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APPLIED PSYCHOLOGY | RESEARCH ARTICLE

Biopsychosocial factors in drives for muscularity and muscle dysmorphia among personal trainers

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Abstract: Muscle dysmorphia (MD) is a type of body dysmorphic disorder related to body image disturbances associated with musculature and leanness. This study surveyed the presence of MD and drive for muscularity (DFM) in both male and female personal trainers ($n = 1039$, $M_{age} = 35.10$, SD = .38) using a biopsychosocial foundation. Prevalence rates for MD and a DFM in the current sample were 23 and 28%, respectively. Kendall's tau-*b* revealed that general appearance concerns, muscle concerns, and somatic features were positively related to both MD and a DFM. A DFM and MD were significantly, positively correlated with internalization of thin ideals, muscular/athletic ideals, family and peer pressures, but not media pressures. All psychopathologic variables (depression, anxiety, hostility, somatization, interpersonal sensitivity, obsessive-compulsive) were significantly and positively related to MD and DFM. Men and women who displayed high MD and DFM behaviors did so with little disparity, suggesting that these behaviors may be less gender-specific for personal trainers. Physique concealment was the only subscale of the MDI to depict a significantly positive relationship with every variable across each biopsychosocial dimension except for race, suggesting that this behavior may be more central to MD than putatively believed. This study furthers the extant knowledge of MD and

ABOUT THE AUTHORS

Beau James Diehl is the Founder and CEO of Andromeda Psychological Coaching and Research Solutions LLC, which is a company that specializes in psychological coaching, external program evaluation for businesses, and higher education statistics and research support for college students. His research interests include transformational leadership styles in coaching, substance use disorders, body image disturbances, eating disorders, and body dysmorphic disorders in both males and females.

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PUBLIC INTEREST STATEMENT

Muscle dysmorphia refers to an unhealthy preoccupation with a person's muscularity that is believed to affect millions of individuals. Problematically, researchers have historically focused on groups such as bodybuilders and college students. Therefore, a primary aim of the current study was to incorporate personal trainers across the United States to examine psychological, physical, and social interactions with muscle dysmorphia and drives for muscularity. Prevalence rates for muscle dysmorphia were 23% among personal trainers. Interestingly, individuals within the study were much more susceptible to peer and family pressures as opposed to being influenced by the media. It was found that men and women who exhibited muscle dysmorphia were only separated by 33 cases, suggesting that female personal trainers had almost equal concerns to males. Examining muscle dysmorphia in unresearched populations should help the scientific community form a better understanding of how muscle dysmorphia affects different groups with different sport affiliations.

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a DFM by exploring an under-researched population and providing data structured in a unique biopsychosocial framework that serves as a viable basis for continued research with this and other populations.

Subjects: Health Psychology; Individual Sports; Quantitative Methods in Sport; Sport Psychology

Keywords: body image disturbances; body dysmorphic disorder; biopsychosocial model; personal trainers; bigorexia; reverse anorexia; physique concealment; peer and media pressures; muscularity; body image

1. Introduction

Muscle dysmorphia (MD) is a proposed subtype of body dysmorphic disorder whereby individuals have a pathological preoccupation with muscularity and leanness resulting from a body image disturbance (American Psychiatric Association, 2013; Pope, Gruber, Choi, Olivardia, & Phillips, 1997). Individuals who have MD tend to view themselves as being insufficiently muscular and may engage in behaviors of compulsive weightlifting, disordered eating habits, and the use of anabolic steroids as a means to address the perceived flaws in their physical build (Olivardia, 2007; Olivardia, Pope, & Hudson, 2000).

Those with MD also experience salient anxiety in situations where their physique is exposed to others, which can lead to careful precautions to circumvent such stressful scenarios (Grieve, Truba, & Bowersox, 2009). Researchers have indicated that individuals with MD may combat this social anxiety through the use of concealing clothing as a means to camouflage the perceived faults in their muscularity (Olivardia, 2007), but body parts not perceived as embarrassing might be exposed and even emphasized (Baghurst et al., 2014). Alternatively, individuals with MD frequently participate in body checking behaviors, often consulting mirrors and other reflective surfaces to engage in critical self-evaluations of their own musculature (Olivardia, 2007).

A construct relative to MD is the *drive for muscularity* (DFM). Individuals may also pursue a muscular phenotype as defined by media messages and perceived societal standards by consistently striving to improve the musculature of their physiques. McCreary and Sasse (2000) explained that a DFM could be conceptualized across a continuum of severity. This ranges from individuals who exhibit no interest in their physical build to those who commonly engage in intensive and potentially physically damaging behaviors not unlike those found in persons with MD. Muscle dysmorphia and a DFM are two separate constructs, but an intense DFM often results in the exhibition of muscle dysmorphic symptoms (Gray & Ginsberg, 2007; Grieve & Helmick, 2008), influences negative outcomes similar to MD (Robert, Munroe-Chandler, & Gammage, 2009), and may also play a crucial role in predicting MD (McCreary & Saucier, 2009).

2. Problem, framework and purpose

Muscle dysmorphia is often conceptualized as an emerging disorder despite being identified in the 1990s (Pope, Katz, & Hudson, 1993), and the exact etiology and sequelae of the disorder remain unclear. Muscle dysmorphia is also considered largely under-recognized and under-researched in the extant literature (Parent & Moradi, 2011; Tod & Lavallee, 2010). Little is known about MD and its exacerbating or associated constructs such as psychopathology, body comparison, and sociocultural attitudes about appearance. Few researchers have adopted a comprehensive, multidisciplinary, biopsychosocial approach to examining potential affective, perceptual, social, and cognitive behavioral connections with regard to a DFM and MD (see Cafri, van den Berg, & Thompson, 2006; Grieve, 2007; Lantz, Rhea, & Mayhew, 2001; Olivardia, 2001; Woodruff, 2012).

Olivardia (2001) indicated that a multidisciplinary approach such as the biopsychosocial framework (see Engel, 1977) is likely the most thorough and logical way to assess MD. As the etiology and manifestation of MD are not well understood, it is vital that factors that may influence the

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Table 1. Tablature of all proposed study variables by dimension and instrument						
Dimension	**Demographic factors**	**Biological factors**	**Psychological factors**	**Sociological factors**	**A drive for muscularity**	**Muscle dysmorphia**
Instrument	**DEM**	**BCS**	**SCL-90-R**	**SATAQ-4**	**DMS**	**MDI**
Study variables	Sex	General appearance, non-weight, non-muscular concerns	Somatization	Internalization-thin/ low body fat	A drive for muscularity (single score)	Size and symmetry concerns
	Race	Muscular concerns	Obsessive-compulsive	Internalization-Muscular/athletic		Supplement use
	Age	Weight concerns	Interpersonal sensitivity	Pressures-family		Exercise dependence
	Height	General somatic features	Depression	Pressures-peers		Pharmacological use
	Weight		Anxiety	Pressures-media		Dietary behavior
	Competitive weightlifter		Hostility			Physique concealment
	Competitive bodybuilder					

development of MD be identified in order to bolster any type of comprehensive prevention or treatment program. Therefore, this study was structured using the biopsychosocial model as a theoretical framework to operationalize all study variables into biophysical, psychological, and socially measured dimensions (see Table 1).

Engel's (1977) biopsychosocial model was a response to inadequacies with the traditional biomedical model, and Engel suggested that disease and illness were not strictly biological entities with similarly biological manifestations. Rather, disease and illness, as well as treatment and wellness, are influenced by a myriad of psychological and sociocultural factors. Therefore, treatment is undermined when practitioners only focus on the physical dimension of pathology. The biopsychosocial approach was appropriate for this study insofar as MD has been empirically supported to be composed of biological, psychological, and social dimensions (Grieve, 2007). Specifically, MD can be considered a preoccupation with *physically* altering one's body to be more muscular based on *psychological* body image disturbances influenced by *sociocultural* standards of beauty. Therefore, MD as the primary construct of interest associated with this study embodies each dimension of the biopsychosocial approach.

Engel's (1977) position was that biological and psychological ailments are interrelated, and that psychological ailments can have physical manifestations as biological ailments can have psychological manifestations. In turn, these manifestations can be impacted by societal and cultural environs, and these environs can also influence the behaviors a person engages in that may lead to a sickness, exacerbate a sickness, or lead to a remedy for that sickness.

Researchers explained that Engel's theory has developed and withstood numerous bouts of criticism, and that the biopsychosocial approach has become popular among those affiliated with medical and social sciences well into the twenty-first century. In Borrell-Carrio, Suchman, and Epstein's (2004) article *The Biopsychosocial Model 25 Years Later: Principles, Practice, and Scientific Inquiry,* the authors described how the biopsychosocial model had become both a philosophy and practical guide to clinical care. They indicated the versatility of the model, as well as that the multifaceted approach concerning biological, psychological, and social components of the patient is an ideology which clinicians can apply comprehensive approaches to both diagnosis and treatment. However, despite the multidisciplined popularity of the biopsychosocial model, this framework has yet to be integrated in everyday medical care (Lane, 2014). In addition, to popular yet limited utilization in

clinical settings, Lane argued that the biopsychosocial model is also useful for testing theories, structuring research designs and exploring the characteristics of various psychological disorders.

Demographic characteristics such as competitive bodybuilding, competitive weightlifting, and association with appearance-based sports have been identified as likely risk factors for developing MD (Baghurst, Parish, & Denny, 2014; Bratland-Sanda & Sundgot-Borgen, 2012a, 2012b; Cella, Iannaccone, & Cotrufo, 2012; Parish, Baghurst, & Turner, 2010). However, such characteristics often require meticulous dieting and valetudinarian engagements that may be largely indicative of the requisites of sport and less indicative of underlying body image disturbance (Skemp, Mikat, Schenck, & Kramer, 2013; Suffolk, 2013). Therefore, it is logical to treat such variables as controls to more accurately assess the extent and nature of MD as well as a DFM.

To date, only one study had addressed the predictive relationship between a DFM and a measure of MD in a mixed-gender sample (Robert et al., 2009), and it is important that the relationship between a DFM and MD be better explored between the sexes in order to provide an adequate assessment of how these body dysmorphic behaviors interrelate. Gym enthusiasts, weightlifters, bodybuilders, student athletes, and college students are some of the most often studied populations in DFM and MD research (Baghurst & Lirgg, 2009; Grieve & Helmick, 2008; Suffolk, Dovey, Goodwin, & Meyer, 2013; Wolke & Sapouna, 2008). This is problematic, as a greater exploration of how MD and a DFM present in a myriad of populations is an important step in identifying at-risk groups and possibly developing more sophisticated treatment and prevention methods. Personal trainers (PT) are an under-researched population with regard to MD and a DFM. This is also problematic because PTs are in a vocational role proximal to sport and fitness and are therefore in a unique position to encounter such disorders within their clients as well as within themselves. Furthermore, PTs are a viable population for MD research because it is possible for them to (un)knowingly encourage symptoms of MD and/or unhealthy muscular drive behaviors in their clients and therefore exacerbate the collective morbidity of body dysmorphic behaviors.

The purposes of this study were to: (a) examine the possible relationships among body comparison behaviors, sociocultural attitudes about appearance, and psychopathology related to MD and DFM, (b) lay statistical groundwork so that a model for MD in PTs may be tested in future research, (c) build upon existing literature and past implications for future research by assessing the predictive relationship of a DFM on a measure of MD, (d) incorporate a data analysis plan that considers for the statuses of competitive weightlifters and bodybuilders as viable control variables, and (e) examine potential muscle dysmorphic gender differences in an as-of-yet researched population.

3. Materials and methods

3.1. Participants
Participants were personal trainers (PT) acquired using an online database from an International Personal Trainer Accrediting Agency. The listserv was screened for only PTs within the United States, which resulted in a total target population of 12,782. After a data collection period of six weeks, 1,127 PTs responded to the invitation email to participate in the study. The invitational email contained an external link to Survey Monkey© where the informed consent form, 163-item survey, and debriefing were electronically stored and presented.

3.2. Instruments

3.2.1. Demographic information
Participants completed a demographic questionnaire that included questions of their age, race/ethnicity, gender, and competitive weightlifting status, and bodybuilding status.

3.2.2. Body comparison scale

The BCS (Fisher, Dunn, & Thompson, 2002) is a 36-item self-report instrument that is utilized to assess the ways in which both males and females tend to compare specific parts of their bodies with others of the same sex (e.g. chest, waist, muscle tone). Participants were required to respond on a five-point Likert scale between 1 (*Never)* and 5 (*Always)*. The scale was standardized in a gender-heterogeneous group of 1,760 students, ranging from seventh graders to college sophomores (Fisher et al., 2002). It has demonstrated excellent internal consistency (α = .95), and in the current sample values ranged from α = .85 to α = .95.

3.2.3. Symptom checklist-90-revised (SCL-90-R)

The SCL-90-R (Derogatis, 1994) is a 90-item self-report survey intended to assess various dimensions of psychopathology across nine subscales. Respondents were required to indicate their current level of distress using a five-point Likert scale range from 0 (*Not at all)* to 4 (*Extremely)*. Simonds, Handel, and Archer (2008) reported that the depression, hostility, paranoid ideation, anxiety, psychoticism, and somatization subscales of the SCL-90-R demonstrated good incremental validity. Because subscales of phobic anxiety, paranoid ideation, and psychoticism are not typically related to MD (see Tod & Lavallee, 2010; Wolke & Sapouna, 2008), they were omitted from the current study to keep the battery of assessments as short as possible. In the current sample, somatization (α = .81), anxiety (α = .88), depression (α = .92), obsessive compulsive (α = .90), interpersonal sensitivity (α = .88), and hostility (α = .82) subscales of the SCL-90-R all had good-to-excellent internal consistencies.

3.2.4. Sociocultural attitudes toward appearance questionnaire-4 (SATAQ-4)

The SATAQ-4 (Thompson et al., 2011) is a 22-item self-report measure that is intended to assess sociocultural influences on personal appearance. It is comprised of five factors that assess internal and external pressures. The questionnaire uses a five-point Likert-type format where participants are asked to issue responses ranging from 1 (*Definitely disagree)* to 5 (*Definitely agree)*. Schaefer et al. (2015) indicated that the SATAQ-4 demonstrated good-to-excellent internal consistency in a series of three separate samples using undergraduate males and females (α = .86–.96). From the current sample the Cronbach's values were acceptable to high (α = .74–.96).

3.2.5. The muscle dysmorphia inventory

The MDI (Rhea, Lantz, & Cornelius, 2004) is a 27-item self-report survey consisting of six subscales. Participants were asked to respond to various statements about attitudes, feelings, and behaviors associated with MD on a six-point Likert scale from 1 (*Never)* to 6 (*Always)*. Rhea and colleagues reported that the internal consistencies of the MDI subscales ranged from α = .72 to .94. In the present study, subscales of dietary behavior (α = .70), supplement use (α = .83), exercise dependence (α = .71), physique concealment (α = .74), and size and symmetry concerns (α = .82) all yielded acceptable-to-high results. However, the pharmacological use subscale yielded low internal consistency (α = .32), and item total statistics indicated that the deletion of the question "I use steroids" would only modestly improve that level to α = .45. Therefore, caution should be exercised when interpreting analyses related to the pharmacological subscale of the MDI.

3.2.6. The drive for muscularity scale

The DMS (McCreary & Sasse, 2000) is a 15-item self-report measure intended to assess the degree to which individuals desire a more muscular physique through a series of attitudinal and behavioral questions. Each item on the DMS is reversely scored on a six-point Likert scale from 1 (*Always)* to 6 (*Never)*.

McCreary and Saucier (2009) indicated that internal consistencies for the DMS were good for both men (α = .90) and women (α = .83). McCreary, Sasse, Saucier, and Dorsch (2004) further supported the reliability of the DMS by finding corrected item-total correlations of .37–.65. In a separate study, Cafri and Thompson (2004) showed that the DMS exhibited substantial 7–10 day test–retest correlations for men (α = 93). In the current sample, the DMS exhibited high internal consistency (α = .89).

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4. Data analysis

Data were analyzed using SPSS v.21. The 1,127 responses were assessed for missing items and outliers. The data-set did have missing items; therefore, a five-factor multiple imputation procedure was used to correct the missing data. Most of the items on the data-set were structured with Likert-type scales, and multiple imputation has been shown to yield acceptable parameter estimates with Likert-type data where less than 10% of the total values are missing (Fox-Wasylyshyn & El-Masri, 2005; Leite & Beretvas, 2010). An analysis of monotonicity in the data-set was used to determine that only 5.1% of the total values were missing where there was no salient pattern in the data-set, and missing items appeared to be random. Cases with missing items >70% were completely eradicated from the data-set, while cases with missing items ≤70% were addressed with five-factor multiple imputation using the linear regression model (Tabachnick & Fidell, 2001).

The data were analyzed for potential outliers. A majority of the items that displayed salient outliers were typically related to the putative symptoms of MD and high drives for muscularity. Muscle dysmorphia and potentially unhealthy drives for muscularity tend to affect only a small portion of individuals (Olivardia, 2001, 2007; Pope, Phillips, & Olivardia, 2000); therefore, it was not surprising to see similar phenomena in the data. These outliers were retained because their exclusion would likely remove the demonstration of MD as a measured behavior and potentially undermine the intention of the study.

All variables displayed a bimodal distribution and were clearly non-normally distributed. A non-normal distribution was statistically supported by a series of Kolmogorov-Smirnov, Lilliefores corrections, and Shaprio-Wilk tests ($p < .001$). However, the preliminary observation of bimodal distributions using Q-Q plots in the data supported the assumption that most data were likely composed of one "normal" group of responses and one less prominent "muscle dysmorphic/muscular drive" group of responses. Therefore, non-parametric techniques (Kendall's tau b, Mann-Whitney-U tests) were employed in lieu of further data transformation to preserve outliers that were likely meaningful to the study. The use of multiple imputation to account for missing items was also beneficial in partially normalizing the distortion caused by outliers without removing them from the data-set. After the data were screened for missing items and unusable cases, a final sample of $n = 1,039$ was used in the subsequent analyses.

5. Results

5.1. Demographic information

Of the 1,039 participants, two-thirds (66%) were women where ages ranged between 18 and 86 ($M = 35.10$, SD = .38). Most (83.9%) identified as European American-Caucasian followed by African-American (4.7%), Hispanic/Latino (3.8%), Pacific Islander (2.2%), Biracial/multiracial (2.2%), Native American (.8%), and Other (2.4%). Sixty individuals identified as being competitive weightlifters (5.8%) and 59 as competitive bodybuilders (5.7%). The prevalence rate for MD was 23% (Male cases = 135, Female cases = 102) and the prevalence rate for a DFM was 28% (Males = 158 cases, Females = 130 cases).

5.2. MD and biopsychosocial factors

Kendall's tau-b was used to assess the relationship between body comparison behavior, sociocultural attitudes toward appearance, psychopathological factors, and the MDI. These correlations have been sectioned into six separate correlation matrices depicting biophysical, sociological, and psychological variable relationships with the MDI total-item and subscale scores (see Tables 2–7). Specifically, Table 2 depicts correlations with the proposed biophysical study variables and MDI total-item scores, and Table 3 depicts correlations with the proposed biophysical study variables and each subscale of the MDI. Tables 4 and 5 illustrate sociological variable relationships with MDI total-item and subscale scores, respectively. Finally, Tables 6 and 7 depict psychopathological study variable relationships with MDI total-item and subscale scores, respectively. Results were structured in this manner because it was important to examine how these variables correlated with one another as well as with MD within the context of examining specific MDI subscales as a detailed inclusion which provides more insight than total MDI scores alone.

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Table 2. Biophysical variable relationships and the muscle dysmorphia inventory: Correlations and descriptive statistics

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Muscle dysmorphia inventory	–												
2. Sex	−.25	–											
3. Race/ethnicity	.04	−.11**	–										
4. Weight (pounds)	.20**	−.55**	.07*	–									
5. Age	−.17**	.10**	−.01	−.05	–								
6. Competitive bodybuilder	.23**	.00	.06	.00	−.06	–							
7. Competitive weightlifter	.16**	−.08**	−.01	.09**	−.10**	.19**	–						
8. BCS: General appearance[a]	.08*	.17**	−.08*	−.09**	−.13**	−.03	−.03	–					
9. BCS: Muscle concerns	.28**	−.04	−.05	.10**	−.16**	.04	.03	.42**	–				
10. BCS: Weight concerns	.15**	.27**	.06	−.07*	−.14**	.02	−.02	.44**	.56**	–			
11. BCS: Somatic features	.24**	.11**	−.08*	.02	−.17**	.05	.01	.39**	.64**	.65**	–		
12. *M*	64.70	1.66	1.51	153.74	35.08	1.06	1.06	15.77	15.51	14.14	15.64	–	
13. *SD*	16.20	.47	1.40	32.86	12.35	.23	.23	5.68	5.41	4.90	4.88	–	–

[a]Body comparison scale.

*$p < .05$, two-tailed.

**$p < .001$, two-tailed.

Table 3. Biophysical variable relationships with the muscle dysmorphia inventory subscales: Correlations and descriptive statistics

Variables	Dietary behavior	Supplement use	Exercise dependence	Physique concealment	Size and symmetry concerns	Pharmacological use
1. Sex	−.14**	.25**	−.8*	−.14**	−.32**	.01
2. Race/ethnicity	.04	.06	.00	.05	.03	.02
3. Weight (pounds)	.11**	.21**	.04	.15**	.22**	.03
4. Age	.06	−.13**	−.14**	−.17**	−.16**	−.01
5. Competitive bodybuilder	.21**	.21**	.19**	.09**	.18**	.16**
6. Competitive weight-lifter	−.10**	.16**	.12**	.08*	.16**	.04**
7. BCS: General appearance[a]	.10**	.00	.05	.20**	.07*	.09**
8. BCS: Muscle concerns	.13**	.15**	.20**	.27**	.28**	.11**
9. BCS: Weight concerns	.07*	.04	.14**	.21**	.10**	.13**
10. BCS: Somatic features	.12**	.10**	.19**	.24**	.22**	.11**
11. *M*	16.12	8.17	14.33	10.62	12.16	3.30
12. SD	4.76	4.55	4.03	4.00	5.00	.99

[a]Body comparison scale.

*$p < .05$, two-tailed.

**$p < .001$, two-tailed.

Table 4. Sociological variable relationships and the muscle dysmorphia inventory: Correlations and descriptive statistics

Variables	1	2	3	4	5	6	7	8
1. Muscle dysmorphia inventory	–							
2. SATAQ-4: Internalization of thin/low body fat	.08*	–						
3. SATAQ-4: Internalization of muscular/athletic physique	.38**	.33**	–					
4. SATAQ-4: Family pressures	.08*	.21**	.11**	–				
5. SATAQ-4: Peer pressures	.10**	.25**	.17**	.48**	–			
6. SATAQ-4: Media pressures	.02	.32**	.17**	.26**	.32**	–		
7. M	64.70	15.44	18.33	6.40	6.88	12.30	–	–
8. SD	16.20	4.06	3.83	3.43	3.78	5.57	–	–

Note: Sociocultural attitudes toward appearance questionnaire-4.

*p < .05, two-tailed.

**p < .001, two-tailed.

Table 5. Sociological variable relationships with the muscle dysmorphia inventory subscales: Correlations and descriptive statistics

Variables	Dietary behavior	Supplement use	Exercise dependence	Physique concealment	Size and symmetry concerns	Pharmacological use
1. SATAQ-4: Internalization of thin/low body fat[a]	.07*	−.01	.12**	.14**	.00	.10**
2. SATAQ-4: Internalization of muscular/athletic physique	.25**	.22**	.34**	.23**	.33*	.11**
3. SATAQ-4: Family pressures	.01	.03	.00	.16**	.07*	.08*
4. SATAQ-4: Peer pressures	.03	.05	.03	.21**	.09*	.09*
5. SATAQ-4: Media pressures	−.01	.00	.01	.14**	−.03	.05
6. M	16.12	8.17	14.33	10.62	12.16	3.30
7. SD	4.76	4.55	4.03	4.00	5.00	.99

[a]Sociocultural attitudes toward appearance questionnaire-4.

*p < .05, two-tailed.

**p < .001, two-tailed.

5.2.1. MD and the biophysical dimension

All variables within this biophysical dimension were positively, significantly correlated with MD, except for sex and race (see Table 2). Age was significantly, negatively correlated with MD. The general appearance subscale of the BCS was the only variable to be significantly correlated with MD at the $p < .05$ alpha level while all correlations were significant at the $p < .001$ level. Somatic features and identification as competitive bodybuilder were found to have the strongest correlations with MD, while general appearance and weight-related concerns were found to have the weakest relationships with MDI scores (see Table 3).

Table 6. Psychological variable relationships and the muscle dysmorphia inventory: Correlations and descriptive statistics

Variables	1	2	3	4	5	6	7	8	9
1. Muscle dysmorphia inventory	–								
2. SCL-90-R: Somatization[a]	.13**	–							
3. SCL-90-R: Obsessive-compulsive	.13**	.48**	–						
4. SCL-90-R: Interpersonal sensitivity	.15**	.43**	.59**	–					
5. SCL-90-R: Depression	.13**	.48**	.63**	.66**	–				
6. SCL-90-R: Anxiety	.12**	.48**	.60**	.56**	.61**	–			
7. SCL-90-R: Hostility	.13**	.41**	.52**	.54**	.55**	.48**	–		
8. M	64.70	.47	.66	.59	.65	.35	.40	–	–
9. SD	16.20	.41	.65	.61	.67	.49	.49	–	–

[a]Symptom checklist-90-revised.

*$p < .05$, two-tailed.

**$p < .001$, two-tailed.

Table 7. Psychological variable relationships with the muscle dysmorphia inventory subscales: Correlations and descriptive statistics

Variables	Dietary behavior	Supplement use	Exercise dependence	Physique concealment	Size and symmetry concerns	Pharmacological use
1. SCL-90-R: Somatization[a]	.06	.10**	.10**	.14**	.09**	.14**
2. SCL-90-R: Obsessive-compulsive	.02	.06	.08*	.19*	.13*	.11**
3. SCL-90-R: Interpersonal sensitivity	.02	.07*	.10**	.23**	.15**	.01**
4. SCL-90-R: Depression	.02	.07*	.08*	.18**	.13**	.11**
5. SCL-90-R: Anxiety	.02	.07*	.06*	.17**	.12**	.12**
6. SCL-90-R: Hostility	.05	.09**	.10**	.16**	.13**	.07*
7. M	16.12	8.17	14.33	10.62	12.16	3.30
8. SD	4.76	4.55	4.03	4.00	5.00	.99

[a]Symptom checklist-90-revised.

*$p < .05$, two-tailed.

**$p < .001$, two-tailed.

5.2.2. MD and the social dimension

No variables within the SATAQ-4 were negatively associated with total-item MDI scores (see Table 4). An internalization of thin/low body fat was only modestly related to MD. Internalization of the muscular/athletic physique maintained the strongest relationship with MDI scores while pressures from the media to alter one's physique did not have any significant relationship with MD. Physique concealment was the only subscale to have a significantly positive relationship with every subscale of the SATAQ-4 at the $p < .001$ alpha level (see Table 5). An internalization of muscular/athletic ideals maintained a statistically positive relationship with every subscale of the MDI. Supplement use, size, and symmetry concerns had the weakest relationships with variables on the SATAQ-4.

5.2.3. MD and the psychological dimension

All psychological variables (somatization, obsessive-compulsive behavior, interpersonal sensitivity, depression, anxiety, and hostility) were significantly, positively related to item-total MDI scores (see

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Table 6). All of the relationships between psychopathology and the MDI were small but significant at the *p* < .001 alpha level. Physique concealment was the strongest behavior of MD to be correlated with the SCL-90-R whereas dietary behavior was not statistically correlated with any of the SCL-90-R variables (see Table 7). Somatization and hostility were the two psychological variables that exhibited the most consistent positive relationships with every MDI subscale; obsessive-compulsive behavior was the least consistent.

5.3. DFM and biopsychosocial factors

Kendall's tau-*b* was also used to assess the relationship between body comparison behavior, sociocultural attitudes toward appearance, psychopathological factors, and a DFM. The results of these correlations are depicted in matrices separated into groups consisting of the biophysical, social, and psychological dimensions. Similar to the MDI, scores on the DMS maintained statistically significant and positive relationships with all biophysical variables except for race (see Table 8). However, the variables of sex and age were significantly, negatively correlated with a DFM. Muscular concerns were significantly, positively associated with a DFM to a greater degree than with MD.

An internalization of thin/low body fat was not significant for a DFM even though it was modestly significant for MD (see Table 9). Both DMS and MDI scores illustrated a strong, positive relationship with an internalization of muscular and athletic ideals. Media pressures were not related to a DFM, nor were they related to the total MDI scores in this sample. Similar to the MDI, total-item scores on the DMS depicted a statistically strong and positive relationship with all psychopathological variables at the *p* < .001 level (see Table 10). Interpersonal sensitivity and depression were the two variables most strongly related to a DFM whereas somatization and anxiety depicted the weakest correlation. Depression had a stronger relationship to a DFM than it did with MD, but somatization had a weaker relationship with a DFM than it did with MD.

Table 8. Biophysical variable relationships with the drive for muscularity: Correlations and descriptive statistics													
Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Drive for muscularity scale	−												
2. Sex	−.26**	−											
3. Race/Ethnicity	.02	−.11**	−										
4. Weight (Pounds)	.22**	−.55**	.07*	−									
5. Age	−.22**	.10**	−.01	−.05	−								
6. Competitive bodybuilder	.14**	.00	.06	.00	−.06	−							
7. Competitive weightlifter	.14**	−.08**	−.01	.09**	−.10**	.19**	−						
8. BCS: General appearance[a]	.10*	.17**	−.08*	−.09**	−.13**	−.03	−.03	−					
9. BCS: Muscle concerns	.40**	−.04	−.05	.10**	−.16**	.04	.03	.42**	−				
10. BCS: Weight concerns	.20**	.27**	.06	−.07*	−.14**	.02	−.02	.44**	.56**	−			
11. BCS: Somatic features	.32**	.11**	−.08*	.02	−.17**	.05	.01	.39**	.64**	.65**	−		
12. *M*	39.33	1.66	1.51	153.74	35.08	1.06	1.06	15.77	15.51	14.14	15.64	−	
13. SD	12.63	.47	1.40	32.86	12.35	.23	.23	5.68	5.41	4.90	4.88	−	−

[a]Body comparison scale.

*p < .05, two-tailed.

****p* < .001, two-tailed.

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Table 9. Sociological variable relationships with the drive for muscularity: Correlations and descriptive statistics

Variables	1	2	3	4	5	6	7	8
1. Drive for muscularity scale	–							
2. SATAQ-4: Internalization of thin/low body fat[a]	.62	–						
3. SATAQ-4: Internalization of muscular/athletic physique	.38**	.33**	–					
4. SATAQ-4: Family pressures	.11*	.21**	.11**	–				
5. SATAQ-4: Peer pressures	.13**	.25**	.17**	.48**	–			
6. SATAQ-4: Media pressures	.06	.32**	.17**	.26**	.32**	–		
7. *M*	39.33	15.44	18.33	6.40	6.88	12.30	–	–
8. *SD*	12.63	4.06	3.83	3.43	3.78	5.57	–	–

[a]Sociocultural attitudes toward appearance questionnaire-4.

*$p < .05$, two-tailed.

**$p < .001$, two-tailed.

Table 10. Psychological variable relationships with the drive for muscularity: Correlations and descriptive statistics

Variables	1	2	3	4	5	6	7	8	9
1. Drive for muscularity scale	–								
2. SCL-90-R: Somatization[a]	.13**	–							
3. SCL-90-R: Obsessive-compulsive	.15**	.48**	–						
4. SCL-90-R: Interpersonal sensitivity	.17**	.43**	.59**	–					
5. SCL-90-R: Depression	.17**	.48**	.63**	.66**	–				
6. SCL-90-R: Anxiety	.13**	.48**	.60**	.56**	.61**	–			
7. SCL-90-R: Hostility	.14**	.41**	.52**	.54**	.55**	.48**	–		
8. *M*	39.33	.47	.66	.59	.65	.35	.40	–	–
9. SD	12.63	.41	.65	.61	.67	.49	.49	–	–

[a]Symptom checklist-90-revised.

*$p < .05$, two-tailed.

**$p < .001$, two-tailed.

5.4. Prediction of the MDI using the DMS

Linear bivariate regression analysis using the least squares method was used to evaluate the ability of the DMS to predict each subscale as well as the total score of the MDI. This method was chosen because the investigation of R^2 using linear regression has shown to be robust when multiple imputation has been used (Harel, 2009), and also because: (a) linear regression as a parametric test has demonstrated valid statistical results for non-normally distributed data in large samples, (b) large sample sizes tend to exhibit normal distributions regardless of shape, and (c) the means of large random samples tend to exhibit normality even if the distributions appear non-normal (Elliott & Woodward, 2007; Lumley, Diehr, Emerson, & Chen, 2002; Pallant, 2007).

A DFM was able to significantly predict MD in this study sample of PTs ($\beta = .98$, $t(6,092)$ $p < .001$). Linear regression indicated that 96% of the variance in MD was explained by a DFM [$R^2 = .96$ $F(1, 6.091) = 141,025.98$, $p < .001$] and the DMS served as an excellent measure in predicting MDI scores. A series of bivariate linear regressions were run on each of the subscales to investigate the predictive power of specific characteristics of the DMS related to MD. It was found to be an excellent predictor of each MDI subscale, but variance was best explained in the size and symmetry concerns and exercise dependence subscales of the MDI (see Table 11).

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Table 11. Series of linear regressions between muscular drive and muscle dysmorphia inventory subscales

MDI subscales	*B*	S. E.	*B*	*t*	*p*	*F*	F Sig.	*R²*
Dietary behavior	.39	.00	.95	231.70	.000	54,147.82	.000	.90
Supplement use	.21	.00	.91	176.85	.000	31,276.20	.000	.84
Exercise dependence	.35	.00	.96	263.51	.000	69,437.70	.000	.92
Physique concealment	.26	.00	.94	209.69	.000	43,968.96	.000	.88
Size and symmetry	.31	.00	.97	329.65	.000	108,668.15	.000	.95
Pharmacological use	.08	.00	.93	201.38	.000	40,553.38	.000	.87

Table 12. Hierarchical multiple regression predicting muscle dysmorphia from a drive for muscularity with controls

		B	S. E.	*β*	*t*	*p*	*R*	*R²*	*ΔR²*
1	(Constant)	30.51	2.80		10.89	.000	.37	.13	.13
	Competitive bodybuilder	20.81	2.06	.30	10.09	.000			
	Competitive weightlifter	11.53	2.05	.17	5.64	.000			
2	(Constant)	10.49	2.00		5.25	.000	.77	.60	.47
	Competitive bodybuilder	13.76	1.42	.20	9.69	.000			
	Competitive weightlifter	3.96	1.41	.06	2.80	.005			
	Drive for muscularity	.90	.026	.70	34.53	.000			

Researchers have indicated that using measures such as the MDI or the DMS with individuals who identify as being weightlifters and/or bodybuilders can be problematic because these types of individuals typically engage in rigorous valetudinarian procedures as mandates of their sport and not due to some type of underlying body image disturbance (Baghurst & Kissinger, 2009; Suffolk, 2013). Therefore, a follow-up analysis was done to examine if the DMS could predict MD when bodybuilders and weightlifters were treated as statistical controls.

Assumptions were assessed during the hierarchical multiple regression analysis. Multicolinearity (tolerance = .941–.943, VIF = 1.06) and outliers did not pose a problem (Cook's distance, max = .03). The entire model accounted for 60% of the variance in MDI scores, and the DFM accounted for an additional 47% of variance after the variables of bodybuilder and weightlifter had been statistically controlled (see Table 12).

5.5. MDI and sex

A Mann-Whitney *U* test evaluated if there was a difference between males and females on the total and subscale scores of the MDI. Overall, men exhibited more muscle dysmorphic symptoms than women ($U = 75,862.50$, $z = -9.87$, $p < .001$, $r = .31$) where men scored more highly (647.70) than women (454.29) across each subscale of the MDI. Differences between genders on the dietary subscale were significant ($U = 96,893$, $z = -5.29$, $p < .001$, $r = .16$), where men averaged 588 compared with 485 for women. Men also scored significantly higher (640.88) than women (457) on the supplement use subscale ($U = 78,316$, $z = -9.48$, $p < .001$, $r = .29$). Differences between men and women on the exercise dependence subscale were statistically significant ($U = 107,356.50$, $z = -2.956$, $p < .05$, $r = .30$) where again men (558.15) scored higher than women (500.37).

The physique concealment subscale of the MDI was also statistically significant with regard to gender differences, ($U = 97,214$, $z = -5.23$, $p < .001$, $r = .16$), where men (587.45) scored higher than women (485.29). Differences between men and women on the size and symmetry concerns subscale of MDI were significant, ($U = 66,264.50$, $z = -12.00$, $p < .001$, $r = .37$), where again men (676.32)

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		B	S. E.	β	t	p	R	R^2	ΔR^2
	Table 13. Multiple hierarchical regression depicting bodybuilder and weightlifter controls								
	(Constant)	30.58	2.80		10.91	.000	.37	.13	.13
1	Competitive bodybuilder	20.77	2.06	.30	10.08	.000			
	Competitive weightlifter	11.50	2.04	.17	5.63	.000			
2	(Constant)	48.89	3.16		15.48	.000	.47	.22	.09
	Competitive bodybuilder	21.11	1.96	.30	19.80	.000			
	Competitive weightlifter	9.71	1.95	.14	4.99	.000			
	Sex	−10.13	.094	−2.6	−10.75	.000			

ranked higher than women (439.56). There was no significant difference between men (516.67) and women (521.72) on the pharmacological subscale (U = 120,435.50, z = −.22, p = .82, r = .01).

A further hierarchical regression analysis was computed holding competitive weightlifter and bodybuilder status as controls to assess their influence on sex and MD. Multicolinearity (tolerance = .96 to .943, VIF = 1.05) and outliers did not pose a problem (Cook's distance, max = .001). The analysis indicated that sex explained 9% of the variance within the model. Furthermore, identification as a competitive weightlifter or bodybuilder accounted for 13% of the total variance, and therefore influenced MDI scores slightly more than sex (see Table 13).

The specific manifestations of MD and a DFM were segregated by sex. Scores on the MDI were assessed to identify a minimum score of 27 and a maximum score of 123. That data was used to transform MDI scores into a dichotomous variable where values through 75 (lower 50%) were deemed minimally muscle dysmorphic and a range of 76–123 (upper 50%) was considered maximally muscle dysmorphic. Similar measures were taken with the DMS so that a score through 45 (lower 50%) was considered a minimal drive and a score of 46 to 90 (upper 50%) was considered a maximum drive.

Cross-tabulation revealed an important and relative proximity between the sexes after the aforementioned variable transformations. The number of males and females who scored maximally on the MDI were only differentiated by 33 cases (Males = 135 cases, Females = 102 cases). Similarly, males and females were only differentiated by 28 cases on the maximal end of the DMS (Males = 158 cases, Females = 130 cases). These findings indicated that perhaps muscle dysmorphic and muscular drive behaviors do not skew as greatly between sexes in PTs when compared to other researched populations (e.g. college students, gym members, etc.).

6. Discussion

The purpose of this study was to assess the presence MD and DFM in personal trainers using a biopsychosocial foundation. This is the first known study to incorporate PTs as a target population in MD and DFM research, and is one of the few studies to adopt and incorporate a biopsychosocially operationalized framework in assessing MD and a DFM across biophysical, psychological, and social dimensions. A majority of the operationalized biopsychosocial variables were strongly, positively related with MD as well as a DFM at the p < .001 alpha level, indicating that the variable structure used within the present study would be a suitable model for MD and a DFM in PTs.

6.1. The biophysical dimension

An important finding from this research was that a muscular drive and the display of muscle dysmorphic behaviors as operationalized by the DMS and MDI were positively correlated with the same variables except for race. Both the DFM and MD tended to diminish in relation to age, and this was consistent with findings from previous researchers (for review see Tod & Lavallee, 2010). To date, the Body Comparison Scale has not been used in concomitance with the MDI, but it is not surprising that

muscle concerns and somatic features were the subscales most strongly correlated with both a DFM and MD; both subscales dealt with aspects of physicality and musculature.

It was somewhat surprising that weight concerns were significantly, positively correlated with MD at an alpha level of $p < .05$ while weight concerns were significantly, positively correlated with a DFM at an alpha of $p < .001$. Previous researchers have indicated that individuals with muscle dysmorphic symptoms often engage strenuous exercise and typically use supplements for the purpose of diminishing adiposity so as to better display musculature (Morgan, 2000). Based on the putative behaviors of MD, one would expect weight control to be less prominent in the DFM and more symptomatic of an underlying body image disturbance associated with MD. Previous researchers have been unable to establish a general correlation between a DFM and anthropometric measures of adiposity (e.g. Chittester & Hausenblas, 2009; McCreary, Karvinen, & Davis, 2006), but the specific relationship between a DFM and *adiposity concerns* are largely unknown. Therefore, more research is needed, and new measures ought to be developed to establish how a preoccupation with weight differs between muscle dysmorphic behaviors and muscular drive, especially in PTs.

Muscular concerns were more strongly, positively correlated with a DFM than with MD. This finding is important, as it may help to contrast the two disorders. Specifically, an individual who exhibits muscle dysmorphic behaviors may have a strong preoccupation with muscularity *and* leanness, accompanied with feelings of inadequacy about his or her own physique, but an individual with an intense DFM may harbor more or only muscular concerns because the ultimate objective of the drive is the attainment and/or display of physical muscularity. This is related to the aforementioned inclusion of adiposity concerns and how the integration of fat storage may be an immense concern for both MD and a DFM. Therefore, it is useful, albeit psychometrically or methodologically, to separate individuals who singularly have a strong DFM from those who have a strong DFM associated with MD by controlling for concerns about, as well as the measured presence of, adiposity in a sample of participants.

6.2. The psychological dimension

The DFM and MD each separately had statistically significant relationships with psychopathology (i.e. somatization, interpersonal sensitivity, depression, anxiety, obsessive compulsive behavior, and hostility), with interpersonal sensitivity being the largest common correlation between the two dependent variables. These findings are noteworthy, as few studies have incorporated a measurement of psychopathology like the SCL-90-R in muscle dysmorphic and muscular drive assessments as a means to provide data that are inclusive of psychological disturbances. However, these results support the findings from previous researchers who used the SCL-90-R and a measure of MD (e.g. Maida & Armstrong, 2005; McFarland & Kaminski, 2009; Wolke & Sapouna, 2008) and further build upon such studies by adding a DFM as a dependent variable of interest.

Different from the aforementioned studies, obsessive-compulsive behavior exhibited the least consistency across the MDI subscales. However, the correlation matrix indicated that obsessive-compulsive behavior exhibited a stronger relationship with a DFM, and depression had a stronger correlation with a DFM than MD. Interpersonal sensitivity maintained a strong, significantly positive relationship with both a DFM and MD. Therefore, the results from the present study suggest that social sensitivity may be more applicable to PTs in exacerbating MD behaviors and unhealthy muscular drives than obsessive behaviors or feelings of depression. Further, research that deals with obsessive and interpersonal sensitivity behaviors as temporal agents and can classify them as either byproducts or precipitators of MD would greatly help to conceptualize the unique symptoms of MD.

The correlations for both the DMS and the MDI on the SCL-90-R were small, but their identical correlational significance with examples of psychopathology suggests that a muscular drive may be influenced by psychological disturbance in a manner similar to MD. Future research would benefit from further dichotomizing MD and a DFM and assessing the potential overlaps in pathology with alternate measures that singularly assess constructs such as obsessive-compulsive behavior,

depression, anxiety, and interpersonal sensitivity. Also, research that goes beyond correlations and assesses the potential causal relationships between psychopathology, DFM, and MD would greatly contribute to the current literature.

6.3. The social dimension

Internalization of thin/low body fat ideals was not significant for a DFM even though it was significant for MD. Considering the similarity with which the scores from the DMS and MDI depicted on all study variables, it may be prudent to explore this specific variable in future research. Based on previous work, it was expected that individuals with muscle dysmorphic symptoms would have more adipose concerns (Morgan, 2000; Olivardia, 2007), but individuals who reported a high DFM had more weight-related concerns on the Body Comparison Scale than thin/low body fat concerns on the SATAQ-4. This is a noteworthy finding, because although these two subscales assess different constructs, their disparity with regard to MD suggested that muscle dysmorphic and muscular drive goals are different despite an overarching goal commonality in increased musculature.

The internalization of a muscular and athletic physique was the strongest related subscale for both MD and a DFM. Media pressure was the least correlated variable for both the MDI and the DMS and also not significant. Trainers had reported being much more susceptible to peer and familial influences than media influences. These results were surprising, as the internalization of media-based muscular ideals has been shown to relate to and/or be statistically capable of predicting MD (Cafri et al., 2006; Daniel & Bridges, 2010; Fernandez & Pritchard, 2012), as well as to a DFM (Giles & Close, 2008).

It is possible that this variation may be unique to PTs or that media influence is not as collectively salient to MD and a DFM. Whether PTs acquire some type of fortitude to media influence based on their education or training is unknown and necessitates further examination. Some have suggested that much of MD research is potentially confounded by the overuse of college students as target populations (Suffolk et al., 2013). Therefore, it is possible that the large range in the age of participants (18–86) for this study is responsible for better capturing media influence over a lifetime, considering individuals typically become less susceptible to media influence as they age regardless of whether or not that influence is one of body image (Ashford, LeCroy, & Lortie, 2006; Taylor, Peplau, & Sears, 2005).

One of the most novel sociological findings in the current study was in relation to physique concealment. When the specific subscales of the MDI were separated, media pressures were shown to have a statistically positive relationship with physique concealment, but did not illustrate a meaningful relationship with any other MDI subscale. Physique concealment was the only subscale of the MDI to depict a significantly positive relationship with every variable across each biopsychosocial dimension except for race. Despite a focal preoccupation with muscularity, these findings suggest that the act of concealing one's physique may be a more prominent behavior of MD than putatively believed. This assertion is partially supported by the significant correlations found between interpersonal sensitivity and a DFM and MD, respectively. Additional research that isolates physique concealment as a distinct behavior of MD, considers specific body parts or regions (e.g. Baghurst et al., 2014), and compares its manifestation to other body image disturbance behaviors may help to indicate the provenance of concealing one's physique as a viable and perhaps central behavior of MD.

6.4. Drive for muscularity and muscle dysmorphia: Predictive capabilities

A DFM was able to significantly predict MD in this study sample of PTs. It also explained 47% of the variance when controlling for weightlifters and bodybuilders, and was more instrumental in predicting MD than competitive bodybuilding or weightlifting statuses. Few studies have considered the ability of a DFM to predict MD, and fewer studies have controlled for bodybuilders and weightlifters in muscle dysmorphic and muscular drive research. Future research into the interplay between a DFM and MD would help to better establish the commonalities and differences between these two separate constructs. For example, McCreary and Sasse (2000) indicated that the DMS could be split

into two separate subscales denoting behaviors as well as attitudes. It would be beneficial to address these specific subscales of the DMS and examine which attitudinal or behavioral aspects of a DFM are more or less instrumental in predicting MD.

6.5. Sex differences and the MDI

It was anticipated that men and women might have had similar exhibitions of muscle dysmorphic behavior based on the commonality of personal training and vocational proximity to sport and fitness. This assumption was largely supported. MDI and DMS scores were analyzed with cut-off points in the post-analysis phase. Cross-tabulation with cut-off points for the DMS and the MDI revealed that men and women who had exhibited maximal scores were only differentiated by 28 cases for the DMS and 33 for the MDI.

A score on the MDI indicative of severe MD (i.e. a response of "6" to each and every question) is one of 162, while a score of 27 is indicative of no MD symptomology (see Rhea et al., 2004). The mean display of muscle dysmorphic symptomology among PTs in this sample was 64.1, which indicated that although muscle dysmorphic behaviors were present in the sample, they were relatively minimal. Drives for muscularity were slightly more pronounced in this sample of PTs.

Similarly, the minimum and maximum DMS scores were 15 and 90, respectively. Personal trainers scored an average of 39, which is indicative of a small-to-medium presence of a DFM in the sample. Participants who identified as being competitive weightlifters and/or bodybuilders were almost equally split between males and females. This equality likely bolstered the data when competitive statuses were treated as controls.

The findings from the current study indicated that perhaps muscle dysmorphic and muscular drive behaviors do not skew as greatly between sexes in PTs when compared to other populations such as students or gym members. It is important to note that there were more women than men who participated in the study. Men exhibited significantly more symptoms of MD than women, which is congruent with numerous research studies (Giardino & Procidano, 2012; Pope, Olivardia, Borowiecki III, & Cohane, 2001; Pope et al., 1993). However, cross-tabulation revealed minimal differences with regard to muscle dysmorphic cases between the sexes, which is also congruent with previous research (Ebbeck, Watkins, Concepcion, Cardinal, & Hammermeister, 2009; Goodale, Watkins, & Cardinal, 2001; Robert et al., 2009). Gender-heterogeneous studies remain sparse in muscle dysmorphic literature, and it is not clear which covariates close or widen the gap between men and women with regard to MD. Although there were more female than male participants, the case-wise exhibition of MD and a DFM was noticeably proximal to both sexes.

6.6. Limitations and future research

A primary limitation of this study related to generalizability and the characteristics of the participants. A majority of participants identified as being Caucasian, and this could substantially limit how the chosen factors relate to trainers of other races. Furthermore, the sample was mostly composed of females and had a relatively small percentage of individuals who identified as being competitive bodybuilders or weightlifters. A gender-equal sample with more participants identifying as bodybuilders or weightlifters would likely have provided greater accuracy when using gender and competitive weightlifting and bodybuilding as comparison groups.

The phobic anxiety, psychoticism, and paranoid ideation subscales of the SCL-90-R were not used in this study, as they have exhibited little to no relationship with MD in the past literature (see Tod & Lavallee, 2010). Although the omission of these subscales was likely beneficial in improving response rates, their omission can be viewed as problematic in that the inclusion of these subscales would likely have been useful because each of the SCL-90-R subscales used in the study yielded a significant correlation with a DFM and MD.

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Aspects of structural equation modeling or types of factor analysis were not part of the study. However, because many of the subscales displayed strong, positive correlations with MD and a DFM, it is likely that this data could be transformed into a suitable muscle dysmorphic/muscular drive model for PTs using structural equation modeling techniques. Furthermore, researchers would benefit from incorporating additional dimensional variables such as body/fat-free mass indexing (Cafri et al., 2006; Olivardia et al., 2000), other body dysmorphic disordered behaviors (Phillips & Castle, 2001), or underlying body image disturbances (Parent, 2013).

7. Conclusion

The present study has contributed to the current MD, DFM, and body image literature by examining muscle dysmorphic symptoms and muscular drives in PTs using a novel biopsychosocial framework. These findings indicated that MD and a DFM are measurably present in the vocation of personal training and are closely intertwined with psychological and psychosocial attitudes and behaviors. The presence of MD and intense DFM manifested in 23 and 28% of the sample, respectively, which is slightly higher than data from previous research using narrower populations such as college students and gym enthusiasts (e.g. Leone, Sedory, & Gray, 2005; Olivardia, 2001). Although individuals with high scores on the MDI and the DMS are not a majority in the sample, their scores are importantly and significantly correlated with psychopathology that belies the necessary inclusion, emphasis, and support for individuals, trainers, and clients who may struggle with body dysmorphic disorder and body image disturbances.

This study provides unique insight into an unresearched population and a further exploration of various demographics with different sport and vocational affiliations will likely add to the empirical merit of MD. Personal trainers were shown to display muscle dysmorphic and muscular drive behaviors that were largely congruent with the extant literature, but the presence of MD seemed to be less inclusive of sex and much more related to muscular drives. Furthermore, PTs were particularly susceptible to pressures from family and peers and displayed less influence by the media to alter their physiques. A further examination of the interrelationship between the importance of familial vs. peer influences at multiple stages of life would be an excellent direction for future research as the data within the current study indicated a decrease of social internalizations as age increased.

Muscle dysmorphia as well as the DFM shared similar, statistically positive correlations with psychopathologic variables and especially interpersonal sensitivity. Muscular drive and MD were often strongly associated with the same variables using the same alpha level ($p < .001$), and both displayed statistically significant correlations across the biopsychosocial dimensions. This finding is congruent with an extensive muscle dysmorphic literature review from Jones and Morgan (2010), who had found that "men with muscle dysmorphia show abnormalities on every biopsychosocial variable" (p. 26). Trainers are likely to be a population of interest in ongoing MD and DFM research; their vocation places them in a role where they are likely to encounter individuals who struggle with disordered exercise and body image disturbances, yet they too may unknowingly struggle with these same problems.

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