

Sizing it up: A Systematic Review of the Nosology of Muscle Dysmorphia

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ABSTRACT

Background: Muscle dysmorphia (MD), a condition in which the principal symptom is that of marked preoccupation with one's body being insufficiently muscular, has been the subject of considerable nosological debate in recent years. **Aims:** The purpose of our systematic review is to examine the extant literature, with a focus on identifying the underlying psychopathology of MD, so as to allow accurate classification and determination of subsequent potential treatment implications. Electronic searches were performed within a date range of 2005–2015. We included only articles which employed assessments compatible with the criteria proposed by Pope *et al.* **Results:** Our review encompassed a total of 29 papers, comprising cross-sectional or case report designs. Seven papers proposed MD be classified within the eating disorder spectrum, three papers favored an obsessive-compulsive spectrum classification, while six papers suggested classification within the body dysmorphic disorders. The remaining 13 papers either felt MD did not adequately fit within existing diagnostic categories or required creation of a new category of body image disorders (BID). **Conclusions:** The centrality of body image disturbance in MD, in addition to its divergence from disorders within other diagnostic categories, suggests that creating a new category of BID would better reflect the psychopathology of MD, with additional potential benefits being increased validity of an MD diagnosis and subsequent development of targeted treatments.

Key words: Anorexia, bigorexia, body image, eating disorder, muscle dysmorphia, muscularity

INTRODUCTION

A significant body of literature describes disorders characterized by a disturbance of body image, affecting both men and women to varying degrees. One such disorder, muscle dysmorphia (MD) has gained increasing recognition in recent years, both in the scientific literature and lay media. MD is a condition in which the principal symptom is that of marked preoccupation with one's body being insufficiently muscular, despite often being of above average muscularity and lean body mass. While certainly not a gender exclusive disorder, literature suggests

that men are at significantly greater risk of developing MD than women. Originally conceptualized^[1] as “reverse anorexia” due to the apparent behavioral and cognitive similarities with anorexia nervosa (AN), further research^[2] resulted in the adoption of the term MD. The presence of pathological exercise behaviors aimed at increasing lean muscle mass was one of the features contributing to this conceptualization, with disordered eating being deemed a secondary characteristic.

From a nosological perspective, there has been increasing debate in the literature as to where MD best fits within current

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psychiatric classification systems. In the^[3] Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5), it is currently classified as a subtype of body dysmorphic disorder (BDD). Various alternative suggestions have been put forward, including that MD may be best classified within existing categories of feeding and eating disorders (ED's), in view of MD's undeniable similarities with the ED's, particularly AN. Other suggestions have included placing MD within the grouping of obsessive-compulsive spectrum disorders. Indeed, some authors continue to question whether MD is a genuine disorder, despite it being a well-described entity.

The purpose of this paper is to present a systematic review of the extant, contemporary literature on MD, with a focus on interrogating the nosology, based on the features of the underlying psychopathology. We present a discussion on both treatment implications and future research directions and go on to suggest that MD may be best classified under a new category of body image disorders (BID).

METHODS

Electronic searches were performed in PubMed, PsycINFO, EMBASE, and The Cochrane Library. While descriptions of MD date back to as early as 1993, to maintain the contemporary nature of the investigation and discussion, the above databases were searched within a date range of 2005–2015, using the terms MD, bigorexia, reverse anorexia, and muscularity. Searching included all languages. Finally, reference lists of included studies were checked to identify as yet undiscovered publications which could then be assessed for suitability.

Inclusion criteria

To examine the best available contemporary evidence on MD nosology, we included only articles which employed assessments compatible with the criteria proposed.^[2] These encompassed the MD symptom questionnaire, MD disorder inventory, MD inventory, drive for muscularity scale, modified MD scale, and the MD questionnaire.

Exclusion criteria

Articles which did not justify or explain the method of MD assessment/diagnosis were excluded, as were articles consisting of primarily of viewpoints/commentaries, reviews, and articles which were not deemed to be primarily related or applicable to MD.

Selection of articles included in review

Titles and abstracts were initially read by the first author, whom also decided on inclusion and exclusion of papers based on the above-mentioned criteria. Some papers which did not meet criteria for the review were, however, considered

to be rich in content and contributed to elements of the discussion (see below). First authors of the included papers were contacted as required to clarify methodology. From a total of 1576 records, 54 articles were fully assessed for eligibility, with 29 papers included in this review. Reasons for exclusion are shown in Figure 1.

Methodological quality and bias in included studies

Included studies were assessed for quality according to the National Health and Medical Research Council (NHMRC) recommendations, with included papers representing level IV evidence^[4] due to being cross-sectional or case-report designs. No evidence of language bias was found, as searching was not limited to English.

RESULTS

Figure 1 shows the Preferred Reporting Items for Systematic reviews and Meta-analysis flowchart of the article searching and selection for this review. A total of 29 articles were included, with dates ranging from 2005 to 2015. A total of 29 full-text articles were excluded following full review for suitability. Many articles were excluded due to being commentary articles, reviews, or failing to specify the method of diagnosing MD. Finally, additional articles were excluded due to MD not being discussed at all throughout the paper.

Characteristics of included studies

The majority of studies comprised relatively small, non-clinical samples through a cross-sectional design. Six case reports were also included. In view of the absence of experimental or epidemiological study designs, the included articles represent Grade IV evidence according to the NHMRC guidelines [Table 1].

Prevalence of MD

Throughout our review, the highest reported prevalence of MD was 44%, found in a sample of 51 male weightlifters,^[5] with the lowest reported prevalence in weightlifters being 13.6%.^[6] This replicated the prevalence rates found by Alves dos Santos Filho *et al.*^[7] in their 2016 review, reflecting the relatively scarce availability of prevalence data. Notably Bo *et al.*,^[8] found in a sample of 440 college students that males were at a significantly greater risk than females of developing MD, with students of exercise and sports sciences courses at a 5-fold risk above baseline. Of the included studies, three included females.^[5,9,10]

Evidence for characterization of MD as an ED

The similarities between AN and MD have been extensively documented,^[11-14] with a number of clear similarities evident from etiological, psychological, behavioral, and comorbidity perspectives, with this concept dating back to^[1] original description of MD as “reverse anorexia.” Seven papers

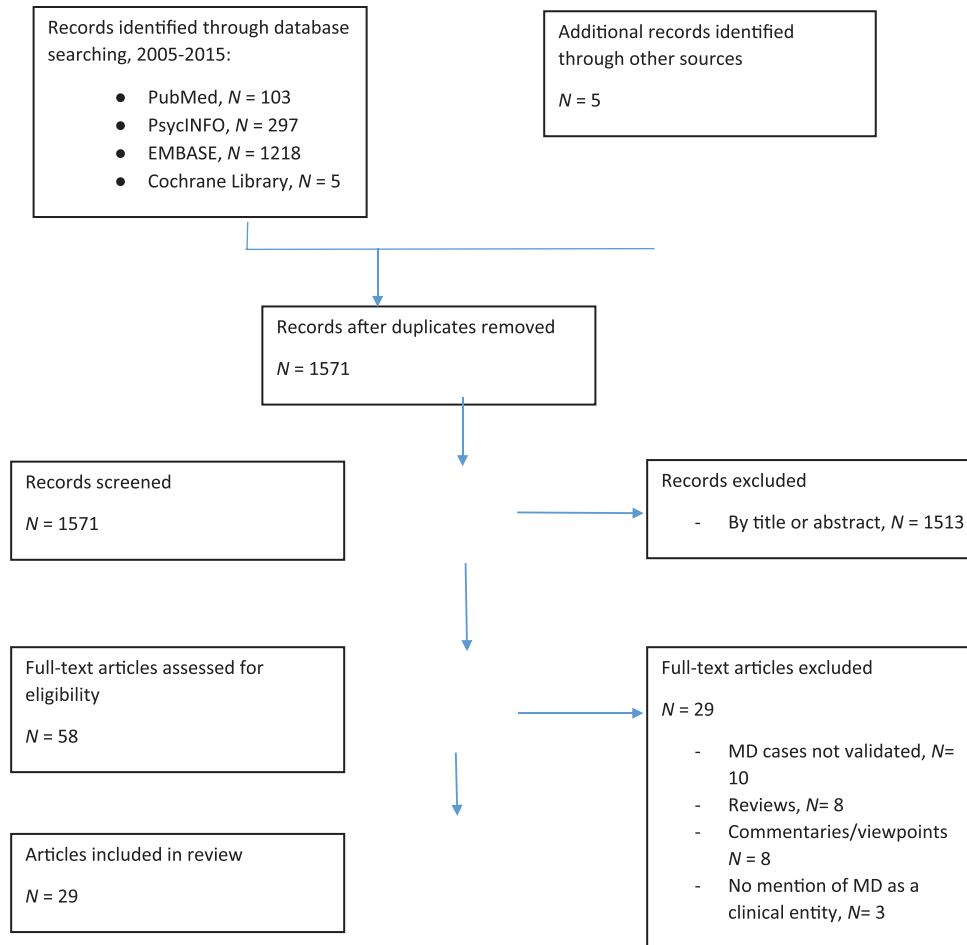


Figure 1: Preferred Reporting Items for Systematic reviews and Meta-analysis flowchart

(24.1%) in our review proposed MD be classified with the ED's.^[9,15-19] In addition, from a psychological and behavioral perspective, a number of authors have previously described MD compulsions as being experienced as egosyntonic, again similarly to AN.^[20,21] Further to this Kanayama and Pope,^[22] suggest there may be a shared biological vulnerability between MD and AN. This has been further discussed by Benninghoven *et al.*^[23] and Raevuori *et al.*,^[24] through demonstration in twin studies, whereby cotwins of AN sufferers expressed significant MD symptomatology in addition to mood and anxiety symptoms. Given these extensive similarities, it is unsurprising that suggestions for classifying MD as an ED remain prominent.

Evidence for characterization of MD within the obsessive-compulsive spectrum

Four papers favored an OC spectrum classification for MD,^[8,9,25,31] representing 10.3% of literature included in our review. One of these studies, however,^[8] suggested that females at risk of MD may show psychological profiles more closely resembling profiles seen in the ED's, whereas men may present with more obsessive-compulsive symptoms. In addition, a key finding by Tucker *et al.*^[10] was the relationship between pressures to attain a

sociocultural physique ideal and the development of MD, which may suggest a primary body image pathology.

Evidence for characterization of MD within the BDD spectrum

Six papers suggested MD be placed with BDD, as it is at present,^[5,26-30] one of these studies^[29] found that in a sample of 95 men with BDD (25 of whom had MD), men with MD experienced poorer quality of life, had higher lifetime prevalence of substance use disorder (86% vs. 51%) and were significantly more likely to have attempted suicide (51% vs. 16%). Similarly Cafri *et al.*,^[5] described greater functional impairment, more severe body dissatisfaction and body checking, and higher rates of mood and anxiety disorders in MD sufferers when compared to controls.^[26] Furthermore, highlighted that variations of MD may present with a pathological pursuit of leanness, as opposed to muscularity, albeit while retaining as much lean muscle tissue as possible.

Evidence for characterization of MD as a BID

Thirteen papers^[5,6,32-40] either suggested MD may be best classified as a BID or were unable to identify an appropriate nosology based on existent criteria.

Table 1: Characteristics of studies

Author/s	Study design	Sample characteristics; size (n), gender (M/F), age (years) ± 1SD	Method of MD assessment	Findings	Suggested nosology
Behar and Molinari (2010)	Cross-sectional	Weightlifters (88) and medical students (84), M, mean ages: Weightlifters: 27±7 Medical students: 22±1	Pope <i>et al.</i> 's (1997) criteria	MD prevalence 13.6% in weightlifters. 42% of weightlifters with MD had used AAS, and 67% used other EPAD.	BDD, OC spectrum
Bo <i>et al.</i> , (2014)	Cross-sectional	College students, M/F (440), mean ages: Nutrition 19.8±2.7 Exercise sciences: 19.9±1.8 Biology: 19.7±1.4	MDDI	Attending exercise sciences school showed odds ratio of 5.15 (95% CI 1.44–18.4) for experiencing MD traits. Choice of course influenced by premorbid disorders/behaviors	OC spectrum
Cafri <i>et al.</i> , (2006)	Case report	College student (1), M, 20.	Pope <i>et al.</i> 's (1997) criteria	MD shows drive for muscularity and leanness; ED demonstrates drive for thinness. Not all MD cases may have drive for muscularity; some may desire leanness without muscle gain	BDD
Cafri <i>et al.</i> , (2008)	Cross-sectional	Weightlifters (51), M, mean ages: Current MD (15): 25.2±5.7 Past MD (8): 25.2±6.6 No MD (28): 26.1±5.0	Pope <i>et al.</i> 's (1997) criteria	MD lifetime prevalence in weightlifters=44%. Males with current MD experienced greater functional impairment, more frequent body dissatisfaction and body checking. MD also=higher rates of mood and anxiety disorders	BDD
Chandler <i>et al.</i> , (2009)	Cross-sectional	College students (97), M, mean age 21.7±4.5	MDI	OC symptoms and anxiety traits showed strong relationships with SPA and MD symptomatology	New classification, OC spectrum disorder
Danilova <i>et al.</i> , (2013)	Cross-sectional	College students and gym users (57), M, 41 with low MD symptoms, 16 with high MD symptoms. Mean ages: Low MD: 25.6±7.0 High MD: 26.5±7.7	MDI	Significantly higher gap between actual and ideal self in men with high MD symptoms compared to men with low MD symptoms	Nil suggested
Grieve <i>et al.</i> , (2008)	Cross-sectional/correlational	College students (134), M, mean age: 22.1±4.9	MDDI	Greater symptoms of SPA=greater MD symptoms. Men with higher SPA also exercised more for appearance reasons.	Nil suggested
Grieve and Helmick (2008)	Cross-sectional	College students (64), M, mean age: 27.5±10.6	MDI	Men who scored higher for self-objectification also showed greater drive for muscularity and more MD symptoms.	Nil suggested

(Contd...)

Table 1: Continued

Author/s	Study design	Sample characteristics; size (n), gender (M/F), age (years) ± 1SD	Method of MD assessment	Findings	Suggested nosology
Grieve and Shacklette (2012)	Cross-sectional	(100), M, age range 18–54.	MDQ	Depressive symptoms significantly correlated with, and predictive of MD	Nil suggested
Hildebrandt <i>et al.</i> , (2006)	Cross-sectional	Weightlifters (237), M, mean age: 32.6±12.4	Pope <i>et al.</i> 's (1997) criteria	MD prevalence 16.9%. MD subjects showed increased bulimic and OC symptoms, greater drive for muscularity, more SPA, and more physique protection behaviors	Nil
Hildebrandt <i>et al.</i> , (2010)	Cross-sectional	APED users (1000), M, mean age: 28.3±8.5	MDDI	Unique pathological phenotypes of masculine ideal exist in men with BID. Drug use not only limited to AAS but also included high rates of growth hormone and illicit thermogenic use.	BDD
Kanayama <i>et al.</i> , (2006)	Cross-sectional	Weightlifters (89), M, mean ages: AAS users: 29.3±6.5 Non-users: 30.1±10.5	Pope <i>et al.</i> 's (1997) criteria	Greater MD symptoms in AAS users.	Nil suggested
Kuennen and Waldron, 2007	Cross-sectional	(49), M, mean age: 28.3±8.35	MDI	Direct relationship between perfectionism and exercise dependence; relationship between muscularity and self-esteem	Nil suggested
Lamana <i>et al.</i> , (2010)	Cross-sectional	College students (348), (101) M, (247) F, mean age: 19.1±2	MDDI	Sociocultural influences on appearance predict body dissatisfaction → negative affect → MD and ED symptomatology	ED
Leone <i>et al.</i> , (2014)	Cross-sectional	(304), M, mean age: 22.4±4.3	MDDI	Men with higher levels of alexithymia more likely to report MD symptoms, however, not drive for muscularity	BDD, OC spectrum
Maida and Armstrong (2005)	Cross-sectional	Weightlifters (106), M, age range: 18–45	MDSQ	MD prevalence 25%. Symptoms of BDD, OC symptoms, body dissatisfaction, and hostility found to be main predictors of MD	OC spectrum
Martin and Govender (2011)	Cross-sectional	High school students (508), M, age range: 15–19.	DMS	Adherence to masculine ideal associated with increased body image discrepancy and increased drive for muscularity. Muscularity directly equated to self-esteem.	Nil suggested

(Contd...)

Table 1: Continued

Author/s	Study design	Sample characteristics; size (n), gender (M/F), age (years) ± 1SD	Method of MD assessment	Findings	Suggested nosology
Menees <i>et al.</i> , (2013)	Cross-sectional	College students, (118), M, age range: 18–39	MDQ	Out of those whom recalled receiving critical comments about their bodies, the more severe the comment, the more MD symptoms were reported	Nil suggested
Mosley (2009)	Case report	Bodybuilder (1), M, 27.	Pope <i>et al.</i> 's (1997) criteria	MD risk increased when exercise driven by appearance concerns as opposed to general health or fitness reasons	ED
Murray <i>et al.</i> , (2010)	Case report	Weightlifter (1), M, 32	MDDI	Disruption to dietary practices resulted in a significant escalation of MD symptoms	ED
Murray <i>et al.</i> , (2011)	Case report	(1), M, 20	MDDI	Dietary restrictions in MD may facilitate pathways into binge eating episodes; binge eating and purging may serve emotional regulatory functions in MD.	ED
Murray <i>et al.</i> , (2012)	Cross-sectional	College students (119), M, mean age: 21.9±2.5	MDDI	Low self-esteem, perfectionism, mood intolerance, and perfectionism significant predictors of MD	ED
Murray <i>et al.</i> , (2012b)	Cross-sectional	Gym users: AN (24), MD (21), controls (15). Mean ages: AN: 23.9±6.7 MD: 28.2±6.7 Controls: 28.5±8.3	Pope <i>et al.</i> 's (1997) criteria,	Men with AN and MD showed similar symptom profiles - AN and MD nosologically similar.	ED
Murray and Griffiths (2014)	Case report	(1), M, 15	Pope <i>et al.</i> 's (1997) criteria	Family-based therapy may be useful in treating adolescent MD	ED
Pope <i>et al.</i> , (2005)	Cross-sectional	BDD patients (63), M, mean ages: MD: 36±11 Non MD: 34.6±9.6	Pope <i>et al.</i> 's (1997) criteria	BDD+MD=poorer quality of life, increased suicide attempts, increased AAS and substance use compared with BDD	BDD
Readdy <i>et al.</i> , (2011)	Cross-sectional	College students (373), F (219), M (154), mean ages: F: 19.8±2.1 M: 20.1±2.4	MMDS	MD may be related to perceptions of pressure to attain socioculturally ideal physique	OC spectrum
Thomas <i>et al.</i> , (2011)	Cross-sectional	Weightlifters (30), M, mean age: 20.9±2.6	MDDI	Functional impairment significantly higher on non-weight training days. MD symptoms may have state-like properties and be influenced by situational factors	BID

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Table 1: Continued

Author/s	Study design	Sample characteristics; size (n), gender (M/F), age (years) ± 1SD	Method of MD assessment	Findings	Suggested nosology
Walker <i>et al.</i> , (2009)	Cross-sectional	College students (550), M, mean age: 18.9±1.6	MDDI	Increased body checking=more MD and depressive symptoms, and greater APED use. Body checking important construct in body image disorder.	Nil suggested
Wolke and Sapouna (2008)	Cross-sectional	Bodybuilders (100), M, mean age: 29.8±9.1	MDI	Childhood bullying=greater risk of MD. MD strongly associated with low self-esteem, anxiety, depressive and OC symptoms	BDD

MD: Muscle dysmorphia, CI: 95% Confidence interval, SD: Standard deviation, BDD: Body dysmorphic disorder, ED: Eating disorder, OC: Obsessive-compulsive, SPA: Social physique anxiety, BID: Body image disorder, AAS: Anabolic-androgenic steroid, AN: Anorexia nervosa, APED: Appearance and performance enhancing drug, MDI: Muscle dysmorphia inventory, MDDI: Muscle dysmorphic disorder inventory, MDO: Muscle dysmorphia questionnaire, MDSQ: Muscle dysmorphia symptom questionnaire, DMS: Drive for muscularity scale, MMDS: Modified muscle dysmorphia scale

A number of these studies found prominent body image dissatisfaction to be a core feature of MD - specifically Danilova *et al.*,^[32] found that the perceived gap between the actual and ideal self when shown pictures of various physiques were significantly greater in men with high MD symptoms in comparison to men with low MD symptoms. These findings are also supported by Maida and Armstrong^[25] who found symptoms of body distortion/dysmorphia to be stronger predictors of MD behaviors than were ED or obsessive-compulsive symptoms, despite the authors favoring an OC spectrum classification. Similarly Martin and Govender,^[36] demonstrated that adherence to the masculine ideal was associated with significantly increased body image discrepancy and drive for muscularity.

Grieve *et al.*^[33] found that men with higher levels of social physique anxiety (SPA) undertook exercise more for reasons of self-presentation and perceived image (muscularity) enhancement, as opposed to being motivated by physical fitness or recreational reasons. Further to this, men with higher levels of SPA also expressed higher levels of MD symptoms. It is important to note, however, that this was a correlational study; therefore, causality could not be determined, and it may be that the development of MD contributed to greater SPA. A number of additional correlates of SPA were also described in this study, including low self-esteem, low rates of participation in public exercise or social events, body image dissatisfaction, increased disordered eating, and prominent fear of negative evaluation of one's physique by others.^[11] It was also noted that men with higher measures of self-objectification demonstrated greater drive for muscularity and expressed more MD symptomatology. Similar findings were evident in another study,^[6] and while unable to suggest a classification, those authors found that subjects with MD showed high SPA and physique protection behaviors, in addition to a greater drive for muscularity and bulimic symptoms. Many of these findings were further replicated by Walker *et al.*,^[39] who demonstrated a relationship between increased body checking behaviors (such as regularly checking one's reflection, feeling muscles for size, and tone and seeking reassurance from others about muscularity) and greater MD symptoms, in addition to higher rates of appearance and performance enhancing drug (APED) use.

Martin and Govender^[36] found that adherence to masculine ideals was associated with increased body image discrepancy, and significantly increased drive for muscularity. Similarly Kuennen and Waldron,^[35] found a significant relationship between muscularity and self-esteem. Interestingly, one study^[27] described a number of male body image disturbance phenotypes with varying behaviors and presentations, although noted a drive for both muscularity and leanness to be at the core of all variations. However, these authors again favored a BDD classification for MD.

APED use in MD

The use of the term “APED,”^[27] also described as “body image drugs,”^[14,40] highlights that anabolic-androgenic steroids (AAS), and other illicit compounds are not simply used to enhance strength and performance but are used extensively by those with MD to attain muscularity and leanness. A number of authors have described AAS use in MD,^[11,38,41,42] with estimates of >50% of sufferers having current or lifetime use of AAS.^[41] Behar and Molinari, (2010), found AAS use in 42% of weightlifters with MD, and a general APED usage of 67%.^[27] Highlighted the high rate of utilization of over the counter and illicit thermogenic compounds in MD. It seems logical that APED use in MD parallels the use of similar agents in AN, with their use in both disorders aimed at expediting the process of attaining an unrealistic appearance ideal, or compensating for a variation from the rigidly planned nutrition and/or exercise regimen.

DISCUSSION

This systematic review investigated the contemporary suggestions on the nosology of MD, in studies in which MD cases were appropriately validated. A number of studies assessed comorbidities and factors associated with the development of MD. Overall, the majority of papers reviewed either did not conclude that MD fits appropriately within any current DSM-5 category (despite its current classification), or did not suggest a classification see Figure 2, with many describing MD as a disorder of body image.

Specific findings

While a number of papers described body image disturbance as being at the core of MD psychopathology, it is important to note the absence of neurobiological research pertaining specifically to MD, with evidence coming from subjective surveys and experiments, such as participants selecting

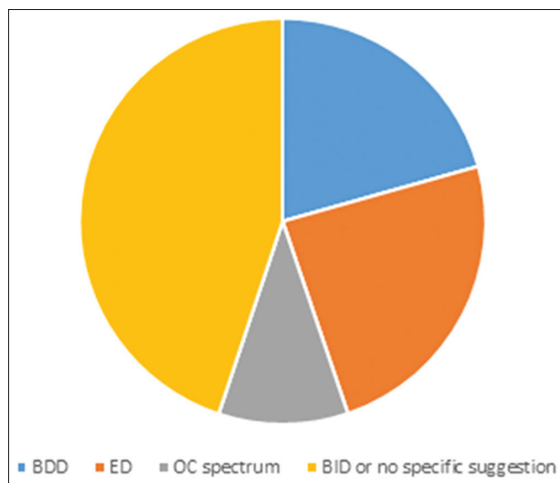


Figure 2: Suggested nosology of muscle dysmorphia in reviewed article ($n = 29$)

representation of their true and ideal self, based on photos of varying physiques Phillipou *et al.*,^[43] in their recent systematic review of neurobiological changes reported in individuals with AN, described many structural and functional brain differences such as alternations in neurotransmitter function, regional cerebral blood flow, glucose metabolism, volumetrics, and the blood oxygen level dependent response. In view of the clear similarities between AN and MD, it seems plausible that similar neurobiological correlates may be evident in subjects with MD. In addition to this, there are a number of clear links between MD, the ED’s (particularly AN), and BDD, with many etiological, psychological, and behavioral similarities.

Despite the clear links and similarities with BDD and AN, MD seems to demonstrate unique elements in its presentation and behaviors that suggest it may represent a discrete entity. The increased presence of compulsive exercise and lower scores on measures of eating pathology (compared to men with AN);^[13] provides an example of MD’s divergence from the currently recognized ED’s. In addition to this, MD demonstrates a clear pursuit of muscularity and leanness, as opposed to thinness. In terms of divergence from BDD, BDD presentations rarely include such significant disturbance in dietary and exercise behavior as that seen in MD, and indeed BDD diagnostic criteria suggest that at present, clinicians should determine whether a BDD presentation is better explained by an ED, with MD also showing greater comorbidity and functional impairment than “non-MD” BDD patients.^[29]

Treatment implications

Treatments for MD currently focus on serotonergic antidepressants and cognitive behavioral therapy,^[21,44] again notably similar to the ED’s and BDD.^[18,22] At present, there is a distinct lack of published data on specific MD treatments. Previous publications have described the difficulties in treating MD, including reluctance of sufferers to seek treatment due to the egosyntonic nature of beliefs and behaviors,^[45] and their outward appearance often being that of a “healthy” individual.^[46]

Griffiths *et al.*^[46] have previously suggested that placing MD within the ED category may result in males becoming even less likely to seek treatment, for fear of being labeled with a disorder which society continues to view as a primarily “female problem.” Stigma against those with ED’s is a recognized problem, with the male experience of ED pathology being no exception. Griffiths *et al.* suggested that some MD sufferers may internalize the experience of not having a “real illness,” and maybe thus reluctant to seek treatment. In addition Menees *et al.*,^[37] found that boys who were exposed to critical comments about their physiques from fathers and sports coaches were at increased risk for developing MD, thus paving the way for interventions at

a population level, through delivery of education on, and awareness of MD, particularly to higher risk groups.^[47]

Enhancing the validity of an MD diagnosis through appropriate classification may assist in the development of more targeted treatments, both in severe and subclinical cases, as well as improving rates of treatment seeking, particularly by males. It is apparent that a vast number of subclinical cases of MD exist,^[48] and while many of these cases would benefit from treatment, individuals may only be correctly diagnosed during assessment and treatment of another primary disorder or comorbidity, such as anxiety or depressive disorder.^[21] In addition, the aforementioned APED use adds a further layer of complexity to MD, and it is important that this is recognized and responded to within treatment approaches.^[49] We suggest that placing MD within a diagnostic category which reflects its underlying pathology of body image disturbance (BID) may encourage further investigation into the underlying neurobiological processes evident in body image disturbance, and the subsequent development of targeted treatments.

Limitations of this review

This review has a number of limitations. First, despite relatively large numbers of empirical articles being available, the number of articles suitable based on our inclusion criteria is relatively small. Limiting the search range to 2005 onward may have contributed to this relatively small number; however, this strategy was chosen to allow interrogation of the contemporary literature and debates. In addition, the majority of included articles employed a cross-sectional design, with a small number of case reports included. Regardless, level of evidence for the included literature was level IV, representing the lowest level of the NHMRC evidence hierarchy. A minority of studies (three) included female subjects, with many studies also enrolling in non-clinical subjects. Selection and response bias may have been an additional factor in some samples, as many subjects were recruited from flyers and advertisements at universities and gymnasiums. Prevalence data for the general population were particularly scarce. Samples were generally from Western countries, with the majority from North America and Australia. In addition, many of the rating scales used in the reviewed articles (particularly in assessing eating pathology) were developed and validated in female ED samples - their utility in male subjects is questionable.^[50]

CONCLUSION

It is clear there is a significant need to further our understanding of the experience of muscularity oriented body image pathology, with our review further demonstrating the continuing uncertainty regarding the most fitting classification for MD. In view of the majority of reviewed studies describing MD either as a disorder of body image

(currently a non-existent category in the DSM-5), or failing to suggest appropriate classification, when combined with the available evidence suggesting body image disturbance lays at the core of this disorder, we suggest MD would be best classified under a new category of “BID.” MD’s striking similarities with the ED’s, particularly AN, would suggest this classification could also logically encompass the ED’s, and indeed BDD and its variants, thereby better reflecting the shared underlying psychopathology of body image distortion. Future research on MD will need to utilize a variety of sample characteristics and validated symptom measures to determine who may be at risk for MD, in addition to bodybuilders and weightlifters. Further to this, we reiterate that exploring the underlying neurobiology of MD is crucial. In closing, we suggest this review allows us to extrapolate that disturbance of body image lays at the core of MD pathology, with other behavioral manifestations occurring secondary to this, and therefore we suggest it should be classified as such under the new heading of BID.

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