology sample  $\chi^2(27) = 83.10$ ,  $p < 0.001$ . The model explained 41.7% (Nagelkerke  $R^2$ ) of the variance in BDD and correctly classified 82.6% of cases. Sensitivity was 44.1%, specificity was 94.0%, positive predictive value was 14.9% and negative predictive value was 68.4%. The variables age, exercising for weight control, health, and enjoyment, relationship status (single vs in a relationship), and ethnicity (white vs Asian) added significantly to the prediction ( $p = < 0.05$ ). In the no indicated-eating disorder symptomology sample  $\chi^2(28) = 227.30$ ,  $p < 0.001$ . The model explained 25.6% (Nagelkerke  $R^2$ ) of the variance in BDD and correctly classified 80.5% of cases. Sensitivity was 22.6%, specificity was 95.7%, positive predictive value was 41.7% and negative predictive value was 82.5%. The variables age, gender, BMI, EAI score, exercising for weight control, mood, attractiveness and tone, and sexuality (heterosexual vs 'prefer not to say') added significantly to the prediction ( $p \leq 0.05$ ). Full regression results for both populations are shown in Table 2.

There were significant interactions between eating disorder status and homeowner status, exercising for enjoyment, sexuality (heterosexual vs bisexual), and ethnicity (white vs Asian). Full interaction data are shown in Table 3.

## Discussion

The present study explored the prevalence of BDD among health club users stratified by eating disorder status, and the extent of which several novel correlates were associated with BDD. The prevalence of BDD differed largely according to eating disorder status (indicated eating disorder symptomology 76.7%; no indicated eating disorder symptomology 21.2%), yielding an OR of 12.23. Although this is the first study to our knowledge to report the relationship between BDD and eating disorders in this way, these results are in general agreement with the literature base. For example, Cash and Deagle [36] concluded, in their meta-analysis of negative body image in eating disorder patients compared to control groups, that subjects with eating disorders experienced significantly greater feelings of body dissatisfaction when compared to control groups (ranging from moderate to very-large effect sizes). Furthermore, Rabe-Jablonska and Sobow [37] found that 25% of subjects displayed symptoms of BDD 6 months prior to developing anorexia nervosa. This adds evidence that eating disorders and BDD are closely interlinked, highlighting a need to further investigate the links between the two conditions. Furthermore, our prevalence results suggest that subjects presenting with symptoms of BDD should also be screened for eating disorders at regular intervals.

BDD was associated with gender, but only in the group with no indicated eating disorders, indicating that BDD in

this sample is more prevalent in females than males, which is contrary to the general BDD literature that suggests no gender differences in BDD [15], however does agree with the limited literature exploring body image disturbances and health club users [20]. Another possible reason for this could be the method of data collection. There is evidence of a positive association between social media use and negative feelings of body image in women [38, 39]; therefore, this group of females could be more at risk of BDD than other populations.

Lower BMI was a correlate of BDD only in health club users who had an indicated eating disorder symptomology. This is consistent with the eating disorder literature which states that striving for a lower body weight (and, therefore, a lower BMI) via excessive exercise is a common symptom of both anorexia and bulimia nervosa [40], adding to the evidence that exercise levels should be closely monitored in subjects with indicated eating disorders.

There were significant positive associations between EAI score and BDD in the sample without indicating eating disorder symptomology. This is in broad agreement with Corazza et al. [12] and Trott et al. [41], who also found positive associations between obligatory exercise and BDD. This could be because subjects who are unhappy with their bodies use exercise as a means to increase attractiveness, which could lead to pathological exercise. More research exploring the extent of this relationship is warranted.

Exercising for weight control was positively associated with BDD in both sub-samples. Exercising for mood, attractiveness and tone were positively correlated with BDD only in the sample without indicated eating disorder symptomology. Furthermore, both exercising for health and enjoyment were both negatively associated with BDD in the sample with indicated eating disorder symptomology. This is the first study to highlight such an association and adds evidence that subjects with potential BDD should also be screened for eating disorders, as exercising for weight control has been consistently correlated with several types of eating disorder [37, 41].

There were no significant associations between sexuality, social media use, and BDD, with the exception of a small association between heterosexuality and 'prefer not to say' in the non-indicated eating disorder symptomology sample. There was, however, a significant interaction effect between BDD and heterosexuality, and BDD and bisexuality. The mostly null-findings regarding sexuality and BDD are in generally in contrast with the literature that states that both bisexual and homosexuals suffer with BDD more than heterosexuals [13, 17], however we hypothesise that this could be because of our samples: we had very low numbers of homosexual and bisexual men in this study compared with heterosexuals, which reduced the power of the multivariate associations.

**Table 2** Logistic regression summary of independent variables (dependent variable = body dysmorphic disorder status)

	Indicated-eating disorder symptomology				No-indicated eating disorder symptomology			
	Unadjusted associations		Adjusted associations <sup>a</sup>		Unadjusted associations		Adjusted associations <sup>a</sup>	
	Odds ratio (95% CI)	<i>p</i> value	Odds ratio (95% CI)	<i>p</i> value	Odds ratio (95% CI)	<i>p</i> value	Odds ratio (95% CI)	<i>p</i> value
BDD prevalence	76.7% (71.7–81.7%)				21.2% (19.1–23.4%)			
Age	0.939 (0.913–0.966)	<0.001**	0.945 (0.899–0.913)	0.027*	0.953 (0.940–0.966)	<0.001**	0.957 (0.937–0.978)	<0.001**
Sex	1.431 (0.359–5.699)	0.611	0.828 (0.092–7.453)	0.867	3.204 (1.986–5.171)	<0.001**	0.287 (0.159–0.518)	<0.001**
BMI <sup>b</sup>	0.999 (0.940–1.060)	0.965	1.044 (0.956–1.140)	0.340	1.034 (0.999–1.069)	0.056	1.052 (1.011–1.095)	0.013*
Life limiting illness	3.365 (0.465–24.373)	0.230	1.101 (0.076–16.052)	0.944	(not enough data to run analysis)	NA	0.000 (0.000–0.000)	0.999
Fitness instructor status	1.432 (0.813–2.522)	0.214	1.177 (0.513–2.703)	0.700	0.989 (0.763–1.282)	0.936	1.044 (0.750–1.453)	0.797
EAI score	1.060 (1.001–1.123)	0.046*	1.017 (0.934–1.108)	0.695	1.126 (1.087–1.167)	<0.001**	1.089 (1.042–1.139)	<0.001**
Exercise hours for leisure	1.001 (0.943–1.062)	0.972	1.025 (0.936–1.122)	0.597	0.999 (0.965–1.033)	0.937	0.997 (0.954–1.043)	0.910
Homeowner status	2.495 (1.397–4.458)	0.002**	0.446 (0.168–1.185)	0.105	1.651 (1.274–2.139)	<0.001**	0.954 (0.652–1.395)	0.808
REI weight control	1.237 (0.977–1.566)	0.077	1.604 (1.124–2.288)	0.009*	1.569 (1.395–1.765)	<0.001**	1.301 (1.121–1.509)	0.001**
REI fitness	0.728 (0.548–0.966)	0.028*	1.201 (0.730–1.977)	0.471	0.989 (0.858–1.139)	0.876	0.825 (0.667–1.019)	0.074
REI mood <sup>b</sup>	0.987 (0.800–1.218)	0.901	1.370 (0.961–1.953)	0.082	1.366 (1.228–1.520)	<0.001**	1.252 (1.082–1.449)	0.003**
REI health	0.615 (0.458–0.826)	0.001**	0.490 (0.280–0.857)	0.012*	0.914 (0.801–1.042)	0.179	0.837 (0.679–1.031)	0.095
REI attractiveness <sup>b</sup>	1.185 (0.992–1.417)	0.061	1.111 (0.829–0.490)	0.480	1.433 (1.306–1.572)	<0.001**	1.247 (1.099–1.415)	0.001**
REI Tone	1.074 (0.907–1.272)	0.410	1.148 (0.915–1.439)	0.233	1.223 (1.116–1.339)	<0.001**	1.172 (1.050–1.309)	0.005**
REI enjoyment	0.771 (0.651–0.913)	0.003**	0.695 (0.528–0.913)	0.009*	1.050 (0.960–1.148)	0.283	0.911 (0.809–1.027)	0.126
SMUIS social integration and emotional connection	1.296 (1.029–1.633)	0.023	1.170 (0.770–1.777)	0.463	1.421 (1.261–1.601)	<0.001**	1.175 (0.973–1.420)	0.093
SMUIS integration into social routines	1.330 (1.063–1.664)	0.013	1.174 (0.770–1.789)	0.456	1.254 (1.116–1.410)	<0.001**	0.996 (0.834–1.190)	0.965
Sexuality: Heterosexual vs homosexual	0.682 (0.284–1.641)	0.393	0.672 (0.045–10.106)	0.774	0.947 (0.624–1.438)	0.799	0.472 (0.211–1.056)	0.068
Sexuality: Heterosexual vs bisexual	1.122 (0.349–3.607)	0.847	0.293 (0.012–7.072)	0.449	0.651 (0.365–1.161)	0.146	0.745 (0.275–2.018)	0.562
Sexuality: Heterosexual vs ‘prefer not the say’	5.213 (0.852–31.909)	0.074	0.026 (0.001–1.240)	0.064	5.738 (0.769–42.836)	0.088	0.090 (0.010–0.823)	0.033*
Relationship status: Single vs ‘in a relationship’	0.948 (0.528–1.703)	0.859	0.194 (0.062–0.610)	0.005**	0.857 (0.652–1.127)	0.268	0.913 (0.622–1.340)	0.642



**Table 2** (continued)

	Indicated-eating disorder symptomology				No-indicated eating disorder symptomology			
	Unadjusted associations		Adjusted associations <sup>a</sup>		Unadjusted associations		Adjusted associations <sup>a</sup>	
	Odds ratio (95% CI)	<i>p</i> value	Odds ratio (95% CI)	<i>p</i> value	Odds ratio (95% CI)	<i>p</i> value	Odds ratio (95% CI)	<i>p</i> value
Relationship status: Single vs married	2.054 (1.149–3.672)	0.015*	0.418 (0.030–1.341)	0.142	1.566 (1.190–2.061)	0.001	1.091 (0.685–1.740)	0.713
Relationship status: Single vs widowed	(not enough data to run analysis)	NA	NA	NA	(not enough data to run analysis)	NA	(not enough data to run analysis)	NA
Relationship status: Single vs 'other'	3.365 (0.465–24.373)	0.230	0.235 (0.015–3.597)	0.298	0.444 (0.106–1.870)	0.269	2.849 (0.425–19.082)	0.281
Ethnicity: White vs Hispanic	6.730 (0.600–75.460)	0.122	0.122 (0.006–2.466)	0.170	0.647 (0.266–1.576)	0.338	1.675 (0.562–4.995)	0.355
Ethnicity: White vs black <sup>b</sup>	1.648 (0.147–18.477)	0.685	3.852 (0.090–165.654)	0.482	2.159 (0.269–17.331)	0.469	0.000 (0.000–0.000)	0.999
Ethnicity: White vs Asian	6.306 (1.784–22.286)	0.004**	0.060 (0.011–0.315)	0.001**	1.134 (0.562–2.289)	0.725	0.831 (0.370–1.865)	0.654
Ethnicity: White vs 'other'	2.222 (0.363–13.595)	0.388	0.336 (0.021–5.626)	0.437	1.630 (0.627–4.239)	0.316	0.505 (0.163–1.560)	0.235

<sup>a</sup>Model adjusted for all other variables<sup>b</sup>Interaction terms showed correlate differs by eating disorder status\* $p < 0.05$ ; \*\* $p < 0.01$ 

This study should be considered within its limitations. Firstly, due to the cross-sectional nature of the study design, the direction of correlation (and, therefore, causality) is impossible to determine. Further longitudinal analysis is required to determine the direction of the observed correlations. Secondly, the use of a self-report tools are carry inherent limitations [42]. Moreover, the sample was restricted to health club users who were recruited via social media, making the generalisation of the findings across different populations difficult.

### What is already known on this subject

Body dysmorphic disorder (BDD) and eating disorders are similar and often present as concurrent conditions. It is unknown, however, how novel correlates such as exercise motivation, exercise addiction, and social media use associate with body dysmorphic disorder in indicated vs non-indicated eating disorder symptomology.

### What this study adds

This study provides evidence that health club users with indicated eating disorder symptomology are over 12 times more likely to concurrently suffer with BDD, with

correlates varying significantly between eating disorder symptomology status. Furthermore, due to high levels of morbidity associated with eating disorders, practitioners working with subjects with BDD should consider screening for eating disorders.

### Conclusion

The main findings of this study suggest that although BDD and eating disorders are closely interlinked, with more than three-quarters of subjects with indicated eating disorder symptomology also having indicated BDD, several correlates are unique to BDD in the absence or presence of eating disorder symptomology, suggesting different aetiologies for BDD with vs without indicated eating disorders. Further research exploring the links between BDD and eating disorders is warranted. Moreover, practitioners working with subjects with possible BDD (in health centres and in health care settings) should consider screening for eating disorders due to the high levels of morbidity associated with this condition.

**Table 3** Interaction effects between independent variables and eating disorder status (dependent variable = BDD status)

Independent variable*eating disorder status	Beta coefficients (95% CI)	p value
Age	0.987 (0.972–1.002)	0.090
Sex	2.167 (0.378–12.409)	0.385
BMI	0.988 (0.966–1.011)	0.307
Life limiting illness	NA	NA
Fitness instructor status	0.665 (0.342–1.293)	0.229
Exercise hours for leisure	0.976 (0.922–1.032)	0.392
<b>Homeowner status*</b>	0.459 (0.251–0.841)	0.012
REI weight control	0.948 (0.857–1.048)	0.294
REI fitness	0.942 (0.859–1.032)	0.201
REI mood	0.926 (0.843–1.018)	0.110
REI health	0.921 (0.841–1.010)	0.079
REI attractiveness	0.933 (0.847–1.027)	0.158
<b>REI enjoyment*</b>	0.888 (0.797–0.988)	0.029
REI Tone	0.948 (0.854–1.052)	0.315
SMUIS social integration and emotional connection	0.944 (0.800–1.113)	0.491
SMUIS integration into social routines	0.960 (0.850–1.084)	0.511
Exercise addiction status	0.675 (0.367–1.243)	0.207
Sexuality: Heterosexual vs homosexual	0.893 (0.509–1.566)	0.693
<b>Sexuality: Heterosexual vs bisexual*</b>	0.184 (0.037–0.912)	0.038
Sexuality: Heterosexual vs ‘prefer not the say’	0.479 (0.021–10.956)	0.645
Relationship status: Single vs ‘in a relationship’	0.699 (0.354–1.378)	0.301
Relationship status: Single vs married	0.596 (0.299–1.187)	0.141
Relationship status: Single vs widowed	NA (not enough data)	–
Relationship status: Single vs ‘other’	0.122 (0.007–2.037)	0.143
Ethnicity: White vs Hispanic	0.196 (0.013–2.981)	0.241
Ethnicity: White vs black	NA	NA
<b>Ethnicity: White vs Asian**</b>	0.065 (0.012–0.348)	0.001
Ethnicity: White vs ‘other’	0.785 (0.057–10.832)	0.857

\* $p < 0.05$ ; \*\* $p < 0.005$ **Funding** None.

## Compliance with ethical standards

**Conflict of interest** No authors declare any conflict or competing interests.**Ethical approval** This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.**Informed consent** All participants provided informed consent prior to their participation.

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