SYMPTOMS OF MUSCLE DYSMORPHIA, BODY DYSMORPHIC DISORDER, AND EATING DISORDERS IN A NONCLINICAL POPULATION OF ADULT MALE WEIGHTLIFTERS IN AUSTRALIA

JOHANNA E. NIEUWOUDT, SHI ZHOU, ROSANNE A. COUTTS, AND RAY BOOKER

School of Health and Human Sciences, Southern Cross University, Lismore, Australia

ABSTRACT

Nieuwoudt, JE, Zhou, S, Coutts, RA, and Booker, R. Symptoms of muscle dysmorphia, body dysmorphic disorder, and eating disorders in a nonclinical population of adult male weightlifters in Australia. J Strength Cond Res 29(5): 1406–1414, 2015—The current study aimed to (a) determine the rates of symptoms of muscle dysmorphia (MD), body dysmorphic disorder (BDD), and eating disorder; (b) determine the relationships among symptoms of MD, BDD, and eating disorders; and (c) provide a comprehensive comparison of symptoms of MD, BDD, and eating disorders in a nonclinical population of adult male weightlifters in Australia. The participants (N = 648, mean age = 29.5 years, SD = 10.1) participated in an online survey, consisting of Muscle Appearance Satisfaction Scale, the Body Dysmorphic Disorder Questionnaire, and the Eating Attitude Test-26. Results indicated that 110 participants (17%) were at risk of having MD, 69 participants (10.6%) were at risk of having BDD, and 219 participants (33.8%) were at risk of having an eating disorder. Furthermore, 36 participants (5.6%) were found at risk of having both MD and BDD, and 60 participants (9.3%) were at risk of having both MD and an eating disorder. Significant correlations and associations were found between symptoms of MD and BDD, and symptoms of MD and eating disorders. Support was provided for the comorbidity of, and symptomatic similarities between, symptoms of MD, BDD, and eating disorders. Male body image research suggests that there has been a dramatic increase in males who are dissatisfied with their bodies and want to become more muscular. Research suggested that a drive for muscularity underlies the behavioral symptoms of muscle dysmorphia (MD; (29)). Muscle dysmorphia is observed as a strong drive to increase muscularity and decrease body fat (35) and seems to be based on perceived muscularity, regardless of actual muscle size and definition (36). The prevalence of MD is not yet known (30). Only a few researchers have published the MD rates found in their studies (e.g., (18,35)), and such rates have ranged from 10 to 53.6%.

KEY WORDS muscularity, weightlifting, men, prevalence, disordered eating

INTRODUCTION

Male body image research suggests that there has been a dramatic increase in males who are dissatisfied with their bodies and want to become more muscular. Research suggested that a drive for muscularity underlies the behavioral symptoms of muscle dysmorphia (MD; (29)). Muscle dysmorphia is observed as a strong drive to increase muscularity and decrease body fat (35) and seems to be based on perceived muscularity, regardless of actual muscle size and definition (36). The prevalence of MD is not yet known (30). Only a few researchers have published the MD rates found in their studies (e.g., (18,35)), and such rates have ranged from 10 to 53.6%.

It seems that MD may be a form of body dysmorphic disorder (BDD), where the preoccupation is overall muscularity, as opposed to a perceived physical defect (29). Indeed, an MD specifier has been added to BDD in the fifth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-5; (1)). Body dysmorphic disorder is characterized by a preoccupation with a perceived or imagined defect in physical appearance causing marked impairment in functioning (1) and affects 0.7–2.4% of the general population (6,12,21). Research indicated that men with BDD may also display symptoms of MD. In their respective studies, C. G. Pope et al. (34) found that 14 of the 63 male participants with BDD also had MD, and H. G. Pope et al. (35) found that 18 of the 193 participants with BDD also had MD. Another study found that 5 of 15 (N = 28) participants with MD symptoms also displayed other classic BDD symptoms (18). In contrast, participants (n = 13) without MD did not display these BDD symptoms (18).

Research has found that males with BDD who also displayed MD symptoms were similar to those with BDD but without MD symptoms on many variables, such as BDD severity and delusionality, preoccupation with non-muscle–related body
parts, and non-MD-related BDD behaviors (34). Individuals with BDD and MD had clinically significantly higher rates of attempted suicide, a higher prevalence of anabolic androgenic steroid use, more likely to weight train excessively, and have a strict diet compared with individuals with BDD but without MD symptoms (34). Body dysmorphic disorder symptomatology was found to be positively correlated with compulsive exercise, which reflects the relationship between compulsive exercise and MD as a type of BDD (5).

Muscle dysmorphia was originally thought to be a form of eating disorder (36), with symptoms of MD closely resembling those exhibited by men with an eating disorder (29). Arguments against the categorization of MD as a form of eating disorder have been partly based on the assumption that disordered eating was only a secondary feature of the condition (28). Eating disorders are characterized by persistent disturbances in eating habits that lead to a change in food consumption and cause clinically significant distress or impairment in important areas of functioning (1). Research suggests that the rate of males diagnosed with an eating disorder is increasing, from 10% in previous years to about 25% in 2007 (19).

Researchers have argued that MD should be categorized within an eating disorder spectrum because MD (drive for weight gain) and anorexia nervosa (drive for weight loss) exists on opposing ends of the same continuum of body image psychopathology (27). Researchers concluded that there were many similarities between MD and anorexia nervosa, such as disordered eating practices, shared etiological factors, diagnostic crossover with time, shared familial transmission, and response to similar treatment approaches (27), with further research providing moderate support for symptomatic similarities between MD and anorexia nervosa (25). It seems that eating practices alone can exacerbate MD symptoms because MD is inclusive of central eating- and exercise-related practices (26). Behar and Molinari (3) found that a group of weightlifters with MD scored higher in the 40-item Eating Attitudes Test and Eating Disorders Inventory compared with a group of weightlifters without MD. The weightlifting groups also scored higher in the 40-item Eating Attitudes Test and Eating Disorders Inventory compared with medical students who did not do weightlifting (3).

To advance the understanding of MD symptomatology, further research is needed to explore the symptomatic relationships among MD, BDD, and eating disorders. Furthermore, the rates of MD symptoms, BDD symptoms, and eating disorder symptoms in adult male weightlifters are largely unknown. To address this, an online survey study was conducted in a nonclinical population of adult male weightlifters in Australia that aimed to (a) determine the rates of MD symptoms, BDD symptoms, and eating disorder symptoms; (b) determine the relationships among symptoms of MD, BDD, and eating disorders; and (c) provide a comprehensive comparison of symptoms of MD, BDD, and eating disorders. The outcomes of this study would thus contribute toward enhancing the understanding of these disorders. It will inform strength and conditioning professionals of the rates of symptoms of MD, BDD, and eating disorders in adult males who are working out with weights (i.e., free weights or machines) and increase their awareness of these disorders in weightlifting/training populations. A better understanding of the symptoms of these disorders may allow strength and conditioning professionals to identify and refer at-risk individuals for help from mental health practitioners.

**METHODS**

**Experimental Approach to the Problem**

This study used a cross-sectional design with an online survey. Symptoms of MD were assessed with the Muscle Appearance Satisfaction Scale (MASS), symptoms of BDD were assessed with the Body Dysmorphic Disorder Questionnaire (BDDQ), and symptoms of eating disorders were assessed with the 26-item Eating Attitude Test (EAT-26).

**Subjects**

Before conducting the study, ethics approval was obtained from the Human Research Ethics Committee of Southern Cross University (with approval number ECN-12-169). Participants were invited to participate in an online survey about weightlifting, diet, and male body image. The inclusion criteria were (a) adult males at least 18 years of age, (b) individuals who are working out with weights (i.e., free weights or machines) at least 3 times per week, and (c) currently residing in Australia. An information statement was provided at the start of the questionnaire. Participant consent was implied by completing the survey. Participation was voluntary, and participants could withdraw at any time of the study.

A total of 648 adult males participated in the online survey. The participants’ ages ranged from 18 to 65 years (mean = 29.5 ± 10.1 years). The majority of participants (85.3%) were Caucasian, heterosexual (93.4%), and 40% of the participants indicated that they were single. Participants were engaged in weightlifting at least 3 days or more per week. Most participants (94.8%) had 1 weightlifting session per day.

**Procedure**

Potential participants were recruited online: through e-mails, participant friends, weightlifting and bodybuilding discussion forums, and Facebook. A link (web address) to the survey was provided. Facebook searches were initiated using the words “gym” and the names of cities/suburbs of cities and towns in Australia. Invitations to participate in the study were posted on Facebook profile walls. Facebook users were asked to share the post. Invitations to participate were posted on Australian bodybuilding and weightlifting forums, such as Aussie gym junkie (www.aussiegymjunkies.com), Australian bodybuilding (www.ausbb.com), and Size Matters (www.sizematters.com.au). E-mails were sent by the University bulk e-mail system to all students and staff.

The online survey was opened for 51 weeks, from August 8, 2012 to July 30, 2013. The online survey was supported by Qualtrics research software. Participants were free to...
withdraw from the survey at any stage without explanation and were able to skip any questions that they did not want to answer. The survey could be saved and continued at a later time.

**Measures**

The following self-report measures were used: the MASS, the BDDQ, and the EAT-26.

**Muscle Appearance Satisfaction Scale.** The MASS (23) is a 19-item self-report measure of MD symptomatology, in which items are rated on a 7-point Likert scale, with responses ranging from 1 (strongly disagree) to 7 (strongly agree). Total scores range from 19 to 133. The MASS consists of 5 subscales: Bodybuilding Dependence, Muscle Checking, Substance Use, Injury Risk, and Muscle Satisfaction. The scores from each question under each subscale are added up. The MASS provides a dimensional description, with higher scores in the subscales indicating greater risk for MD. There is no cut-off score with a clinical population (S. B. Mayville, written personal communication, November 7, 2011). Although there is not a defined cut-off score, this instrument provides a dimensional description, with higher scores in the subscales indicating greater risk for MD. Therefore, in the current study, quartiles (25th and 75th percentiles) were identified for each subscale to determine the degree of MD symptoms among the participants. Participants whose scores were at and above the 75th percentile on the subscales were considered as reporting high symptoms, and individuals with scores at and below the 25th percentile were regarded as reporting low symptoms. The participants whose scores were between the 25th and 75th percentiles were considered to possess moderate symptoms. Participants who had high scores in 3 or more subscales of the MASS were considered as being at greater risk of MD in the current study.

In previous studies with male participants, the MASS showed good internal consistency in the United States but varied internal consistency in other countries. The MASS had good test-retest reliability (r ranged from 0.76 to 0.89) and showed construct validity between the MASS and measures of body image disturbance (23). In the current study, the MASS had good internal consistency (\( \alpha = 0.89 \)). The subscales of the MASS had Cronbach’s alpha ranging from 0.72 to 0.86.

**Body Dysmorphic Disorder Questionnaire.** The BDDQ (32) is a self-report screening tool to assess the presence of BDD symptoms. The BDDQ (32) consists of a series of “yes or no” questions that ask the individual about appearance concerns and the impact of these concerns on the individual’s life. If the individual answers “yes” to a question, it leads to a question asking to list or describe the concern or impact of the concern. An individual is likely to have BDD if the individual answers “yes” to both parts of question 1, “yes” to any of the questions in question 3, and selects “b” or “c” for question 4.

The BDDQ has had 100% sensitivity and 89% specificity in a psychiatric outpatient setting (32).

**Eating Attitudes Test—26 Items.** The EAT-26 is a self-report measure designed to assess eating disorder symptomatology (13). The EAT-26 is used as a screening tool to identify individuals who are at increased risk for eating disorders (13). The EAT-26 consists of 26 items, and the response to each item is rated on a 6-point Likert-type scale from 1 (almost never) to 6 (never). Item scores for items 1 to 25 range from 3: always, 2; usually, 1: often, 0: sometimes, 0: rarely, to 0: never. Item 26 is reverse scored. Scores are calculated by simply summing the values of the participant’s choices for the entire scale: scores range from 0 to 75. A score of 20 or above indicates a high level of concern about dieting, body weight, and problematic eating behaviors (13). Behavioral questions are also included in the questionnaire and determine the presence of extreme weight-control behaviors and providing an estimate of their frequency. In previous studies, the EAT-26 demonstrated good internal consistency. In the present study, the EAT-26 had good internal consistency (\( \alpha = 0.820 \)).

**Statistical Analyses**

Descriptive statistics were used to explore the study population’s characteristics. Mean values of the measurements with SD were reported. Cronbach’s alpha was used to determine the reliability and internal consistency of the MASS and the EAT-26. Crosstabulations were used to examine frequencies of participants at risk of MD only, BDD only, an eating disorder only, at risk of both MD and BDD, at risk of both MD and an eating disorder, and at risk of both BDD and an eating disorder. Log-linear analysis was used to find associations between MD, BDD, and eating disorder variables. Spearman rank order correlation (\( r_s \)) and point-biserial correlation (\( r_{pb} \)) analyses were undertaken to examine the associations between MD, BDD, and eating disorder symptomatology. The level of significance was set at \( p \leq 0.05 \).

Continuous variables were not normally distributed; non-parametric tests were therefore used to compare continuous variables across groups. Participants at risk of, and not at risk of, MD, BDD, and eating disorders were compared on each of the measures. Kruskal-Wallis tests were conducted to compare continuous variables across groups of participants at risk of, and not at risk of, MD, BDD, and eating disorders. Mann-Whitney U-tests were undertaken to examine between-group differences, and effect size (\( \delta \)) was calculated by \( z / \sqrt{\text{square root of } N} \). Chi-square tests and Fisher’s exact tests were used to explore the relationships between categorical variables across groups of participants at risk of, and not at risk of, MD, BDD, and eating disorders. Bonferroni corrections were made to control for possible type 1 error for contrast analyses, leading to a corrected critical significant level of \( p < 0.002 \). Statistical analyses were performed using IBM SPSS, Statistics 20 (IBM SPSS; Chicago, Illinois).
RESULTS

Muscle Dysmorphia, Eating Disorder, and Body Dysmorphic Disorder Symptomatology

The mean scores of the MASS and its subscales were calculated for the total sample (MASS, 66.50 ± 19.05; Bodybuilding Dependence subscale, 18.46 ± 6.21; Muscle Checking subscale, 11.62 ± 5.47; Substance Use subscale, 12.43 ± 5.55; Injury Risk subscale, 11.63 ± 4.40; Muscle Satisfaction subscale, 12.61 ± 4.24). The survey results indicated that a number of participants were at risk of having either MD, BDD, or an eating disorder, or both MD and BDD, both MD and an eating disorder, or both BDD and an eating disorder, as seen in Table 1.

Log-linear analysis was used to find associations between MD, BDD, and eating disorder variables. The 3-way log-linear analysis produced a final model that retained the 2-way interactions between MD and BDD, MD and eating disorders, and BDD and eating disorders. The likelihood ratio of the highest order interactions (MD by BDD by eating disorders) model was not significant, $\chi^2(2.191) = 1, p = 0.139$. The likelihood ratio of the 2-way interactions (MD by BDD; MD by eating disorders; and BDD by eating disorders) model was significant, $\chi^2(90.820) = 3, p < 0.001$. To break down this effect, separate $\chi^2$ tests on the MD, BDD, and eating disorder variables were performed. Significant associations were found between MD and BDD, $\chi^2(67.885) = 1, p < 0.001$; and between MD and eating disorders, $\chi^2(25.494) = 1, p < 0.001$. The main effect of BDD was the most important effect in the model ($z = 12.192$). The odds of having symptoms of MD and symptoms of BDD were 0.49. The odds of having symptoms of MD and symptoms of eating disorders were 1.2. The odds ratio of 0.41 indicated that the odds of having symptoms of MD and symptoms of BDD were 0.41 times the odds of having symptoms of MD and symptoms of eating disorders. In other words, the odds of having symptoms of MD and symptoms of eating disorders were

<table>
<thead>
<tr>
<th>TABLE 1. Number and percentage of participants who were at risk of having MD, BDD, or an eating disorder, or co-existence of disorders.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
</tr>
<tr>
<td>MD</td>
</tr>
<tr>
<td>BDD</td>
</tr>
<tr>
<td>Eating disorder</td>
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<tr>
<td>MD and BDD</td>
</tr>
<tr>
<td>MD and eating disorder</td>
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<tr>
<td>BDD and eating disorder</td>
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</tbody>
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*MD = muscle dysmorphia; BDD = body dysmorphic disorder.

<table>
<thead>
<tr>
<th>TABLE 2. Mean (±SD) scores on the MASS total score, the subscales of the MASS, and the EAT-26 total scores.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>MASS total score</td>
</tr>
<tr>
<td>Bodybuilding dependence</td>
</tr>
<tr>
<td>Muscle checking</td>
</tr>
<tr>
<td>Substance use</td>
</tr>
<tr>
<td>Injury risk</td>
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<tr>
<td>Muscle satisfaction</td>
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<tr>
<td>EAT-26 total score</td>
</tr>
</tbody>
</table>

*MD = muscle dysmorphia; BDD = body dysmorphic disorder; EAT = eating disorder; EAT-26 = Eating Attitudes Test-26 items; MASS = Muscle Appearance Satisfaction Scale.
2.45 times the odds of having symptoms of BDD and symptoms of MD.

Mean scores and SDs of groups of participants at risk of, and not at risk of, MD, BDD, and eating disorders on the subscales of the MASS, the total score of the MASS, and the total score of the EAT-26 are shown in Table 2. Participants at risk of MD, BDD, and eating disorders reported the highest mean score on the MASS total score, Bodybuilding Dependence subscale, Muscle Checking subscale, and Substance Use subscale. Participants at risk of both MD and eating disorders reported the highest mean score on the Injury Risk subscale. On the Muscle Satisfaction subscale, participants at risk of MD only reported the highest mean score. Participants at risk of MD, BDD, and eating disorders reported the highest mean score on the EAT-26 total score.

To meet the independence assumption of the Mann-Whitney U-test, comparisons were calculated for groups of participants at risk of (a) no disorder, (b) MD only, (c) BDD only, (d) eating disorders only, (e) both MD and BDD, (f) both MD and eating disorders, and (g) MD, BDD, and eating disorders. However, this study is limited to comparisons of the following groups: (a) at risk of MD only and BDD only and (b) at risk of MD only and eating disorders only.

Mann-Whitney U-tests revealed significant differences between groups with MD only and BDD only on the Bodybuilding Dependence subscale ($U = 81.500, z = -3.328, p < 0.001, r = 0.50$), the Injury Risk subscale ($U = 77.000, z = -3.634, p < 0.001, r = 0.51$), and the MASS total score ($U = 47.000, z = -4.284, p < 0.001, r = 0.61$).

Mann-Whitney U-tests revealed significant differences between groups with MD only and eating disorders only on the Bodybuilding Dependence subscale ($U = 614.000, z = -7.097, p < 0.001, r = 0.54$), the Muscle Checking subscale ($U = 866.500, z = -6.148, p < 0.001, r = 0.47$), the Substance Use subscale ($U = 845.500, z = -6.251, p < 0.001, r = 0.47$), Injury Risk subscale ($U = 858.000, z = -6.237, p < 0.001, r = 0.47$), Muscle Satisfaction subscale ($U = 1226.500, z = -4.859, p < 0.001, r = 0.37$), and the MASS total score ($U = 98.000, z = -8.933, p < 0.001, r = 0.68$).

Mann-Whitney U-tests revealed no significant differences between groups on the EAT-26 total score. Chi-square tests and Fisher's exact tests were used to explore the relationships between categorical variables (from the BDDQ) across groups of participants at risk of, and not at risk of, MD, BDD, and eating disorders.

### Table 3. Spearman rank order correlation and point-biserial correlations between the MASS, BDDQ, and the EAT-26.

<table>
<thead>
<tr>
<th></th>
<th>MASS</th>
<th>BD</th>
<th>MC</th>
<th>SU</th>
<th>IR</th>
<th>MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BDDQ (r_s)</td>
<td>0.324</td>
<td>0.315</td>
<td>0.299</td>
<td>0.218</td>
<td>0.178</td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.014</td>
<td>0.045</td>
<td></td>
</tr>
<tr>
<td>Has it upset you a lot (r_pb)</td>
<td>-0.211</td>
<td>-0.186</td>
<td>-0.186</td>
<td>-0.035</td>
<td>-0.247</td>
<td>-0.005</td>
</tr>
<tr>
<td>p</td>
<td>0.017</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Are there things you avoid (r_pb)</td>
<td>-10.219</td>
<td>0.035</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>How much time do you think about it (r_pb)</td>
<td>0.383</td>
<td>0.385</td>
<td>0.372</td>
<td>0.255</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>0.005</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*MASS = Muscle Appearance Satisfaction Scale total score; BD = Bodybuilding Dependence subscale; MC = Muscle Checking subscale; SU = Substance Use subscale; IR = Injury Risk subscale; MS = Muscle Satisfaction subscale; EAT-26 = Eating Attitudes Test–26 items; BDDQ = Body Dysmorphic Disorder Questionnaire; r_s = point-biserial correlation coefficient; r_b = Spearman rank order correlation coefficient.*
Chi-square tests revealed significant associations between “being worried about how you look” and whether participants were at risk of symptoms of MD or not, \( \chi^2 (1, n = 642) = 25.815, p < 0.001, \phi = -0.201 \), whether participants were at risk of BDD or not, \( \chi^2 (1, n = 642) = 42.171, p < 0.001, \phi = -0.256 \), and whether participants were at risk of eating disorders or not, \( \chi^2 (1, n = 642) = 16.140, p < 0.001, \phi = -0.159 \).

Chi-square tests revealed significant associations between “thinking about your appearance problems a lot” and whether participants were at risk of symptoms of MD or not, \( \chi^2 (1, n = 412) = 19.894, p < 0.001, \phi = -0.220 \), and whether participants were at risk of BDD or not, \( \chi^2 (1, n = 412) = 26.899, p < 0.001, \phi = -0.405 \).

Fisher’s exact tests revealed significant associations between the “amount of time spent thinking about how you look” and whether participants were at risk of symptoms of MD or not, \( \chi^2 (2, n = 164) = 24.902, p = 0.001, \phi = 0.391 \), and whether participants were at risk of BDD or not, \( \chi^2 (2, n = 164) = 188.356, p < 0.001, \phi = 0.964 \).

Correlational Analyses
Spearman rank order and point-biserial correlational analyses were undertaken to examine the correlations between MD, BDD, and eating disorder symptomatology. A number of significant correlations were found, as seen in Table 3.

Discussion
The present study found that 110 participants (17%) were at risk of MD, as seen in Table 1. Previous studies have reported 10–53.6% of participants being at risk of MD (e.g., (18,35)). Muscle dysmorphia rates vary significantly depending on the sample population, the assessment methods, and sample size. Muscle dysmorphia has been found to be associated with bodybuilding activities (2,14,17,18,37), such as long hours of weightlifting, as stipulated in the proposed MD criteria (35). It would thus be expected that samples consisting of bodybuilders and weightlifters would be at increased risk of MD compared with samples of university students. Because of the lack of standardized procedures for diagnosing individuals with MD and the diversity of sample populations, the currently published rates of participants at risk of MD might not be comparable.

The percentage of participants (10.6%, n = 69) who were at risk of having BDD in the present study, as seen in Table 1, was much higher compared with the percentage (0.7–2.4%) of individuals with BDD in the general population (6,12,21) but was comparable with prevalence rates reported in student populations, which have ranged from 5% (7) to 13% (4). It could be speculated that the high rate of BDD symptoms might be because of the nature of the sample we studied because BDD prevalence rates vary significantly depending on the sample population, the assessment methods, and sample size (6). Alternatively, the high rate of BDD symptoms might be because the BDDQ, a self-report screening tool, was used in the present study. It is possible that participants may be more willing to disclose their specific BDD concerns in a survey (6) compared with in-person interviews that are usually conducted for making a clinical diagnosis of BDD. Body dysmorphic disorder may also be difficult to diagnose and is often underdiagnosed (31). Individuals with BDD might be reluctant to discuss their appearance concerns because they may be ashamed of their BDD symptoms (6). It should be noted that the BDDQ can be used to assess the presence of BDD symptoms (32) but not for making a clinical diagnosis of BDD.

The relationship between MD and BDD has received limited investigation in previous research. The current study found that 36 of the 648 participants (5.6%) were at risk of having both MD and BDD (Table 1), with the odds being 0.49 of having symptoms of both MD and BDD. Previous studies that have found that 9.3% of 193 male participants and 22.2% of 63 male participants with BDD also had MD (34,35). Another study found that 5 of 15 participants with MD (33.3%) also displayed other classic BDD symptoms (18). Results from this study indicated that MD symptoms were significantly associated with symptoms of BDD, as \( \chi^2 (67.885) = 1, p < 0.001 \). Symptoms of BDD were found to be the most important effect (z = 12.192) in MD with BDD, MD with eating disorders, and BDD with eating disorder interactions.

Significant associations were revealed between BDD symptomatology (in particular between “being worried about how you look,” “thinking about your appearance problems a lot,” “being upset about a lot,” and the “amount of time spent thinking about how you look”) and whether participants were at risk of MD or not. Also, significant correlations were found between MD symptoms and BDD symptoms (32,34,35).

Despite the generally comparable findings between participants at risk of MD only and at risk of BDD only, the distinguishing features for these 2 disorders were the weightlifting activities and unsafe weightlifting behaviors. Significant differences were found in MD symptomatology between participants at risk of MD only and participants at risk of BDD only on the Bodybuilding Dependence subscale, the Injury Risk subscale, and the MASS total score. This may be because the BDDQ does not assess specific MD symptoms, in particular excessive weightlifting habits, and symptoms of overtraining and attitudes toward unsafe weightlifting behavior. Participants at risk of BDD only had slightly higher mean scores than participants at risk of MD only on the Muscle Checking subscale of the MASS (Table 2). A predominant symptom of BDD is the presence of compulsive behaviors designed to examine a perceived
defect (9), thus explaining higher scores on the Muscle Checking subscale.

In eating disorder symptomatology, no significant difference was found between participants at risk of MD only and participants at risk of BDD only. Participants at risk of BDD only had slightly higher mean scores than participants at risk of MD only on the total score of the EAT-26, as seen in Table 2. Eating disorders and BDD can be comorbid (33). Previous research found that 30.1% of participants with BDD were excessively preoccupied with their weight (10) and 29% of participants with BDD had excessive weight concerns (20).

Results of the current study indicated that 219 participants (33.8%) were at risk of having an eating disorder, as seen in Table 1. It could be speculated that the high rate of eating disorder symptoms might be because of the nature of the sample we studied. Research has indicated that serious recreational and competitive bodybuilding may increase the risk of eating disorders (16). Although strict dieting and eating-related disturbances are common among male bodybuilders, little research has examined eating disturbances in this population (16). Muscularity-oriented disordered eating behaviors include very high levels of protein consumption, severe restriction of non-protein-related dietary components (e.g., carbohydrates and fats), interrupting important activities to accommodate frequent eating (eating every 2–3 hours), continued food consumption despite feeling full, consuming a large proportion of calories in liquid (blended) form, and the use of appearance-enhancing drugs, such as supplements, “testosterone boosters,” and steroids (25). Goldfield et al. (15) stated that it was not possible for a bodybuilder to meet criteria for anorexia nervosa, but it was possible to meet criteria for bulimia nervosa. Research indicated a high prevalence of bulimia nervosa in recreational male bodybuilders, with no differences found between males with bulimia nervosa and male bodybuilders in the lifetime prevalence of using diuretics, vigorous exercise, or strict dieting to lose fat or weight (15).

It should be taken into consideration that the high rate of eating disorder symptoms might be because the EAT-26, a self-report screening tool, was used in the present study to assess the presence of eating disorder symptoms. It was used to assess individuals who might be at risk of having eating disorders but not for making a clinical diagnosis of an eating disorder.

Few studies have examined the relationship between MD and eating disorders. The present study found that 60 of the 648 participants (9.3%) were at risk of having both MD and an eating disorder, as seen in Table 1. The odds of having symptoms of MD and symptoms of eating disorders were 12. Results from the current study indicated that MD symptoms were significantly associated with symptoms of eating disorders, as $\chi^2(25.494) = 1$, $p < 0.001$. A previous study found that a group of weightlifters with MD scored higher in the 40-item Eating Attitudes Test and Eating Disorders Inventory compared with a group of weightlifters without MD (3). Murray et al. (26) found that eating practices alone could exacerbate MD symptoms because MD was inclusive of central eating- and exercise-related practices.

No significant differences were identified in eating disorder symptomatology between participants at risk of MD only and participants at risk of eating disorders only. In addition, the correlational data suggested a relationship between the symptoms of MD and eating disorders, as identified through the MASS total score and the EAT-26 total score, as seen in Table 3. Small but significant correlations were found between the Substance Use subscale of the MASS and the laxatives, diuretics behavioral question of the EAT-26, between the Injury Risk subscale of the MASS and the vomit and exercise behavioral questions of the EAT-26, and between the Muscle Satisfaction subscale and the binge eating and the lost ≥9 kg behavioral questions of the EAT-26 (Table 3). The results are perhaps not unexpected because the proposed MD diagnostic criteria repeatedly refer to disordered eating (35). These findings concur with previous research reporting similarities between MD symptoms and eating disorder symptoms (22,29), especially symptoms of anorexia nervosa (25,27).

McFarland and Kaminski (24) found that males with increased symptoms of MD were more likely than other males to use diet pills, to vomit, and to diet to manage their weight. A systematic literature review indicated that the majority of physically active individuals with MD follow specific eating schedules to increase muscle mass and decrease body fat—with such régimes consisting of high protein and low fat foods, with nutritional and performance-enhancing supplements (8).

Significant differences were found between participants at risk of MD only and participants at risk of eating disorders only on all 5 subscales of the MASS, and the MASS total score. This finding is not entirely surprising because the MASS assesses weightlifting activity, muscle checking behaviors, muscle-enhancing supplement use, unsafe weightlifting behavior, and muscle satisfaction. In contrast, the EAT-26 assesses disordered eating pertaining to a drive for thinness and not a drive for muscularity.

The BDDQ and EAT-26 are screening tools and can provide only a probable diagnosis of BDD or an eating disorder. Body dysmorphic disorder and eating disorders should ideally be diagnosed through a clinical interview. Therefore, the rates reported in this study were based on the presence of symptoms of BDD and eating disorders and not on clinical diagnoses. Also, the EAT-26 may not be sensitive to muscularity-oriented disordered eating and body image concerns. Although the current findings suggested similarities between MD and BDD, and between MD and eating disorders, nosological associations could not be inferred.

The current research consisted of an online survey, therefore the possibility existed that participants might have interpreted the meanings of questions or statements differently to those intended or might have perceived some of the statements or questions as vague (11). The sample was also limited to those individuals who had access to a survey over the Internet (11) and to those who had access to the Web sites.
and were aware of the survey. Self-selection bias is a limitation of Internet surveys. Self-selection bias also occur in traditional surveys, thus is not unique to Internet survey research. Also, the data were exclusively based on self-report, which can have tendencies toward social desirability bias.

The findings from the current study provided support for the comorbidity of symptoms of MD and BDD, and symptoms of MD and eating disorders, and a number of similarities were found between MD symptoms and eating disorder symptoms, and between MD symptoms and BDD symptoms. It may reflect a shared pathogenesis between MD, BDD, and eating disorders. Results indicated that MD symptoms were significantly associated with BDD and eating disorder symptoms, with the odds of having symptoms of MD and symptoms of eating disorders being greater than the odds of having symptoms of MD and symptoms of BDD.

**Practical Applications**

The present results do not suggest that working out with weights (i.e., free weights or machines) is not a healthy activity. Weightlifting and training do not cause MD, and only a minority of men who weight train might develop MD. A strict eating and training program is relatively important for individuals who want to increase their muscularity, and it only becomes problematic when the drive for muscularity becomes an obsession, as in MD. Muscle dysmorphia has harmful health consequences, thus strength and conditioning professionals should be aware that adult males who are working out with weights (i.e., free weights or machines) may be at increased risk of having MD. Individuals who work out with weights may also be at risk of BDD and eating disorders, and the symptoms of these disorders may be comorbid. A better understanding and awareness of the rates and symptoms of MD, BDD, and eating disorders may help strength and conditioning professionals to identify and refer at risk individuals for help from mental health professionals.

**Acknowledgments**

Ray Booker is retired.

**References**


