The Classification of Muscle Dysmorphia

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For some time, society's emphasis on appearance has negatively affected women. Now we're finding increasing numbers of men who are also overly dissatisfied with their bodies. This trend has led to a new disorder, *muscle dysmorphia* (MD), which is characterized by a preoccupation with muscularity accompanied by perceptual, affective, and behavioral components that interfere with daily activities. Currently, MD is not included in the *DSM-IV*, although it is purported to be a kind of body dysmorphic disorder (BDD), which in turn is a somatoform disorder. This study investigated relationships among symptoms of MD and variables most relevant to a *DSM* classification of men who lift weights regularly. No relationship was found between MD and a measure of somatoform disorder. Instead, BDD, OCD (obsessive-compulsive disorder), body dissatisfaction, and hostility are the main predictors of MD. This suggests that MD is an OCD spectrum disorder, rather than a somatoform disorder.

Keywords: men weightlifters, muscle dysmorphia, body dissatisfaction, muscularity, *DSM-IV*, body dysmorphic disorder, obsessive compulsive disorder

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American men are experiencing increased concern about their appearance (Olivardia, Pope, Mangweth, & Hudson, 1995). One reason may be due to Western culture's growing emphasis on unrealistic, overly muscular images of men. These muscularly endowed physiques, unattainable for the average male, have been depicted in all forms of the media and even in toy action figures. One need only compare the

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early GI Joe action-figure body of 1964 with the "super-articulated" GI Joe body of today to glimpse the intrusion of society's devotion to muscularity into child culture. Not surprisingly, an increasing number of teenage boys and men are concerned that they are neither muscular enough nor lean enough. These concerns have been accompanied by a higher incidence of eating disorders in males (Olivardia et al., 1995). In fact, Andersen, Cohn, and Holbrook (2000) postulate that up to 25-30 percent of eating disordered individuals might be males.

MUSCLE DYSMORPHIA

With the advent of increased body dissatisfaction comes a fairly new, still underresearched disorder, *muscle dysmorphia* (MD). It has already reached public awareness through the publication of *The Adonis Complex* (Pope, Phillips, & Olivardia, 2000). Pope, Katz, & Hudson (1993) originally referred to this disorder in the medical literature as "Reverse Anorexia Nervosa" because of its similarities to certain aspects of *anorexia nervosa* (AN). Individuals suffering from these two disorders share common perceptual and affective characteristics. Both show a preoccupation with appearance and experience extreme distress and anxiety associated with these preoccupations. They hide their bodies in oversized clothing and participate in compulsive behaviors such as specific eating rituals with strictly monitored food intake (not to be confused with compulsive eating behaviors, in which a person overeats without regard to physical cues of hunger or satisfaction, or binges without purging) and excessive exercise. However, whereas anorexics view their emaciated bodies as too fat, individuals suffering from MD perceive their often extremely muscular physiques as too small and even puny. Moreover, people with MD may engage in harmful and even self-destructive behaviors such as continuing to lift weights even when they are injured and using anabolic steroids (Olivardia, Pope, & Hudson, 2000). A fundamental difference between AN and MD is that anorexics, being concerned with perceived body fat, engage in characteristic pathological eating behaviors with excessive exercise as a secondary characteristic, while those suffering from muscle dysmorphia, being concerned with underdeveloped musculature, engage in pathological exercise routines with restrictive eating as a secondary characteristic (Olivardia, 2001).

The identification of muscle dysmorphia emerged from three studies examining the use of anabolic steroids in weightlifters (Pope et al., 1993). The objective of these studies was not originally associated with muscle dysmorphia. Obviously, not all men who lift weights and participate in strict exercise and diet regimens fall into this pathological category. In fact, most men who exercise at gyms have healthy attitudes about fitness and realistic views about their bodies (Pope, Gruber, Choi, Olivardia, & Phillips, 1997). However, striking symptoms of obsession with muscularity emerged in these studies, thereby moving the authors to recommend that what had been previously referred to as "reverse anorexia nervosa" should be termed "muscle dysmorphia" and be considered a type of body dysmorphic disorder (BDD).

Whereas BDD is defined in the *Diagnostic and Statistical Manual*, 4th edition (American Psychiatric Association, 1994) as a preoccupation with an imagined defect in appearance causing clinically significant distress or impairment in social,

occupational, or other important areas of functioning, not being the result of another mental disorder, Pope et al. (1997) defined *muscle dysmorphia* as a preoccupation with a misperception that muscles in general are small despite sufficient muscularity. This disorder affects both men and women but appears to be more prevalent in men. The mean age of onset is 19.4 years (*SD* = 3.6) (Olivardia, 2001; Olivardia et al., 2000; Pope et al., 1997).

An important outcome of the studies reviewed above is the suggestion that muscle dysmorphia is a valid diagnostic category. However, acknowledgment of its very existence depends upon where in the *DSM* system it should be classified.

MD and OCD Spectrum Disorders. Appearing to be a subtype of BDD, muscle dysmorphia would fall under the category of somatoform disorders. However, it has been suggested that BDD, and therefore MD, might be more appropriately conceptualized as an obsessive-compulsive (or OCD) spectrum disorder[1] because of its similarities to OCD characteristics. During the *DSM-IV* revision process, consideration was given to moving BDD to the anxiety disorders section because of these similarities. The change was not implemented because of a dearth of comparison data (Phillips & Hollander, 1996). Since that time, a wealth of research has documented substantial similarities such as intrusive, obsessional fears and compulsive rituals (Bienvenu, Samuels, Riddle, Hoehn-Saric, Kung-Yee, & Cullen, 2000; Phillips, 1998; Phillips, Dwight, & McElroy, 1998; Phillips, Gunderson, Mallya, McElroy, & Carter, 1998; Saxena, Winograd, Dunkin, Maidment, Rosen, Vapnik, et al., 2001; Simeon, Hollander, Stein, Cohen, & Aronowitz, 1995; Veale et al., 1996.) Additionally, BDD and OCD also exhibit similarities in age of onset, course of illness, and high comorbidity (Lydiard, Brady, & Austin, 1994; Phillips, Pope, & McElroy, 1994**;** Phillips, McElroy, & Hudson, 1995; Zimmerman & Mattia, 1998). Similarities in response to treatment have also been observed in the two disorders (Hollander & Benzaquen, 1997; Hollander, Allen, Kwon, Mosovich, Schmeidler, & Wong, 1999; Phillips et al., 1995, 1998; Rosen, Reitter, & Orosan, 1995; Saxena et al., 2001).

While there appear to be more similarities than differences between BDD and OCD, the differences are important, suggesting more of a spectrum relationship than an interchangeable label. For example, fewer individuals with BDD are married (Phillips et al., 1998), which is consistent with the theory that BDD is more highly correlated with social isolation and impairment than OCD. It was also found that insight is more generally impaired in BDD than in OCD so that subjects are convinced that their defects are real (Phillips et al., 1998; Simeon et al., 1995). Moreover, a substantial percentage of BDD but not OCD subjects have been found to be delusional (Phillips et al., 1994). What these differences in social impairment and insight (along with possible delusions) might suggest is that BDD (and thus MD) relates to OCD as a more socially phobic, depressed, and psychotic variant (Phillips, 2000; Phillips et al., 1998).

While the research literature now supports a recategorization of BDD, there is still a dearth of literature investigating the relationship of MD to either BDD or OCD. The few existing studies were consistent, however, in finding that those suffering from muscle dysmorphia experienced preoccupations and obsessional

thoughts about muscularity, usually accompanied by compulsive behaviors, such as excessive exercise, checking and comparing their muscularity to others, and seeking reassurance, thus providing support for a relationship between MD and OCD (Olivardia, 2001; Olivardia et al., 2000; Pope et al., 1997).

MD and Mood Disorders. Olivardia et al. (2000) elucidated the increased co-morbidity of muscle dysmorphia and mood disorders. Compared to the normal control group, where 20 percent had a history of mood disorders, those with muscle dysmorphia had a 58 percent incidence of major depressive disorder and bipolar disorder.

MD and Anxiety Disorders. There was also an increased comorbidity of muscle dysmorphia with anxiety disorders. Lifetime prevalence of anxiety disorders was found in 29 percent of men with muscle dysmorphia compared to three percent of the comparison group (Olivardia et al., 2000).

MD and Eating Disorders. Phenomenologically, muscle dysmorphia and eating disorders appear closely related. The case-control study by Olivardia et al. (2000) compared men with muscle dysmorphia to normal weightlifters. Men with muscle dysmorphia scored similarly on all *Eating Disorder Inventory* (EDI) subscales (Garner, Olmstead, & Polivy, 1983) compared to people with eating disorders. Results indicated that muscle dysmorphia and eating disorders share symptoms in the EDI subscales "perfectionist traits," "maturity fears," "feelings of ineffectiveness," and "drive for thinness." However, the drive for thinness manifests differently in men with muscle dysmorphia, who are not preoccupied with being overweight *per se* but are instead extremely concerned about leanness, that is, in attaining a low percentage of body fat.

Hudson & Pope (1990) suggested that MD, OCD, bulimia, anorexia, and some anxiety disorders may share a common physiological abnormality and thus MD might be a member of this "family" of affective spectrum disorders. Sociocultural influences that might predispose or cultivate this condition are also similar to messages from the media about the link between muscularity and masculinity. This link is evidenced by the covers of magazines of men with rippled muscles and tight, sculpted abs and the increase in muscularity of action figures such as GI Joe and Star Wars characters (Hall, 2000; Pope, Olivardia, Gruber, & Borowiecki, 1999; Spitzer, Henderson, & Zivian, 1999). Unfortunately, this idealized physique is not attainable by the average male without the use of potentially harmful drugs.

Dissimilarities between muscle dysmorphia and eating disorders are found in familial histories and childhood trauma. A history of family discord and childhood abuse (physical, sexual, and/or emotional) are strong etiological factors in the development of eating disorders (DeGroot, Kennedy, Rodin, & McVey, 1992; Everill & Waller, 1994; Fallon, Sadik, Saoud, & Garfinkel, 1994) but not in cases of MD. It should be noted that prominent features of muscle dysmorphia are shame and embarrassment, thereby possibly affecting the reporting of childhood abuse(s).

MD and Exercise Disorders. Like muscle dysmorphia, exercise disorders have not been recognized as separate disorders in the *DSM-IV*. What appear to be related con-

ditions—exercise addiction (Glasser, 1976), obligatory running (Coen & Ogles, 1993), and morbid exercising (Veale, 1987)—have been described in the *DSM* and termed "exercise dependency." Exercise dependency might appear to be related to muscle dysmorphia in that the individuals commit exorbitant amounts of time to working out. Exercise dependency has also attracted researchers' interests (Blumenthal, O'Toole, & Chang, 1984; Brewerton, Stellefson, & Hibbs, 1995; Furst & Germone, 1993; Yates, 1991). The diagnostic criteria of exercise dependency include biological symptoms such as tolerance and withdrawal symptoms as well as psychosocial symptoms such as interference with functioning in other areas of one's life. To date, research has focused only on aerobic exercise dependency, which differs from muscle dysmorphia in the desired end result. For example, compulsive aerobic exercisers seem to desire the "runner's high" endorphin rush (Blumenthal, O'Toole, & Chang, 1984) rather than an enhanced, large muscular physique. In contrast, individuals suffering from muscle dysmorphia avoid aerobic exercise since this kind of fitness routine tends to reduce lean muscle and body size (Pope et al., 1997).

SUMMARY

The literature reviewed above supports the contention that BDD is an OCD spectrum disorder rather than a somatoform disorder. Since MD is a form of BDD, it would also then fall within the OCD spectrum disorders. MD is also related to eating disorders and to mood and anxiety disorders. While Olivardia et al., (2000) have already postulated MD to be a viable diagnostic category in its own right, direct empirical support for the placement of MD is still lacking.

THE STUDY

Following previous studies, we sought a sample of men who lift weights and who would manifest a broad range of attitudes about their bodies from those falling into the mainstream to those whose preoccupations may be classified as pathological. In this sample, we investigated the relationship between muscle dysmorphic attributes with symptoms of obsessive-compulsive disorder and eating disorders as well as depression and anxiety. Because we intended to differentiate among variables that predicted MD from those that do not, we included some additional personality variables that we suspected were unrelated to MD to provide a contrast set.

Figure 1 illustrates the proposed model of the relationships among OCD, BDD, eating disorders, and MD based on the previous research. Since it is assumed that symptoms of depression and anxiety are pervasive throughout many of these disorders, they are not individually depicted in the suggested model. This model now provides a framework from which to conduct the empirical study that is needed to determine the placement of MD.

The hypotheses that guided this research were that symptoms of muscle dysmorphia are:

1. positively related to variables measuring symptoms of BDD, OCD, eating disorders, depression, and anxiety;

2. less related to a variable measuring symptoms of somatoform disorder; and
3. unrelated to other variables measuring symptoms of personality and pathology, specifically hostility, interpersonal sensitivity, paranoid ideation, and psychoticism.

The reader should note that variable names mentioned in these hypotheses and throughout this study refer to dimensions of symptoms rather than to clinically diagnosed groups.

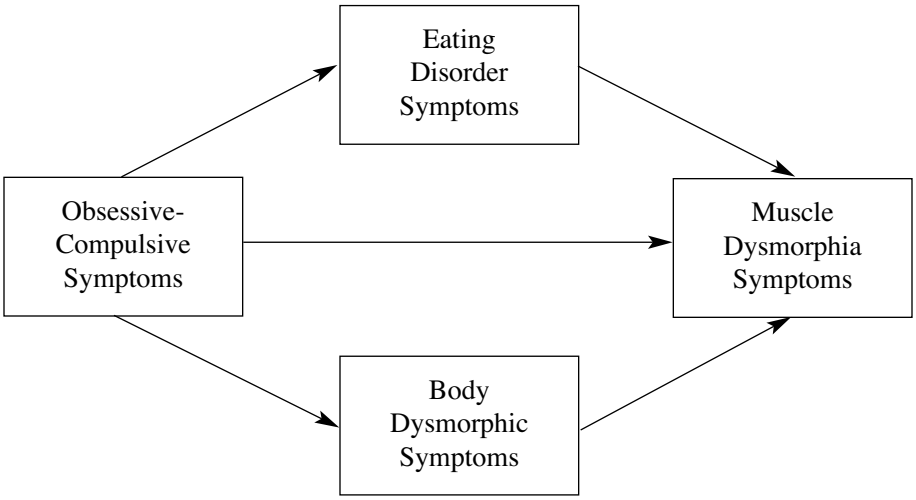

Figure 1. Some proposed obsessive-compulsive spectrum disorders and their possible relationship to OCD and one another.

METHOD

Subjects. The subjects were 106 male volunteers between the ages of 18 and 45 who were involved in varying weight lifting and/or fitness routines. The sample came from clients at private and university gyms in Pennsylvania and New York. Subjects need not have been competitive athletes but were screened before being asked to participate in the study and indicated they lifted weights four or more times weekly.

Materials. Five questionnaires were given to each subject. The first questionnaire, an informational form, included six questions: age range, employment and/or student status, highest level of education attained, marital status, involvement in organized sports, and months/years subject had been weight training.

The second questionnaire measured the dimension of muscle dysmorphia. The two parts to this questionnaire consisted of the *Drive for Muscularity Scale* (McCreary & Sasse, 2000) and the *Muscle Dysmorphia Symptom Questionnaire* (MDSQ) (Olivardia et al., 2000).

The *Drive for Muscularity Scale* (DMS) is a 15-item, self-report questionnaire designed to measure an individual's perception that he or she is not muscular enough and that bulk should be added to his or her frame (irrespective of the person's percentage of muscle mass or body fat). Items are scored on a six-point scale. The scores were normed on an adolescent population (M = 37.78, SD = 12.20). Reliability of the DMS is more than adequate with Cronbach alpha reliability coefficients of .84 (males) and .78 (females). Measures of validity were also found to be adequate. In studies of convergent validity, an ANOVA found that higher DMS scores were related to subjects' attempts to gain weight. The second method for examining convergent validity was to assess the correlations between the DMS and the number of times per week the participant typically engaged in weight training activities. The frequency of weight training was positively but weakly related to DMS scores (r = .24). In terms of discriminant validity, the DMS had no significant correlation with the drive for thinness construct of the *Eating Attitudes Test* (r = -.05) and had a slightly negative correlation with the *Body Dissatisfaction Scale* (r = -.15).

The second part of this questionnaire is an unpublished symptom inventory, the *Muscle Dysmorphia Symptom Questionnaire*, developed by Olivardia & Pope (2000), to assess the severity of muscle dysmorphia. Currently, there are neither reliability nor validity data.

The third questionnaire, the *Body Dysmorphic Disorder—Yale-Brown Obsessive-Compulsive Scale* (Phillips, Hollander, Rasmussen, Aronowitz, DeCaria, & Goodman, 1997) is a 12-item, semi-structured instrument designed to assess severity of BDD on a four-point scale (maximum 48). Each item is rated as a composite of all the subjects' appearance-related obsessions and compulsive behaviors independent of their context. The scale was normed on 125 subjects with BDD (63 men and 62 women). Interclass correlation coefficients demonstrated excellent interrater reliability across four raters for the total score and individual item scores. Test-retest reliability over an interval of one week was also acceptable (r = .88). Cronbach's alpha coefficient was .80, indicating adequate homogeneity of the scale. Total score on the BDD–Y-BOCS was significantly correlated with measures of illness severity.

The *Brief Symptom Inventory* (Derogatis, 1984), the fourth questionnaire, is a shortened form of the Symptom Checklist–90-R (SCL-90-R) and was used for our purposes to measure tendencies of somatization (SOM), obsessive-compulsive disorder (OCD), depression (DEP), anxiety (ANX), as well as the unrelated disorders hostility (HOS), interpersonal sensitivity (IS), paranoid ideation (PI), and psychoticism (PSY), which in our study served to establish discriminant validity. The BSI consists of 53 items scored on a five-point scale constituting eight subscales.[2] The scores used for our comparison purposes were normed on a male nonpatient population. The reliability, validity, and utility of the BSI instrument have been tested in more than 400 research studies. The BSI was found to have adequate psychometric properties with a satisfactory internal consistency ranging from a low of .77 for Psychoticism to a high of .90 for depression. Test-retest measures within a one-week interval produced coefficients between .80 and .90 for somatization. Results of validation studies have proved adequate as well. A high degree of convergent validity for the BSI was found with correlations ranging from .50 to .75 (Derogatis, 1984).

The *Eating Disorders Inventory* (EDI: Garner, Olmstead, & Polivy, 1983), the fifth questionnaire used, measures the range of eating disorder characteristics. There are eight subscales that reflect attitudinal, behavioral, and psychological correlates of anorexia nervosa and bulimia nervosa: drive for thinness (DT), bulimia (BUL), body dissatisfaction (BDIS), ineffectiveness (INEF), perfectionism (PER), interpersonal distrust (IDIS), interoceptive awareness (IA), and maturity fears (MF). The scores used for comparison purposes were normed on a female non-patient population. Psychometric properties for this test are acceptable. Measures of internal consistency have been reported as high (Cronbach's *alpha* = .93) while test-retest reliabilities were between 0.65 and 0.97 (Garner et al., 1983).

Procedure. Signs were posted in and around gym/fitness area entrances asking for volunteers to complete questionnaires for a study looking at male fitness attitudes. The researcher and associates also visited Philadelphia and New York area non-commercial, small gyms to solicit volunteers and relied on gym managers to distribute questionnaires to clients. Each set of randomly ordered questionnaires was placed in a postage-paid, self-addressed mailing envelope. The instructions advised subjects of absolute anonymity and emphasized the importance of completing each question on each questionnaire regardless of its personal relevance in order for data to be included in the study.

RESULTS

Characteristics of the Sample. Of the 200 questionnaires distributed, 106 participants responded, consisting entirely of men who lifted weights regularly (at least four times a week).

The majority (about 79%), were 18 to 32 years old, about 11% were 33 to 40 years old, and about 9% were in their early 40s. Of the 106 participants, about 74% were employed, and 54% were college students. Concerning marital status, 56% were single, 22% had a significant other, 17% were married, and nearly 5% were divorced or separated. Fifteen percent of the subjects had not attended college, almost 29% had completed at least four years of college, and 56% had attended college for one to three years. Of those who had attained a college degree, 3.8% obtained an associate's degree, 26.4% obtained a bachelor's degree, 5.7% obtained a master's degree, 5.7% possessed a medical or law degree, and fewer than 1% possessed other doctorates.

Descriptive statistics for all psychological variables for both the normed samples and the study sample are reported in Table 1.

Incidence of Heightened Symptoms of Muscle Dysmorphia. We intentionally did not study a sample of men who were diagnosed with muscle dysmorphia, and thus our sample included a wider range of symptoms, which is an advantage for a correlational analysis. Nevertheless, the extreme end of our sample is not unlike samples of diagnosed cases featured in previous research (Olivardi et al., 2000). For a participant to be considered as having heightened symptoms of muscle dysmorphia, he needed to demonstrate a high drive for muscularity (a score of over 31 on the *Drive*

Table 1
Descriptive Statistics of All Normed Samples and of Variables of Study Sample

	Normed Sample Mean (SD)	Study Sample Mean (SD)	Possible Range[b]
Muscle Dysmorphia (DMS)	37.96 (12.20)[a]	55.27 (16.01)	6-90
Body Dysmorphia (BDD)	11.29 (7.34)	29.30 (7.50)	0-48
Somatization (SOM)	0.32[c] (0.38[c])	0.23 (0.32)	0-28
Obsessive-Compulsive (OCD)	1.81[c] (0.69[c])	0.37 (0.041)	0-24
Depression (DEP)	1.02[c] (0.80[c])	0.21 (0.33)	0-26
Anxiety (ANX)	0.65[c] (0.57[c])	0.26 (0.31)	0-44
Hostility (HOS)	0.99[c] (0.83[c])	0.03 (0.040)	0-20
Interpersonal Sensitivity (IS)	0.49[c] (0.59[c])	0.24 (0.38)	0-16
Paranoid Ideation (PI)	0.74[c] (0.52[c])	0.03 (0.041)	0-20
Psychoticism (PSY)	0.43[c] (0.48[c])	0.15 (0.27)	0-20
Drive for Thinness (DT)	5.76 (1.91)	5.00 (1.60)	0-25
Bulimia (BUL)	0.92 (1.08)	2.00 (0.014)	0-30
Body Dissatisfaction (BDIS)	12.89 (3.76)	10.20 (0.032)	0-45
Ineffectiveness (INEF)	2.84 (1.77)	2.00 (0.015)	0-45
Perfectionism (PER)	9.94 (5.29)	5.20 (0.16)	0-35
Interpersonal Distrust (IDIS)	2.28 (1.86)	2.20 (0.012)	0-35
Interoceptive Awareness (IA)	2.72 (1.96)	2.90 (0.47)	0-65
Maturity Fears (MF)	0.99 (1.18)	2.50 (0.33)	0-40

Notes: [a]Sample statistic; [b]A higher value indicates more severe symptoms; [c]Original score recalculated for comparison purposes.

for Muscularity Questionnaire, McCreary & Sasse, 2000) and to affirmatively answer several questions related to being preoccupied with thoughts of his muscularity and whether this preoccupation disrupted social functioning. As it turned out, our subjects who met the last two criteria also exhibited scores of over 52 on *the Drive for Muscularity Questionnaire*. About 25%, or 26 participants, fit into this category. Of this 25%, approximately 85% were between the ages of 18 and 32 years, 70% were unmarried, 56% were unemployed, 35% had a college degree, 61% were currently enrolled in or had previously attended college, 57% had been weightlifting for more than five years, and 40% had been seriously weightlifting for more than three years.

Relationships Among Variables of Interest. See Table 2 for the correlation matrix for all variables. As hypothesized, MD symptoms were found to be positively related to variables measuring BDD, OCD, depression, anxiety, body dissatisfaction, and perfectionism (eating disorder scales). MD symptoms were found *unrelated* to symptoms of somatoform disorder. The remaining five eating disorder scales indicated no relationship to MD. Other variables, as expected, showed little or no correlation with MD, with the exception of hostility, which was found to have a moderately positive relationship to MD.

Table 2
Correlations of All Hypothesized Variables

	BDD	SOM	OCD	DEP	ANX	HOS	IS	PI	PSY	DT	BUL	BDIS	INEF	PER	IDIS	IA	MF
MD	.61**	.16	.52**	.36**	.39**	.45**	.12	.11	.05	.15	.14	.48**	.01	.41**	.04	.03	.15
BDD		.29**	.43*	.44**	.38**	.27*	.39**	.15	.13	.17	.03	.32**	.09	.34**	.01	.10	.12
SOM			.23*	.33*	.48*	.23*	.12	.28*	.21*	.07	.03	.20*	.06	.31**	.12	.12	.02
OCD				.34**	.31**	.30**	.12	.11	.05	.13	.01	.29**	.07	.37**	.08	.01	.10
DEP					.72**	.26**	.54**	.48**	.52**	.13	.00	.31**	.16	.38**	.25**	.15	.12
ANX						.37**	.52**	.60**	.52**	.16	.06	.32**	.15	.49**	.32**	.17	.04
HOS							.08	.26**	.08	.12	.09	.38**	.01	.25**	.18	.08	.07
IS								.43**	.58**	.02	.13	.09	.03	.24*	.17	.01	.09
PI									.64**	.06	.07	.14	.08	.12	.63**	.12	.06
PSY										.01	.01	.02	.08	.01	.44**	.17	.05
DT											.13	.16	.09	.10	.04	.25**	.01
BUL												.03	.13	.06	.03	.04	.05
BDIS													.04	.31**	.10	.05	.14
INEF														.06	.03	.01	.11
PER															.06	.06	.02
IDIS																.10	.14
IA																	.26**
MF																	

Notes. *Correlation is significant at the .05 level (2-tailed). **Correlation is significant at the .01 level (2-tailed).

Predicting Muscle Dysmorphia. To better understand these relationships, a stepwise multiple regression was performed on seven variables that had figured in our research hypotheses (and also had a statistically significant relationship with MD). The weaker correlated measures (depression, anxiety, and perfectionism) were not found to contribute significantly to the prediction of MD. The regression indicated that the four remaining variables (BDD, OCD, BDIS, and HOS) were significant predictors of MD ($F(4, 101) = 29.70$, $p = .000$. The multiple correlation coefficient was .74, indicating approximately 54% of the variance of the MD model can be accounted for by the linear combination of these measures. Although BDD was found to be the strongest predictor of MD (*adjusted R squared* = .36, $p = .000$), OCD, HOS, and BDIS all added to the predictive strength (*adjusted R squared* = .52, $p = .000$). A hierarchical multiple regression was also performed on these seven variables, which produced the same four significant predictor variables.

Identifying Mediators. The four variables identified as predictors of MD (BDD, OCD, BDIS, and HOS) were also found to correlate significantly, although mildly, with one another, with the exception of OCD and BDD, where there was a stronger relationship. Thus, it would appear that some of these variables are likely mediators for others. Based on previous research reviewed above, it would seem that OCD is a root variable for MD, mediated by BDD. This is just another way of expressing the idea that MD is a form of BDD, which research suggests is an OCD spectrum disorder. While we were initially surprised that hostility symptoms significantly predicted MD, further investigation of the research literature concerning the relationship of hostility and eating disorders led us to consider that it should be included in our model (see further discussion below). Also, since previous research has established a strong connection between BDIS symptoms and OCD symptoms, BDIS was entered as a mediator candidate.

To test for mediation, a four-step regression procedure introduced by Baron and Kenny (1986) was conducted for each potential mediator. The mediators in the model to be tested were BDD, HOS, and BDIS. OCD was the independent variable (IV), and MD was the dependent variable (DV). The first step in each procedure was to regress the dependent variable (DV) on the independent variable (IV). In Step 2, the mediator was regressed on the independent variable. Next, the DV was regressed

Table 3
Four-Step Regression to Test Mediation of Variables on OCD

Variable	Standardized Coefficient (β, or Beta)	
	Step 1	Step 4
Hostility (HOS)	.445	.305
Body Dissatisfaction (BDIS)	.477	.313
Body Dysmorphic Disorder (BDD)	.519	.316

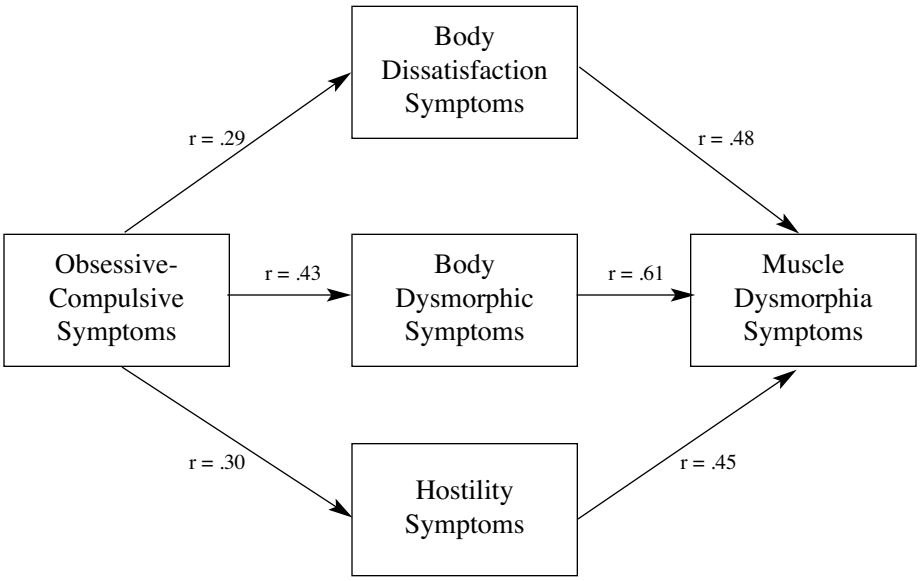

Figure 2. Model of relationship between MD and OCD, BDD, BDIS, and HOS symptoms.

on the IV. Finally, in Step 4 the DV was regressed on both IV and on the mediator. To satisfy mediation, the IV must affect both the DV and the mediator in the predicted direction in Steps 1 and 2, the mediator must affect the DV in the predicted direction in Step 3, and the effect of the IV must be less in Step 4 than in Step 1. All the requirements for mediation were satisfied for each of the potential mediators. The standardized coefficient (β) dropped in all cases from Step 4 to Step 1, as can be seen in Table 3.

These analyses indicate that hostility, body dissatisfaction, and body dysmorphic symptoms are all mediators of obsessive-compulsive symptoms' effect on muscle dysmorphia symptoms. The model that has emerged that best captures these results is depicted in Figure 2.

DISCUSSION

The sample obtained in this study was a reasonable pool to investigate the relationships among the variables of interest here. As anticipated, there was a suitable incidence of acute muscle dysmorphia symptoms. In this study, nearly 25% of the participants (26 out of 106 men) met the previously delineated criteria for the diagnosis of MD (Pope et al., 1997). Moreover, these 26 men shared common characteristics with the MD sample from an earlier study (Olivardia et al., 2000). These characteristics included preoccupation with a perceived inadequacy in their muscularity, which was distinguished from fear of fat (as in anorexia nervosa) or a preoccupation only with other aspects of appearance (as in other forms of body dysmorphic disorder).

Additionally, this preoccupation caused these individuals to give up important social, occupational, or recreational activities to engage in extensive weightlifting. Finally, these men experienced discomfort with and even avoidance of activities where their bodies might be exposed to others.

Characteristics of our entire sample compared as expected to those of the groups that generated the normed results for the scales we used. Although our sample did have a higher mean MD score than that of the group used in the development of the *Drive for Muscularity Questionnaire* (DMS), it should be noted that the norming group used in development of the DMS was an adolescent population. Research has found that the age of onset of MD is 19.4 years (*SD* = 3.6) (Olivardia et al., 2000), which might account for this difference in means.

There were also relatively unimportant differences between our sample and the normed samples for most of the subscales of the BSI. Our sample produced slightly higher means for depression, anxiety, and hostility, while somatization was lower than the normed sample, which was also on the low side. Our sample, in general, seemed to report few somatic symptoms. Finally, our sample mean was substantially lower than the mean of the normed sample for the Y-BOCS-BDD. However this difference is undoubtedly due to the fact that the sample population used for that scale's development consisted of subjects currently diagnosed with body dysmorphic disorder.

We turn now to a discussion of each of the hypotheses that motivated our study. It will be shown that the results of this study generally supported the stated hypotheses but with one additional unexpected significant correlation.

Consistent with the hypothesis that symptoms of muscle dysmorphia (MD) are related to variables measuring body dysmorphic disorder (BDD), a very strong positive correlation was found. In fact, BDD was found to be the strongest predictor of MD. Also as expected, MD was found to have a strong positive relationship to obsessive-compulsive disorder (OCD).

Muscle dysmorphia symptoms are strongly related to body dissatisfaction and moderately related to perfectionism, which are two of the eight measures of eating disorder characteristics (EDI). Consistent with previous research (Olivardia et al., 2000), we found no relationship between MD and the remaining measures of the EDI (bulimia, interpersonal distrust, and interoceptive awareness). Discussions with our participants revealed that some of the questions on the EDI were perceived as being more geared toward women's issues (e.g., questions focusing on buttocks and thigh/hip size) than toward men's issues. It should be noted that the EDI was developed using primarily female anorexic patients and female norm controls (Garner et al., 1983). Perhaps an eating disorder questionnaire that is more gender neutral or one that employs different screening techniques for males would have produced results for the remaining EDI subscales that are more indicative of potential eating issues of men.

Also consistent with our hypotheses and the literature, muscle dysmorphia was moderately related to various measures of affective spectrum disorders, particularly depression and anxiety.

Of great importance to the issue of proper classification was the fact that symptoms of muscle dysmorphia were not related to somatization (a measure of somato-

form disorder). In fact, it was found that our sample reported fairly low somatic symptoms in general. This is of practical value because mental health professionals rely on accurate diagnostic tools to help them identify precisely the mental illnesses their patients suffer, an essential step in deciding what treatment or combination of treatments their patient needs. The *Diagnostic and Statistical Manual* (*DSM*) has become a central part of this process. *DSM-IV* is based on many, many years of research and input of thousands of psychiatric experts. It has evolved into a carefully constructed, numerical index of mental illnesses grouped by categories and subcategories. Each entry contains a general description of the disorder followed by a listing of possible symptoms, which enables clinicians to identify their patients' illnesses with a high degree of accuracy and confidence. *DSM-IV* is organized according to phenomenological principles (i.e., groups of like symptoms, which are commonly associated with a specific illness). Its descriptions of illnesses and lists of symptoms are meant to support the diagnostic process. Moreover, the *DSM-IV*'s mental disorders coding helps in the process of research data collection and retrieval and also helps as researchers compile information for statistical studies. Finally, proper classification is of integral importance since the *DSM-IV*'s codes are often required by insurance companies when psychiatrists, physicians, and other mental health professionals file claims. The U.S. government's Health Care Financing Administration also requires mental healthcare professionals to use the codes for the purposes of Medicare reimbursement.

As hypothesized, our study found no relationship between MD and other measures of personality and pathology such as interpersonal sensitivity, psychoticism, and paranoid ideation. However, a fourth measure that was expected to be unrelated, hostility, turned out to be strongly related to MD. In fact, along with BDD, OCD and BDIS, hostility was found to be one of the four variables with the strongest predictor qualities of MD. A further regression analysis indicated that hostility mediates OCD as a powerful predictor of MD.

There are currently no reported studies citing the relationship between hostility and muscle dysmorphia. Additionally, there is a dearth of research investigating hostility as it relates to OCD and BDD. Based on our findings, specific research should be conducted to look at hostility and its relationship to these variables and also to the specific task conditions of this study. For example, a factor possibly related to hostility was the time at which the questionnaires were completed. Perhaps endorphins released after strenuous exercise affected the participants' level of hostility.

A look at the literature on hostility and eating disorders appears more promising for providing clues to the underlying relationship between hostility and MD in men. Although there have been no studies linking anorexia nervosa or any other eating disorder to *overt* hostility, there have been a number of studies suggesting that *self-directed* hostility is a factor in anorexia nervosa and bulimia (Neuman & Halvorson, 1983). Numerous further studies were consistent in finding self-directed hostility to be one of a number of factors (along with obsessiveness, dependency, unassertiveness, external locus of control, and low self-esteem) that contribute to the psychological profile of women with eating disorders (Cachelin & Maher, 1998; Hall, Blakey, & Hall, 1992; Rosen & Ramirez, 1998; Smolak & Levin, 1993; Tiller, Schmidt, Ali, & Treasure, 1995; Williams, Chamove, & Millar, 1990; Williams, Power, Millar,

Freeman, Yellowlees, Dowds, et al., 1994). Rogers & Petrie (1997, 2001), on the other hand, suggest that self-directed hostility was a poor predictor of scores on *The Eating Attitudes Test* (Garner & Garfinkel, 1979). Our study did find a moderate correlation between hostility (directed towards others) and certain eating disorder traits (body dissatisfaction and perfectionism), although further analyses would be required to determine whether a mediating relationship exists. In any case, the relationship between eating disorders and obsessive-compulsive symptoms and traits has been well established (Jarry & Vaccarino, 1996), as have associated features such as body dissatisfaction and poor body image (Alexander-Mott & Lumsden, 1994). Hence, it might be postulated that hostility as a fourth factor (along with BDD, OCD, and BDIS) might not only play a significant role in the development of MD but, if self-directed, might be a factor in the development of eating disorders in men.

Regression analyses helped us to understand the relationships among the variables related to MD. It was found that BDD alone was not as powerful a predictor of MD as the combination of BDD, obsessive-compulsive disorder (OCD), body dissatisfaction (BDIS), and hostility (HOS). Further, although related to MD, depression, anxiety, and perfectionism did not make independent contributions to the prediction of MD. (The comorbidity of both depression and anxiety with a host of symptom variables and disorders would suggest that they would not be statistically independent factors.) Finally, BDD, BDIS, and HOS were found to be mediators of OCD in its effects on MD.

In summary, a picture emerges of the characteristic symptoms of males who suffer from muscle dysmorphia. In addition to the presenting symptoms described above, he also exhibits symptoms of the researched variables BDD, OCD, BDIS, and HOS as well as depression, anxiety, and perfectionism.

Figure 2 depicts our answer to the main question of this research project: Where does MD belong in relation to the variables studied? It illustrates our causal speculation that OCD is the root factor in MD and exerts its influence through the mediating variables of BDD, BDIS, and HOS. Hence, its symptoms are more closely related to symptoms of an OCD spectrum disorder than to those of a somatoform disorder. MD also shares symptoms with eating disorders through BDIS.

The results of this study have important implications for where MD should be classified diagnostically. MD symptoms were found to be related to symptoms of OCD and BDD rather than to those of somatoform disorders, where it has been officially assigned. Other researchers have already suggested that BDD might better be classified as an OCD spectrum disorder. MD's inherent relationship to BDD, along with its similarities to body dissatisfaction symptoms seen in eating disorders, suggests that, along with BDD, MD should be considered as an OCD spectrum disorder. To extend the empirical support for considering the appropriate categorization of MD, a next step should be to replicate these findings with a clinically diagnosed population of MD. To explore further the role of hostility in BDD and MD, a contrastive sample of the clinically diagnosed eating disordered population should be studied as well. Finally, and most important, these suggested further studies should be executed with the goal of completing a theoretical analysis of why the diagnostic variables are related, how they develop among males suffering from MD, what their sociocultural interpretations might be, and what the implications are for treatment and social policy.

NOTES

1. The term "spectrum disorder" indicates that the disorder in question has features similar to the primary disorder in terms of phenomenology (descriptive characteristics), age of onset, clinical chronic course, comorbidity, possible etiology, familial concordance, and/or treatment response (Bienvenu, Samuels, Riddle, Hoehn-Saric, Liang, Cullen, et al., 2000). It does not imply the disorders are identical.

2. The BSI includes a ninth scale, phobic anxiety, which was not reported in this study.

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