An investigation of the characteristics of muscle dysmorphia in a non-clinical population of adult male weight lifters in Australia

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Bachelor of Exercise Science and Nutrition (BExSc&Nutr) (Hons)

This thesis is presented in fulfilment of the requirements for the degree of Doctor of Philosophy at Southern Cross University

November 2014
Declaration

I certify that the work presented in this thesis is, to the best of my knowledge and belief, original, except as acknowledged in the text, and that the material has not been submitted, either in whole or in part, for a degree at this or any other university.

I acknowledge that I have read and understood the University's rules, requirements, procedures and policy relating to my higher degree research award and to my thesis. I certify that I have complied with the rules, requirements, procedures and policy of the University.

Name: Johanna Elizabeth Nieuwoudt

Signature: [Signature]

Date: 26 November 2014
Special Note

The author wishes it noted that the research studies presented in this thesis were conducted and/or commenced prior to the publication of the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) on 18th May 2013. The completed thesis therefore makes reference, as it is appropriate, to the fourth edition, text revision, of the *Diagnostic and Statistical Manual of Mental Disorders* and the DSM-5. Data collection for the first study was completed on 11th May 2012. Data collection for the second study commenced on 8th July 2012 and was completed on 30th June 2013.

The author also wishes it noted that this thesis complies with the citation, format, and style rules of the sixth edition of the *Publication Manual of the American Psychological Association*. 
Abstract

Muscle dysmorphia (MD) is observed as a strong drive to increase muscularity and decrease body fat, and appears to be based on beliefs regarding one’s muscularity, regardless of actual muscle size and definition. The current scientific literature on MD is inconclusive on several vital questions regarding the characteristics, categorisation, and prevalence of MD. The overall purpose of the research was to investigate whether MD should be included as a new disorder in a classification system for mental disorders, and to improve the understanding and awareness of the rates and symptoms of MD, BDD, and eating disorders. Two studies were designed in this project to address five of these questions.

The first study aimed to: (a) examine inter-rater reliability of the proposed MD criteria, (b) investigate if MD represented a syndrome of co-occurring symptoms, and (c) investigate the correlation between the proposed MD criteria and the Muscle Appearance Satisfaction Scale (MASS) in a non-clinical population of adult male weight lifters in Australia. Adult males \( N = 48 \) who were currently participating in weight lifting were assessed using the MASS and a one-on-one interview. Results of the assessments by two registered psychologists indicated low inter-rater reliability \( (\kappa = .39; p \leq .05) \). A Binomial test revealed that MD represented a syndrome of frequently co-occurring symptoms: there was a significant probability \( (> .70) \) of a participant with one diagnostic symptom of MD (criteria B1 or C) to exhibit another symptom (criterion A) of the disorder. Point-biserial correlation indicated that the proposed MD criteria, excluding criterion B2, were significantly correlated with the total score of the MASS and its subscales, excluding Muscle Satisfaction.

The second study aimed to: (a) determine the prevalence of, and factors contributing to, MD symptoms, body dysmorphic disorder (BDD) symptoms, and eating disorders symptoms; and (b) provide a comprehensive comparison of symptoms of MD, BDD, and eating disorders in a non-clinical population of adult male weight lifters in Australia. Adult males \( N = 648, M_{age} = 29.5, SD = 10.1 \) who were currently participating in weight lifting completed an online survey consisting of the background questionnaire, the MASS, the Body Dysmorphic Disorder Questionnaire, and the 26-item Eating Attitudes Test.

Results indicated that 17.0% of participants were at risk of having MD, 10.6% of participants were at risk of having BDD, and 33.8% of participants were at risk of having an eating disorder. Furthermore, 5.6% of participants were found to be at risk of having both
MD and BDD, and 9.3% of participants were at risk of having both MD and an eating disorder.

Significant differences were found in the number of weight lifting days per week between participants at risk of MD only and participants at risk of eating disorders only. Significant associations were found between a history of being diagnosed with a mental disorder in the past and being identified as at risk of BDD, at risk of both MD and BDD, and at risk of MD, BDD as well as eating disorders. Symptoms of MD were differentiated from symptoms of BDD, and from symptoms of eating disorders. The outcomes of the study provided supportive evidence for the comorbidity of, and symptomatic similarities between, symptoms of MD and BDD, and symptoms of MD and eating disorders.

Overall the findings of this research project has made a significant contribution to the existing literature on MD, BDD, and eating disorders; providing further understanding about the phenomenon of men who want to be more muscular. Some evidence was presented to question the acceptance of the proposed MD criteria. The research project also provided some evidence that questions the MD specifier that has been added to BDD in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders*. 
List of Publications Derived From This Project

Peer Reviewed Journal Publications


Symposium Presentation

Nieuwoudt, J. E. (2014, October). Symptoms of muscle dysmorphia, body dysmorphic disorder, and eating disorders in a non-clinical population of adult male weight lifters in Australia. In J. Yoxall (Chair), *Higher degree research symposium day.* Symposium conducted at the School of Health and Human Sciences, Southern Cross University, Australia
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Glossary of Terms

Anorexia nervosa: A type of eating disorder that is characterised by extreme dieting that leads to severe weight loss with a pathological fear of becoming fat, and a distorted body image (American Psychiatric Association, 2013).

Binge eating: Eating much more than most people would under the same circumstances and feeling that eating is out of control (Garner, Olmsted, Bohr, & Garfinkel, 1982).

Bodybuilding: The pursuit of a muscular physique through a regime of weight training and a specific diet. Bodybuilding competitions involve displaying one’s physique to a panel of judges, and scores are given based on the size, symmetry and definition of one’s musculature (Mosley, 2009).

Body dysmorphic disorder: A mental disorder that is characterised by a preoccupation with a perceived or imagined defect in physical appearance causing marked impairment in functioning (American Psychiatric Association, 2013).

Body image: “The picture we have in our minds of the size, shape, and form of our bodies and the feelings we have about these characteristics and parts that make them up” (Slade & Brodie, 1994, p. 32).

Bulimia nervosa: A type of eating disorder that is characterised by repeated episodes of binge eating followed by inappropriate compensatory behaviours such as self-induced vomiting to avoid weight gain (American Psychiatric Association, 2013).

Diagnosis: The identification of a disorder by the examination of symptoms and signs and by other investigations. The preferred method for the identification of a Diagnostic and Statistical Manual disorder involves a two-stage screening procedure consisting of a self-report screening questionnaire and a semi-structured interview conducted by a qualified clinician (Garner, n.d.).

Drive for muscularity: The desire to achieve the idealised muscular build (McCreary, Sasse, Saucier, & Dorsch, 2004). This idealised muscular build is a subtype of the mesomorphic category, which can be described as a well-developed upper body and arms, broad shoulders, narrow waist and flat stomach (Grogan, 2008; Maisey, Vale, Cornelissen, & Tovee, 1999; Schooler & Ward, 2006; M. Watt & Ricciardelli, 2012).
Eating disorders: A mental disorder that is characterised by persistent disturbances in eating habits that lead to a change in food consumption and cause clinically significant distress or impairment in important areas of functioning (American Psychiatric Association, 2013).

Eating disorders not otherwise specified: An eating disorder that does not meet criteria for a specific eating disorder (American Psychiatric Association, 2000).

Gym: For the purpose of this project, a gym will be defined as any place where males are involved in weight lifting activities, including gyms, gymnasiums, health clubs, and fitness centres.

Muscle dysmorphia: “The belief that one’s body build is too small or is insufficiently muscular” (American Psychiatric Association, 2014, "F 01 Body Dysmorphic Disorder"). Muscle dysmorphia causes the individual to want to become more muscular, even though the individual may currently be more muscular than the average person. It is observed as a relentless drive to become more muscular (H. G. Pope, Gruber, Choi, Olivardia, & Phillips, 1997).

Obsessive compulsive disorder: A mental disorder that is characterised by unwanted and intrusive thoughts that are recurrent and persistent, and that can cause marked anxiety or distress. The individual performs a compulsion in an attempt to ignore, suppress, or neutralise these thoughts (American Psychiatric Association, 2013).

Mental/psychiatric disorder: The features of a mental/psychiatric disorder are:

(a) a behavioral or psychological syndrome or pattern that occurs in an individual; (b) the consequences of which are clinically significant distress (e.g., a painful symptom) or disability (i.e., impairment in one or more important areas of functioning); (c) must not be merely an expectable response to common stressors and losses (for example, the loss of a loved one) or a culturally sanctioned response to a particular event (for example, trance states in religious rituals); (d) that reflects an underlying psychobiological dysfunction; (e) that is not solely a result of social deviance or conflicts with society; (f) that has diagnostic validity using one or more sets of diagnostic validators (e.g., prognostic significance, psychobiological disruption, response to treatment); (g) that has clinical utility (for example, contributes to better conceptualization of diagnoses, or to better assessment and treatment). (Stein et al., 2010, p. 9)
Screening: The process of identifying an individual who might be at increased risk for a disorder.

Weight lifter: The term weight lifter can be applied to almost anyone who engages in weight lifting activities. For the purpose of this project, a weight lifter will be defined as an adult male who engages in weight lifting for the purpose of increasing muscle mass and/or maintaining muscle mass. The term weight lifter is often used interchangeably with weight trainer.

Weightlifter: An individual who engages in the sport of weightlifting.

Weight lifting: For the purpose of this project, weight lifting will be defined as working out with weights (i.e., free weights or machines) for the purpose of increasing muscle mass and/or maintaining muscle mass. The term weight lifting is often used interchangeably with weight training.

Weightlifting: The sport of Olympic-style weightlifting consisting of the snatch, and the clean and jerk lifts.

Weight trainer: For the purpose of this project, a weight trainer will be defined as an adult male who engages in weight training for the purpose of increasing muscle mass and/or maintaining muscle mass. The term weight trainer is often used interchangeably with weight lifter.

Weight training: For the purpose of this project, weight training will be defined as a type of exercise training that involves working out with weights (i.e., free weights or machines) for the purpose of increasing muscle mass and/or maintaining muscle mass. The term weight training is often used interchangeably with weight lifting.
## List of Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AAS</td>
<td>Anabolic-androgenic steroids</td>
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<tr>
<td>BDD</td>
<td>Body dysmorphic disorder</td>
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<tr>
<td>BDDQ</td>
<td>Body Dysmorphic Disorder Questionnaire</td>
</tr>
<tr>
<td>CFA</td>
<td>Confirmatory factor analysis</td>
</tr>
<tr>
<td>CFI</td>
<td>Comparative fit index</td>
</tr>
<tr>
<td>DSM-IV-TR</td>
<td>Diagnostic and Statistical Manual of Mental Disorders fourth edition, text revision</td>
</tr>
<tr>
<td>DSM-5</td>
<td>Diagnostic and Statistical Manual of Mental Disorders fifth edition</td>
</tr>
<tr>
<td>EAT-26</td>
<td>26-Item Eating Attitudes Test</td>
</tr>
<tr>
<td>EDNOS</td>
<td>Eating disorders not otherwise specified</td>
</tr>
<tr>
<td>EPC</td>
<td>Expected parameter change</td>
</tr>
<tr>
<td>HREC</td>
<td>Human Research Ethics Committee</td>
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<tr>
<td>MASS</td>
<td>Muscle Appearance Satisfaction Scale</td>
</tr>
<tr>
<td>MD</td>
<td>Muscle dysmorphia</td>
</tr>
<tr>
<td>MI</td>
<td>Modification index</td>
</tr>
<tr>
<td>RMSEA</td>
<td>Root mean square error of approximation</td>
</tr>
<tr>
<td>SRMR</td>
<td>Standardized root mean square residual</td>
</tr>
<tr>
<td>TLI</td>
<td>Tucker-Lewis fit index</td>
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<tr>
<td>USA</td>
<td>United States of America</td>
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Chapter 1 – Introduction

1.1 Background to the Study

Male body image research indicates that there has been a dramatic increase in the number of men who are dissatisfied with their bodies and want to become more muscular. For example, in 1972, 15.0% of American men were not satisfied with their bodies (Berscheid, Walster, & Bohrnstedt, 1973) compared to 43.0% in 1997 (Garner, 1997). It has been reported that in 2007 up to 96.0% of American male undergraduates, 69.0% of Ukrainian male undergraduates, and 49.0% of Ghanaian males in the samples studied were dissatisfied with their bodies and wanted to increase their level of muscularity (D. A. Frederick et al., 2007). In 2010, researchers reported that up to 77.0% of college males in a sample in Hong Kong and 84.0% in a sample in the United States of America (USA) wanted to be more muscular (Jung, Forbes, & Chan, 2010).

The ideal male body as portrayed by the media consists of a well-developed upper body and arms, broad shoulders, narrow waist and hips, and flat stomach (Grogan, 2008; Maisey et al., 1999; Schooler & Ward, 2006; M. Watt & Ricciardelli, 2012). It is suggested that a difference between the body ideal and the body reality might cause some men to become obsessively preoccupied with weight lifting and dieting in a quest to become more muscular (H. G. Pope et al., 1997). Research also suggested that this drive for muscularity underlies the behavioural symptoms of muscle dysmorphia (MD; Chittester & Hausenblas, 2009; Olivardia, Pope, & Hudson, 2000).

Muscle dysmorphia is observed as a strong drive to increase muscularity and decrease body fat (H. G. Pope et al., 1997) and appears to be based on beliefs regarding one’s muscularity, regardless of actual muscle size and definition (H. G. Pope, Katz, & Hudson, 1993). The condition was originally identified in a study of male bodybuilders in 1993 and was termed “reverse anorexia” as some participants displayed behavioural and cognitive similarities to patients diagnosed with anorexia nervosa (H. G. Pope et al., 1993). The bodybuilders in H. G. Pope et al.’s (1993) study displayed a distorted body image and believed that they were small and thin, although they were in reality quite muscular, which is basically a reversal of the perceptions and beliefs of those suffering from anorexia nervosa.

In further research by H. G. Pope et al. (1997), the condition was renamed muscle dysmorphia, diagnostic criteria were constructed, and the suggestion was made that it be located within the body dysmorphia spectrum. Muscle dysmorphia may be a form of body
dysmorphic disorder, where the preoccupation is overall musculature, as opposed to a perceived physical defect (Olivardia et al., 2000). Well-founded estimates of the prevalence of MD are not yet known (Babusa, Czeglédi, Tury, Mayville, & Urban, 2015; Parent, 2013). However, a few researchers have published the MD rates found in their studies (e.g., Babusa et al., 2015; Chaney, 2008; Hitzeroth, Wessels, Zungu-Dirwayi, Oosthuizen, & Stein, 2001; Maida & Armstrong, 2005; H. G. Pope et al., 1997; Sandhu, Kishore, Shenoy, & Randhawa, 2013), which have ranged from 10.0% to 53.6%.

Despite an array of symptomatology, MD was not listed in the fourth edition, text revision, of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR; American Psychiatric Association, 2000). In 2010, it was proposed by the American Psychiatric Association to include MD in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as a form of body dysmorphic disorder (BDD), and MD was defined as “the belief that one’s body is too small or is insufficiently muscular” (2014, "F 01 Body Dysmorphic Disorder"). In 2013 an MD specifier was added to BDD in the DSM-5 (American Psychiatric Association, 2013), regardless of researchers being unable to reach agreement as to whether MD is a form of BDD, an obsessive compulsive spectrum disorder, or a type of eating disorder (e.g., Maida & Armstrong, 2005; Murray, Rieger, Touyz, & De la Garza Garcia, 2010; H. G. Pope et al., 1997; H. G. Pope, Gruber, et al., 2000).

Body dysmorphic disorder is characterised by a preoccupation with a perceived or imagined defect in physical appearance causing marked impairment in functioning (American Psychiatric Association, 2013). Body dysmorphic disorder is a relatively common disorder which affects 0.7%–2.4% of the general population (Buhlmann et al., 2010; Faravelli et al., 1997; Koran, Abujaoude, Large, & Serpe, 2008; Rief, Buhlmann, Wilhelm, Brahler, & Borkenhagen, 2006). Research has indicated that some men with BDD may also display symptoms of MD, as assessed by the proposed MD criteria developed by H. G. Pope et al. (1997). In their respective studies, C. G. Pope et al. (2005) found that 14 of the 63 male participants with BDD also had MD, and H. G. Pope et al. (1997) found that 18 of the 193 participants with BDD also had MD. Another study found that 5 of 15 (N = 28) participants with MD symptoms also displayed other classic BDD symptoms (Hitzeroth et al., 2001). Additionally, participants (n = 13) without MD did not display the symptoms of BDD (Hitzeroth et al., 2001). These findings suggest that some men with BDD may also have MD. It has been reported that males with BDD who also displayed MD symptoms were similar to those with BDD but without MD symptoms on many variables, such as BDD severity and
delusionality, preoccupation with non-muscle-related body parts, and non-MD-related BDD behaviours (C. G. Pope et al., 2005).

It has also been reported that individuals who had BDD with MD symptoms had clinically significantly higher rates of attempted suicide, and an increased prevalence of anabolic-androgenic steroid (AAS) use compared to individuals with BDD but without MD symptoms (C. G. Pope et al., 2005). Individuals with both BDD and MD symptoms were also more likely to weight train excessively, and have a strict diet, compared to those with BDD exclusively (C. G. Pope et al., 2005). BDD symptomatology was found to be positively correlated with compulsive exercise, which reflects the relationship between compulsive exercise and MD as a type of BDD (Boroughs, Krawczyk, & Thompson, 2010). Achieving the level of muscularity and body leanness becomes an obsession, and the compulsion is to achieve the desired level of muscularity and leanness (H. G. Pope, Gruber, et al., 2000).

Muscle dysmorphia was originally thought to be a form of eating disorder (H. G. Pope et al., 1993), with symptoms of MD closely resembling those exhibited by men with an eating disorder (Olivardia et al., 2000). Arguments against the categorisation of MD as a form of eating disorder have been partly based on the assumption that disordered eating was only a secondary feature of the condition (Olivardia, 2001). Eating disorders are characterised by persistent disturbances in eating habits that lead to a change in food consumption and cause clinically significant distress or impairment in important areas of functioning (American Psychiatric Association, 2013). The estimated lifetime prevalence of eating disorders is 5.6% (Hudson, Hiripi, Pope, & Kessler, 2007). It has been reported that the rate of males diagnosed with an eating disorder is increasing, from 10.0% in previous years to about 25.0% in 2007 (Hudson et al., 2007).

Researchers have also argued that MD should be categorised within an eating disorder spectrum, as MD (drive for weight gain) and anorexia nervosa (drive for weight loss) exist on opposing ends of the same continuum of body image psychopathology (Murray et al., 2010). Researchers concluded that there were many similarities between MD and anorexia nervosa, such as disordered eating practices, shared etiological factors, diagnostic crossover with time, shared familial transmission, as well as response to similar treatment approaches (Murray et al., 2010). Further research may provide support for symptomatic similarities between MD and anorexia nervosa (Murray, Rieger, et al., 2012). It appears eating practices alone can exacerbate MD symptoms, as eating and exercise-related practices are significant components of MD (Murray, Rieger, & Touyz, 2011). Behar and Molinari (2010) found that a group of
weight lifters with MD scored higher in the 40-item Eating Attitudes Test and Eating Disorders Inventory compared to a group of weight lifters without MD. The weight lifting groups also scored higher in the 40-item Eating Attitudes Test and Eating Disorders Inventory compared to medical students who did not engage in weight lifting (Behar & Molinari, 2010).

Recently it has been proposed that MD might be a type of behavioural addiction, where the addiction is body image, and activities that maintain body image are physical exercise and specific eating habits (Foster, Shorter, & Griffiths, 2014). It is also possible that MD might be a new disorder that can be differentiated from BDD and eating disorders.

Blashfield, Sprock, and Fuller (1990) proposed criteria for reviewing the scientific literature for evidence in support of the inclusion of a new diagnostic category in an official classification system. The criteria are: (1) there should be at least 50 journal articles in the last 10 years, and at least 25 of them should be empirical; (2) a set of diagnostic criteria should exist and assessment devices should exist for ascertaining whether these criteria are met or not; (3) there should be at least two independent, empirical studies demonstrating high inter-clinician agreement levels ($\kappa \geq .70$); (4) there should be at least two independent, empirical studies that show that the proposed category represents a syndrome of frequently co-occurring symptoms; and (5) there should be at least two independent, empirical studies demonstrating differentiation of the syndrome from other similar categories.

A review of the current research and potential classification of MD as a disorder in a classification system for mental disorders indicated that several significant limitations and gaps did exist in the scientific literature on MD (Nieuwoudt, Zhou, Coutts, & Booker, 2012). Results of the review showed that Blashfield et al.’s (1990) criteria 1 and 2, addressing whether MD should be introduced as a new disorder into a classification system for mental disorders, had been met. However, further research was needed in support of both the diagnostic criteria for MD and the assessment tools, such as the Muscle Appearance Satisfaction Scale (MASS). The review demonstrated that Blashfield et al.’s (1990) criterion 3 had not been met, and proposed that future research should examine diagnostic reliability and validity, including inter-rater reliability. Blashfield et al.’s (1990) criterion 4 had not been met, and it was suggested that future research should address if MD represents a syndrome that consists of symptoms that frequently co-occur. Criterion 5 had not been met, and the review recommended future studies to investigate whether MD can be sufficiently separated from other (similar) syndromes.
In summary, relatively little is known about the characteristics and prevalence of MD. Researchers do not agree whether MD is a type of BDD or eating disorder, and nosological associations should not be inferred based on the limited scientific research on the relationships between MD and other similar disorders. Conversely, an MD specifier has been added to BDD in the DSM-5 (American Psychiatric Association, 2013). As the correct categorisation of MD in a classification system for mental disorders is extremely important, further scientific research is therefore prudent. It is possible that MD might be a new disorder that can be differentiated from BDD and eating disorders. Results of a review utilising Blashfield et al.’s (1990) proposed criteria for evaluating the scientific literature for evidence in support of the inclusion of a new disorder into classification system for mental disorders revealed that not all of the criteria had been met (Nieuwoudt et al., 2012). In order for MD to be considered for classification as a new disorder, further research is needed to address criteria 3, 4, and 5 that were proposed by Blashfield et al. (1990). To advance the understanding of MD symptomatology, scientific research is needed to investigate the symptomatic relationships among MD, BDD, and eating disorders.

1.2 Research Questions, Hypotheses, and Aims

The purpose of the research presented in this thesis is to advance the understanding of MD as a disorder. This research aims to explore the symptomatic relationships among MD, BDD, and eating disorders to advance the understanding of MD symptomatology, and to contribute not only to the current knowledge regarding MD, but also BDD and eating disorders in order to understand the phenomenon of men who want to be more muscular.

1.2.1 Research questions.

The current scientific literature on MD is inconclusive on several vital questions regarding the characteristics, categorisation, and prevalence of MD. From the above highlights of the literature review (a more detailed literature review is presented in Chapter 2), the following research questions have been proposed to address gaps in the current knowledge:

1. Are high inter-rater agreement levels (κ ≥ .70) achieved among investigators utilising the proposed diagnostic criteria for muscle dysmorphia?
2. Does muscle dysmorphia represent a syndrome of frequently co-occurring symptoms?
3. Is there a high and significant correlation between the assessments, using the proposed muscle dysmorphia criteria and the Muscle Appearance Satisfaction Scale as methods of diagnosis for muscle dysmorphia?
4. Are symptoms of muscle dysmorphia more prevalent than symptoms of body dysmorphic disorder and eating disorders in a non-clinical population of adult male weight lifters in Australia?

5. Can muscle dysmorphia be differentiated from body dysmorphic disorder and eating disorders?

1.2.2 Hypotheses.

The following null hypotheses have been developed which correspond to the research questions listed in 1.2.1.

1. When the same information is presented to two independent investigators who assign a diagnosis of muscle dysmorphia by using the proposed criteria for muscle dysmorphia, high inter-rater agreement levels ($\kappa \geq .70$) will not be demonstrated, because the proportion of agreement between the raters will not be beyond chance.

2. A participant with one diagnostic symptom of muscle dysmorphia will not exhibit another symptom of the disorder, because muscle dysmorphia does not represent a syndrome of frequently co-occurring symptoms.

3. When assessing symptoms of muscle dysmorphia, a high and significant level of correlation will not be found between the assessments using the proposed muscle dysmorphia criteria and the Muscle Appearance Satisfaction Scale, as it is not known if the Muscle Appearance Satisfaction Scale and the proposed diagnostic criteria measure the same construct.

4. Symptoms of muscle dysmorphia will not be more prevalent than symptoms of body dysmorphic disorder and symptoms of eating disorders in a non-clinical population of adult male weight lifters in Australia.

5. Muscle dysmorphia symptoms cannot be differentiated from symptoms of body dysmorphic disorder and symptoms of eating disorders, because muscle dysmorphia does not represent a set of symptoms characteristic of a unique mental disorder.

1.2.3 Aims.

To test the null hypotheses stated in 1.2.2, the aims of the proposed studies are listed below.

1. To determine the inter-rater reliability of the proposed muscle dysmorphia criteria.
2. To investigate if muscle dysmorphia represents a syndrome of frequently co-occurring symptoms.
3. To determine the level of correlation between the assessments using the proposed muscle dysmorphia criteria and the Muscle Appearance Satisfaction Scale in a non-clinical population of adult male weight lifters in Australia.
4. To determine the prevalence of, and factors contributing to, muscle dysmorphia symptoms, body dysmorphic disorder symptoms, and eating disorders symptoms in a non-clinical population of adult male weight lifters in Australia.
5. To provide a comprehensive comparison of symptoms of muscle dysmorphia, body dysmorphic disorder, and eating disorders in a non-clinical population of adult male weight lifters.

1.3 Research Design

The research design was a correlational design utilising a cross-sectional survey methodology, as the primary purpose was descriptive. Two quantitative studies were designed and implemented to investigate the overall research questions and test the null hypotheses according to the aims of the studies.

Study 1 was designed to: (a) determine inter-rater reliability of the proposed MD criteria, (b) determine if the symptoms of MD co-occur frequently, and (c) assess if there was a high and significant correlation between the proposed MD criteria and the MASS. Research questions 1, 2, and 3 were investigated with null hypotheses 1, 2, and 3, according to aims 1, 2, and 3. A one-on-one interview and a self-completion paper-and-pencil questionnaire were administered.

Study 2 was designed to: (a) determine if MD could be differentiated from BDD and eating disorders; and (b) investigate the prevalence rates of MD symptoms, BDD symptoms, and eating disorder symptoms in a non-clinical population of adult male weight lifters in Australia. Research questions 4 and 5 were investigated with null hypotheses 4 and 5, according to aims 4 and 5. A survey was administered by an online self-completion questionnaire.

The details about the methodology and research design utilised in the research are presented in Chapter 3 (see section 3.2) and Chapter 4 (see section 4.2). Figure 1 illustrates the research questions and the corresponding null hypotheses that have been raised from the literature review in Chapter 2.
Figure 1. Schematic outline of research questions with corresponding null hypotheses.
1.4 Significance of the Thesis

An MD specifier has been added to BDD in the DSM-5 (American Psychiatric Association, 2013). Notwithstanding that, it does appear that symptoms of MD closely resemble those exhibited by men with an eating disorder (Olivardia et al., 2000), with support provided for symptomatic similarities between MD and anorexia nervosa (Murray, Rieger, et al., 2012). However, the relationship between MD and eating disorders has received only limited investigation in previous research. Furthermore, the rates of MD symptoms, BDD symptoms, and eating disorder symptoms in adult male weight lifters are largely unknown. This research project will provide new evidence that may result in a better understanding of how men perceive their bodies and also what measures they may take to achieve a muscular body if it is desired. In addition, the project will contribute towards enhancing the understanding of MD, BDD, and eating disorders in adult men.

It is also possible that MD might be a new disorder that can be differentiated from BDD and eating disorders. Blashfield, Sprock, and Fuller (1990) proposed criteria (see section 1.1) for reviewing the scientific literature for evidence in support of the inclusion of a new disorder into classification system for mental disorders. A review of the current research and potential classification of MD indicated that several significant limitations and gaps exist in the scientific literature on MD (Nieuwoudt et al., 2012). Results of the review indicated that Blashfield et al.’s (1990) criteria 1 and 2 addressing whether MD should be introduced as a new disorder into a classification system for mental disorders had been met.

The present research project will address Blashfield et al.’s (1990) criteria 3, 4, and 5 in order to determine whether introducing MD as a new disorder into a classification system for mental disorders, such as the Diagnostic and Statistical Manual of Mental Disorders, can be justified. The categorisation may influence the conceptualisation, assessment and treatment of a disorder (Stein et al., 2010). Therefore the correct categorisation of MD in a classification system for mental disorders is of utmost importance.

In order to understand the phenomenon of men who want to be more muscular, research should look at the signs of eating disorders, signs of BDD (Harvey & Robinson, 2003), and signs of MD. To advance the understanding of MD symptomatology, further research is needed to explore the symptomatic relationships among MD, BDD, and eating disorders.
1.5 Delimitations and Limitations

Participation in this project was delimited to adult males (18 years of age or older) who were currently lifting weights, as men who lift weights are the most suitable population to study for MD (Baghurst & Kissenger, 2009). Participation was also delimited to participants with the ability to read and speak English.

Study 1 was delimited to volunteers from the student population of Southern Cross University and individuals who used the University’s Gym and who were currently lifting weights at least once a week. Data were thus obtained from only one study site from a relatively small non-random sample. The study utilised registered psychologists, but the different levels of experience might contribute to variability in results. Interviews could increase respondent bias due to social desirability, tendency to agree with others, and other social norms (Dillman, Smyth, & Christian, 2009). When self-report questionnaires were completed in the presence of the researcher, as in Study 1, it might lead to increased bias due to social desirability (Dillman et al., 2009).

Study 2 was delimited to volunteers who were currently living in Australia and had access to the internet. Participation was also delimited to participants who were currently lifting weights at least three times per week. The sample was also limited to those individuals who had access to the websites and were aware of the survey. Therefore it was not a random sample of the population, noting however that virtual networks do incorporate random elements (Baltar & Brunet, 2012). Study 2 consisted of an online self-completion questionnaire, with the data exclusively based on self-report which could have tendencies toward social desirability bias. It is possible that participants might have interpreted the meanings of questions or statements differently or might have perceived some of the statements or questions as vague (Dillman et al., 2009).

1.6 Structure of the Thesis

This thesis is structured in five chapters, and comprises of two main studies. Chapter 1 has introduced the research project by providing background to the research. The objective of this research project has been expressed as five specific research questions, with corresponding null hypotheses and aims. This chapter concluded by evaluating the potential significance of the research project, and presenting limitations and delimitations of the research project.

Chapter 2 reviews the literature on MD and discusses relevant research. This chapter investigates whether there is sufficient evidence to support the introduction of MD as a new disorder into a classification system for mental disorders. The characteristics of MD as a
disorder are also explored. The relationships between MD and BDD, and between MD and eating disorders are discussed.

Chapter 3 presents the methodology, research design, empirical findings and discussion of the findings of the first study. The first study was designed to determine the inter-rater reliability of the proposed MD criteria, to investigate if MD represents a syndrome of frequently co-occurring symptoms, and to assess if there was a high level of correlation between the proposed MD criteria and the MASS.

Chapter 4 presents the methodology, research design, empirical findings and discussion of the findings of the second study. The second study was designed to determine if MD can be differentiated from BDD and eating disorders; and to investigate the prevalence rates of MD symptoms, BDD symptoms, and eating disorder symptoms in a non-clinical population of adult male weight lifters in Australia.

Chapter 5 concludes the research project by discussing the overall implications of the main findings, providing suggestions for future research, and identifying its major limitations.
Chapter 2 – Literature Review

2.1 Male Muscularity

2.1.1 The perfect male body.

The quest for the perfect male body is not a new phenomenon. The ancient Greeks believed that physical perfection could be mathematically determined by applying objective concepts such as order, proportion, and symmetry (Park, 2007). The sculptor Polyclitus outlined the ideal mathematical proportions for the perfect human body around 450–440 B.C. (Danto, 1999). Polyclitus prescribed that the ideal head to body ratio should be 1:7, the distance from the knee to the centre of the abdomen and the length of the leg from the foot to the knee should be three times the length of the palm of the hand, and the foot should be three times the length of the palm of the hand (Danto, 1999).

The bodybuilding legend from the period 1940–1950, Steve Reeves, is known as one of the most perfectly proportioned bodybuilders of all time. His body became a benchmark for symmetry and proportion, representing what a bodybuilding physique should look like (Robson, 2012). Reeves recommended the use of bone-to-muscle ratios as presented in Table 1 to create an ultra-symmetrical physique (Robson, 2012). Reeves prescribed that the thigh circumference should be exactly one half of that of the chest circumference, and the circumference of the waist should be twice that of the neck. The arm, neck and calf measurements should be the same (Robson, 2012). Reeves had almost reached his own ideal of the perfect physique, except for his waist that measured 15.0 cm less than twice the circumference of his neck (Robson, 2012).
Table 1

Steve Reeves’ Ultra-Symmetrical Physique Ratios

<table>
<thead>
<tr>
<th>Body part</th>
<th>Ratio</th>
<th>Body part</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arm circumference</td>
<td>252.0% of Wrist circumference</td>
<td></td>
</tr>
<tr>
<td>Calf circumference</td>
<td>192.0% of Ankle circumference</td>
<td></td>
</tr>
<tr>
<td>Neck circumference</td>
<td>79.0% of Head circumference</td>
<td></td>
</tr>
<tr>
<td>Chest circumference</td>
<td>148.0% of Pelvis circumference</td>
<td></td>
</tr>
<tr>
<td>Waist circumference</td>
<td>86.0% of Pelvis circumference</td>
<td></td>
</tr>
<tr>
<td>Thigh circumference</td>
<td>175.0% of Knee circumference</td>
<td></td>
</tr>
</tbody>
</table>


The ideal male body is also described as lean and muscular (Grogan, 2008); thus, its composition should have low body fat and high fat-free mass percentages. The ideal male body is extremely difficult to attain, if not an impossible goal for most men to achieve. It might be that we do not know what normal men’s bodies look like, as the media’s representation of this unrealistic ideal body may have replaced actual knowledge of what is considered a normal man’s body (Donaghue & Smith, 2008). It is also not known what the ideal male body looks like from a male perspective (McNeill & Firman, 2014). The percentages for “normal” fat-free mass and body fat are not known, but healthy body fat percentages have been suggested to be 12.0%–20.0% for men (Kyle, Schutz, Dupertuis, & Pichard, 2003). Kyle et al. (2003) reported the body fat mass index of 2982 healthy adult males, aged 18 to 98 years, to be 4.9 kg/m² ($SD = 1.8$ kg/m²), with the fat-free mass index being 19.1 kg/m² ($SD = 1.4$ kg/m²). In 2004–2005, 62.0% of adult males in Australia were classified as overweight or obese (Australian Bureau of Statistics, 2008), and in 2011–2012, 69.7% of adult males in Australia were overweight or obese (Australian Bureau of Statistics, 2013a). This reality of the overweight/obese male body is very different to the ideal male body as often presented by the media.

2.1.2 Exposure to muscular models.

2.1.2.1 Action figures.

Many action figures are modelled on the physiques of professional bodybuilders. Action figures are plastic figures with which some boys play with (H. G. Pope, Olivardia, Gruber, &
Borowiecki, 1999). These plastic figures range in height from 9.5 cm to 30.5 cm (H. G. Pope et al., 1999). Well known current action figures include G.I. Joe, Hulk, Spiderman, Superman, and Batman (Baghurst, Hollander, Nardella, & Haff, 2006). Children are exposed to these adult designed and created action figures from a very young age, long before they are even capable of forming an independent opinion about what level of muscularity is realistic, and what is humanly possible to achieve (H. G. Pope, Phillips, & Olivardia, 2000). It is hard to prove that action figures have an effect on boys’ body image, but a study that focused on young men (mean age 18.9 years) showed that their body esteem was negatively affected after handling muscular action figures (C. Barlett, Harris, Smith, & Bonds-Raacke, 2005).

Action figures have grown more muscular over the years, and their muscles have become more defined and sculptured through the years (H. G. Pope et al., 1999). Researchers confirmed this notion in 2006, when five current action figures were selected, extrapolated to a height of 177.8 cm, and compared with the versions of the action figures that were produced 25 years ago (Baghurst et al., 2006), as seen in Table 2. Research using current and original Batman, G.I. Joe, Hulk, Spiderman, and Superman action figures indicated that preadolescent and adolescent males prefer current action figures with large muscular physiques instead of original action figures with less muscular physiques (Baghurst, Carlston, Wood, & Wyatt, 2007). Although participants indicated that current action figures appear to be less normal, they thought that current action figures were healthier than their original counterparts (Baghurst et al., 2007).

Action figures display the physiques of professional bodybuilders, with musculature that ranges from that of the biggest bodybuilders to those exceeding what is humanly possible (H. G. Pope et al., 1999). The scaled version of a G.I. Joe action figure (see Figure 2) is bigger in dimensions when compared to professional bodybuilder and current Mr Olympia Phil Health (Mr Olympia 2011, 2012, 2013, & 2014; About Phillip Heath, n.d.) seen in Figure 3. The comparisons of the circumferences of the G. I. Joe action figure and Phil Heath are shown in Table 3.
Table 2

Circumferences of Individual Action Figures Comparing Original and Current Action Figures Extrapolated to a Height of 177.8 cm

<table>
<thead>
<tr>
<th>Circumference of body part</th>
<th>Batman</th>
<th>G.I. Joe</th>
<th>Hulk</th>
<th>Spiderman</th>
<th>Superman</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Original</td>
<td>Current</td>
<td>Original</td>
<td>Current</td>
<td>Original</td>
</tr>
<tr>
<td>Neck (cm)</td>
<td>46.7</td>
<td>61.2</td>
<td>39.1</td>
<td>87.1</td>
<td>46.7</td>
</tr>
<tr>
<td>Chest (cm)</td>
<td>103.9</td>
<td>170.8</td>
<td>104.4</td>
<td>213.9</td>
<td>148.2</td>
</tr>
<tr>
<td>Arm (cm)</td>
<td>40.1</td>
<td>61.2</td>
<td>32.1</td>
<td>85.6</td>
<td>61.2</td>
</tr>
<tr>
<td>Forearm (cm)</td>
<td>33.7</td>
<td>58.3</td>
<td>26.2</td>
<td>64.9</td>
<td>54.2</td>
</tr>
<tr>
<td>Waist (cm)</td>
<td>83.9</td>
<td>95.4</td>
<td>76.9</td>
<td>166.4</td>
<td>97.9</td>
</tr>
<tr>
<td>Thigh (cm)</td>
<td>53.8</td>
<td>81.4</td>
<td>46.7</td>
<td>96.7</td>
<td>68.8</td>
</tr>
<tr>
<td>Calf (cm)</td>
<td>41.9</td>
<td>69.8</td>
<td>32.2</td>
<td>98.3</td>
<td>63.6</td>
</tr>
<tr>
<td>Chest-to-waist ratio</td>
<td>1.24</td>
<td>1.79</td>
<td>1.36</td>
<td>1.29</td>
<td>1.51</td>
</tr>
</tbody>
</table>

Figure 2. Freight, a G. I. Joe action figure.

Figure 3. Phil Heath, Mr Olympia 2014.
Table 3

*Circumferences of Current Action Figure G.I. Joe and Professional Bodybuilder Phil Heath*

<table>
<thead>
<tr>
<th></th>
<th>G.I. Joe</th>
<th>Phil Heath</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>177.8</td>
<td>175.0</td>
</tr>
<tr>
<td>Arm (cm)</td>
<td>85.6</td>
<td>58.4</td>
</tr>
<tr>
<td>Thigh (cm)</td>
<td>96.7</td>
<td>81.3</td>
</tr>
<tr>
<td>Calf (cm)</td>
<td>98.3</td>
<td>50.8</td>
</tr>
<tr>
<td>Neck (cm)</td>
<td>87.1</td>
<td>47.0</td>
</tr>
<tr>
<td>Waist (cm)</td>
<td>166.4</td>
<td>73.7</td>
</tr>
<tr>
<td>Chest (cm)</td>
<td>213.9</td>
<td>137.0</td>
</tr>
</tbody>
</table>


### 2.1.2.2 Male body portrayed in the media.

The depiction of the muscular male body does not stop with children’s action figures. Since the late 1980s, various magazines have started targeting the average man to promote an idealised lean and muscular body, and how to achieve it (Lambre, 2005). The media promote the ideal male body as a well-developed upper body and arms, broad shoulders, narrow waist and flat stomach (Grogan, 2008; Maisey et al., 1999; Schooler & Ward, 2006; M. Watt & Ricciardelli, 2012). It has been suggested that men who are exposed to media images of the ideal male physique may be at increased risk of physical and psychological concerns such as symptoms of eating disorders, body dysmorphic disorder, excessive exercise, and also AAS use (Hobza, Walker, Yakushko, & Peugh, 2007).
In Western society individuals are constantly exposed to the media; thus, social influence will likely have an impact on the self-evaluations of men (Hobza et al., 2007). While it is difficult to directly link the portrayal of the ideal male body in the media with physical and psychological concerns (Hobza et al., 2007), it is believed that body image is influenced by factors such as media advertising and television (Cafri, van den Berg, & Thompson, 2006; Goodale, Watkins, & Cardinal, 2001). The influence of media on body dissatisfaction in men may be explained by the Tripartite Influence model (Galioto & Crowther, 2013). This model suggested that media, peers, and parents primarily influenced body image and eating dysfunction, and internalisation of societal ideals and social comparison were mediating variables (J. K. Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). Further research confirmed that social comparison mediated the influence of the media on body dissatisfaction (van den Berg, Thompson, Obremski-Brandon, & Coovert, 2002).

High body dissatisfaction has been linked to depression, eating pathology, and the use of extreme weight loss methods (Heywood & McCabe, 2006), with severe cases of body dissatisfaction being linked to MD (Nikkelen, Anschutz, Ha, & Engels, 2012). It appears that MD is based on the individual’s beliefs regarding musculature, regardless of actual muscle size and definition (H. G. Pope et al., 1993). While the antecedents of MD are unknown, research suggests that MD is related to the acceptance of male muscularity as portrayed by the media (Baghurst et al., 2006; Cafri et al., 2006; Goodale et al., 2001).

Research has shown that men who are exposed to advertising that features muscular men experience greater discrepancy between their ideal body size and their actual body size (Berry & Howe, 2005), leading to body dissatisfaction—primarily with respect to musculature rather than body fat (Leit, Gray, & Pope, 2002). The self-discrepancy theory postulates that, as discrepancy between ideal body size and actual body size increases, so does body dissatisfaction (Muth & Cash, 1997). Research indicated that exposure to muscular images is related to dissatisfaction regarding current level of muscularity and a desire to increase muscularity (Lorenzen, Grieve, & Thomas, 2004).

Hargreaves and Tiggemann (2009) found that men who were exposed to muscular images of men in television commercials had increased body dissatisfaction, and that was particularly the case among men high in appearance orientation. On the contrary, Nikkelen et al. (2012) did not find higher body dissatisfaction in participants who were exposed to muscular images compared to participants who were exposed to neutral images. It was suggested that exposure to muscular images might have led to self-enhancement instead of body dissatisfaction.
(Nikkelen et al., 2012). It is possible that for some men, the muscular images of other men might serve as an inspiration to achieve the ideal male body as portrayed in the media (Nikkelen et al., 2012).

Similarly, male participants who were exposed to average-size male fashion models did not exhibit a more positive body image compared to when they were exposed to muscular male fashion models (Diedrichs & Lee, 2010). The researchers explained that it may have been possible that the male participants did not consider the fashion models suitable for comparison, as they may have associated the male models with vanity, homosexuality, and femininity (Diedrichs & Lee, 2010).

Video games are a very popular media source (Zeely, King, & Morse, 2014). In fact, 59.0% of Americans play video games, and 51.0% of households in the USA own an average of two consoles dedicated to game playing (Entertainment Software Association, 2014). The average age of video game players is 31 years, and 52.0% of video game players are male (Entertainment Software Association, 2014). A content analysis of video games indicated that human male avatars are larger than the average American man, but without the V-shape promoted by the general media (Martins, Williams, Ratan, & Harrison, 2011). Research found that video games with muscular avatars were related to a decrease in body satisfaction of the game player (Bartlett & Harris, 2008; Zeely et al., 2014). If playing video games does decrease body satisfaction, it might contribute to higher rates of body dissatisfaction among males (Zeely et al., 2014).

After comparing female-audience magazines (28 issues of Cosmopolitan), male-audience magazines (36 issues of Men’s Health and 27 issues of Men’s Fitness), and bodybuilder-audience magazines (22 issues of Muscle & Fitness), researchers found that representations of the ideal male body are less muscular in magazines aimed at women as compared to magazines aimed at men (D.A. Frederick, Fessler, & Haselton, 2005). Images of male bodies are also less muscular in magazines aimed at a male audience compared to magazines aimed at bodybuilders (D.A. Frederick et al., 2005). A content analysis of eight different men’s lifestyle magazines sold in Canada showed that the masculine body ideal was lean and toned as opposed to excessively muscular (Ricciardelli, Clow, & White, 2010). T. G. Morrison, Morrison, and Hopkins (2003) found that exposure to media images of the ideal male body in fitness magazines is positively associated with the individual’s drive for muscularity intensity.

Men’s lifestyle magazines in general have been associated with higher body surveillance, which in turn has been associated with the internalisation of appearance ideals (Aubrey,
The internalisation of appearance, or media, ideals has been found to be related to an increase in body dissatisfaction (Galioto & Crowther, 2013) and was a strong predictor of drive for muscularity (Daniel & Bridges, 2010). Research has found that the association between the exposure to men’s lifestyle magazines and the drive for muscularity was significantly stronger among single men when compared to those in stable romantic relationships (Giles & Close, 2008).

The media do not present beauty ideals in isolation, and muscularity is linked with attractiveness, happiness, desirability, and status (Tiggemann, 2005). Acceptance of this cultural representation can become internalised, leading to basing one’s self-worth on the level of muscularity and attractiveness (Tiggemann, 2005). Hence, psychological outcomes, such as depression, are likely to increase (C. P. Barlett, Vowels, & Saucier, 2008). The results from a meta-analysis suggested that mass media pressure in regards to the ideal male body is negatively related to body esteem, body satisfaction, and self-esteem (C. P. Barlett et al., 2008). Similarly, a review of experimental studies indicated that body satisfaction of young men was negatively impacted by exposure to images of the ideal male body (Blond, 2008). A study conducted in Pakistan found that body satisfaction was more severely negatively affected in those who had high exposure to the media, compared to those with low exposure to the media (Khan, Khalid, Khan, & Jabeen, 2011).

Research has shown that the exposure to muscular images may lead to negative outcomes (Mulgrew, Johnson, Lane, & Katsikitis, 2014). Even if the impact of a single brief media exposure on self-esteem and body image is small, the effects can accumulate over time as we are exposed to mass media, leading to an increase in body image disturbance (Hausenblas, Campbell, Menzel, Doughty, & Thompson, 2013). However, not all research supports the notion that self-esteem is negatively affected by exposure to muscular images. Hatoum and Belle (2004) did not find a relationship between the degree of men’s media exposure and self-esteem, and Hobza et al. (2007) did not find lower self-esteem in participants who viewed images of the ideal male as portrayed by magazines.

**2.1.3 Dissatisfaction with muscularity and drive for muscularity.**

Dissatisfaction with muscularity has been associated with lower body satisfaction and poorer psychological wellbeing (Mishkind, Rodin, Silberstein, & Striegel-Moore, 1986). Body dissatisfaction has been associated with decreased self-esteem, disordered eating, excessive weight lifting, increased use of performance-enhancing supplements, and increased risk of AAS use (Cafri et al., 2005; Myers & Crowther, 2009). Research studies conducted
between 1972 and 1997 indicated that men were becoming increasingly dissatisfied with their bodies. In 1972, 15.0% of American males were dissatisfied with their bodies (Berscheid et al., 1973) compared to 43.0% in 1997 (Garner, 1997). In 2007, researchers reported that up to 96.0% of American undergraduate males, 69.0% of Ukrainian undergraduate males, and 49.0% of Ghanaian males in the samples studied were dissatisfied with their bodies and wanted to be more muscular (D. A. Frederick et al., 2007). In 2010, researchers reported that up to 77.0% of Hong Kong college males and 84.0% of American college males wanted to increase their level of muscularity (Jung et al., 2010). Research conducted in 2010 found that Hong Kong college men had lower global body satisfaction, but greater satisfaction with their level of muscularity, compared with American college men (Jung et al., 2010). Results indicated that 75.0%–77.0% of the sample of Hong Kong college men and 81.0%–84.0% of the American sample of college men wanted to increase their level of muscularity (Jung et al., 2010). One study found that while male participants from Austria, France, and the USA overestimated their current level of muscularity, they still indicated that the ideal male body is on average 12.7 kg more muscular than their own (H. G. Pope, Gruber, et al., 2000). They also thought that women would be more attracted to a body shape that is, on average, 13.6 kg heavier in muscle mass than their own bodies (H. G. Pope, Gruber, et al., 2000). It appears that most men in Western societies want a muscular body with a low percentage of body fat, with broad shoulders, big biceps, and a narrow waist (Cohane & Pope, 2001; Ridgeway & Tylka, 2005).

A drive for leanness, which is the drive to achieve and maintain a low percentage of body fat, is not the same as dissatisfaction with body fat, which relates to feelings about the current distribution and amount of body fat (Tylka, 2011). Similarly, a drive for muscularity is not the same as dissatisfaction with muscularity (Bergeron & Tylka, 2007).

A study found that men who expressed a strong drive for muscularity also viewed muscularity as having many positive benefits, and had a greater appearance orientation, compared to those men who rated the positive benefits of muscularity lower (Martin, Kliber, Kulinna, & Fahlman, 2006). While some researchers found that a greater drive for muscularity is associated with greater contingent self-esteem among males (Grossbard, Lee, Neighbors, & Larimer, 2009), others found that low self-esteem is associated with a greater drive for muscularity (Chittester & Hausenblas, 2009; McCreary & Sasse, 2000). Many maladaptive behaviours and attitudes are associated with a high drive for muscularity, such as exercise dependence (Chittester & Hausenblas, 2009), disturbed eating characterised by high
protein, low fat diets (Cafri et al., 2005), using dietary supplements (Bahrke, Yesalis, Kopstein, & Stephens, 2000; Chittester & Hausenblas, 2009), and AAS (Bahrke et al., 2000; Parent & Morandi, 2011). A higher drive for muscularity in adolescents and young adults is associated with a greater risk for BDD, as well as higher levels of depression and social physique anxiety, and lower levels of self-esteem and life satisfaction (McCreary, Hildebrandt, Heinberg, Boroughs, & Thompson, 2007; J. K. Thompson & Cafri, 2007).

Research suggests that the greater the discrepancy between the body ideal and body reality, the more likely the development of MD in some vulnerable men (Babusa et al., 2015; H. G. Pope et al., 1997). Also, it appears that if men perceive other men to be more muscular than themselves, this could intensify their drive for muscularity (Mills, Jadd, & Key, 2012). It seems that actual body composition is not related to drive for muscularity, as body mass index, fat-free mass index, and body fat percentage were found to be unrelated to drive for muscularity (McCreary, Karvinen, & Davis, 2006). Researchers proposed that a drive for muscularity underlies the behavioural symptoms of MD (Olivardia et al., 2000). Chittester and Hausenblas (2009) confirmed this notion in their study as they found that men with MD do indeed have a very pronounced drive for muscularity.

2.1.4 Body image.

Individuals have an internal drive to continuously compare themselves with other individuals, in order to evaluate their own abilities and characteristics (Nikkelen et al., 2012). This is explained by the social comparison theory, which postulated that individuals get information about themselves by comparison with the opinions and abilities of other people (Festinger, 1954). Researchers posited that social comparison theory asserts that comparing your physical appearance with that of universalistic targets such as celebrities, may lead to reduced body image (Morrison, Kalin, & Morrison, 2004). Given that men in Western society are constantly subjected to the media (Hobza et al., 2007), and specifically to images of the muscular ideal male body, it seems likely that some men may experience a decrease in appearance self-esteem. Indeed, research found that social comparison, when viewing images of the muscular ideal male body, led to a decrease in appearance self-esteem (Morrison et al., 2004), and an increase in body dissatisfaction (Galioto & Crowther, 2013; Hargreaves & Tiggemann, 2009). This might be because some men compare themselves to the ideal male body portrayed by the media, and find that they do not live up to the societal standards (Farquhar & Wasylkiw, 2007).
It appears that men engage in social comparison if they perceive the target to have a desirable physique (Karazsia & Crowther, 2009), but they do not engage in social comparison if the target physique appears to be unrealistic to achieve (Arbour & Ginnis, 2006). This might explain why men who viewed hyper-muscular images did not engage in social comparison when viewing hyper-muscular images, while they did engage in social comparison when viewing muscular images (Arbour & Ginnis, 2006).

Donaghue and Smith (2008) advised that critical judgement of one’s own body size should not be interpreted as evidence of generalised low-esteem or modesty: it might be that it is reflecting the lack of information about what normal bodies look like. If there is a lack of information about what normal bodies look like—thus the unavailability of an objective standard—then social comparison might be important. It seems like the extent to which men engage in universalistic social comparison predicts appearance self-esteem, use of pathogenic weight control practices, number of diets to gain weight, and the use of AAS to increase muscle mass (Morrison et al., 2004). However, research has found that participants do not engage in social comparison often (Hobza et al., 2007). This may be due to participants not being aware of their use of social comparison information, or because social desirability may prevent participants from reporting their use of social comparison information (J. V. Wood & Wilson, 2003).

Most people want other people to view them in a desirable way, because the impression we make on people influences the way they treat us (Hausenblas, Brewer, & Van Raalte, 2004). Individuals attempt to control and monitor how they are perceived and evaluated by others through the process of self-presentation (Leary, Tchividjian, & Kraxberger, 1999). Some individuals may experience anxiety if they believe that others are evaluating their bodies in a negative way, and this is known as social physique anxiety (Hart, Leary, & Rejeski, 1989; Russel, 2002). Social physique anxiety is a form of body image-related social anxiety (Hart et al., 1989), and may be a form of social anxiety in exercise because the body is critical in physical activity (Martin et al., 2006). Social physique anxiety is correlated with MD (Grieve, Jackson, Reece, Marklin, & Delaney, 2008; A. Thomas, Tod, Edwards, & McGuigan, 2014), as both are associated with low self-esteem and body dissatisfaction (Grieve et al., 2008). High levels of social physique anxiety are associated with higher levels of MD symptoms (Grieve et al., 2008). However, MD leads to the development of social physique anxiety because the man perceives his body to be too small and feels evaluated by others in a negative manner (Grieve et al., 2008). College-aged men may be at increased risk
for social physique anxiety and body image disturbance as they tend to adopt masculine
gender norms (Pollack, 1998).

There is a negative relationship between social physique anxiety and exercise behaviour
(Brunet & Sabiston, 2009; Lantz, Hardy, & Ainsworth, 1997). Researchers proposed that this
relationship might be explained by self-determination theory (Brunet & Sabiston, 2009) or by
self-presentation (Lantz et al., 1997). According to self-determination theory, motivation can
be intrinsic or extrinsic (R. M. Ryan & Deci, 2002). Individuals with intrinsic motivation
tend to have higher levels of self-determination and engage in behaviour which is essentially
freely chosen (R. M. Ryan & Deci, 2002). In contrast, individuals with extrinsic motivation
tend to have lower levels of self-determination and engage in behaviour because they feel
pressured by others, or by themselves, to do so (R. M. Ryan & Deci, 2002). Self-presentation
concerns may cause some individuals to exercise (Lantz et al., 1997), because they feel
pressured to enhance their physiques in order to conform to society’s ideals (Brunet &
Sabiston, 2009). When self-presentation is the main motive for weight lifting, it may result in
AAS use in an attempt to achieve the ideal body (Hausenblas et al., 2004).

Men’s physiques are increasingly objectified in the media (H. G. Pope, Olivardia,
Borowiecki, & Cohane, 2001; Ricciardelli et al., 2010). According to the objectification
theory, these images may leave many men convinced that they are small and underdeveloped,
regardless of the actual state of their own bodies (Luciano, 2001). Men who self-objectify—
that is, look at themselves as objects—are more likely to exercise for appearance
enhancement reasons in order to achieve an idealised body (Strelan & Hargreaves, 2005).
Strelan and Hargreaves (2005) found that men who self-objectify are more likely to have
reduced body esteem; however a study conducted by Grieve and Helmick (2008) failed to
support this prediction. It may be possible that men with low body esteem in response to self-
objectification will exercise for appearance reasons. It may also be that exercise in response
to poor body esteem may contribute to an increased likelihood of self-objectification (Strelan
& Hargreaves, 2005).

Strelan and Hargreaves (2005) found that self-objectification is correlated with positive
body image, but results from other studies (Grieve & Helmick, 2008; Morry & Staska, 2001)
suggested that self-objectification does not directly predict men’s body satisfaction. This
might be because people who self-objectify do not necessarily feel dissatisfied with their
bodies, as self-objectification is about looking at yourself as an object, and the way you make
judgements about your body and appearance (Grieve & Helmick, 2008). In contrast, one
study found that the objectification of the male body may cause men to experience higher levels of body dissatisfaction (Galioto & Crowther, 2013). Research indicated that men who score high in self-objectification show a greater drive for muscularity and have higher levels of MD compared to men who score lower in self-objectification (Grieve & Helmick, 2008). However, one study found that drive for muscularity was not related to self-objectification (Daniel & Bridges, 2010).

Body image distortion was found to be a feature of BDD (Cororve & Gleaves, 2001; Hrabosky et al., 2009; Rosen & Ramirez, 1998; Sarwer & Crerand, 2004), eating disorders (Hrabosky et al., 2009; Rosen & Ramirez, 1998), and MD (Choi, Pope, Olivardia, & Cash, 2002). It appears that BDD sufferers are highly invested in their physical appearance (Didie, Kuniega-Pietrzak, & Phillips, 2010). Several domains of body image were found to be negatively correlated with BDD severity (Didie et al., 2010).

2.2 Muscle Dysmorphia

2.2.1 Muscle dysmorphia as a mental health problem.

Muscle dysmorphia is recognised by researchers as a set of symptoms characteristic of a psychological disorder (e.g., Cafri, Olivardia, & Thompson, 2008; Hitzeroth et al., 2001; Murray, Maquire, Russell, & Touyz, 2012; Olivardia et al., 2000; H. G. Pope et al., 1997). Muscle dysmorphia causes the individual to want to become more muscular, even though the individual may currently be more muscular than the average person. It is observed as a relentless drive to become more muscular and the symptoms appear to be more common in men than women (H. G. Pope et al., 1997).

Muscle dysmorphia was originally identified in a study of male bodybuilders in 1993, and was termed reverse anorexia as some participants displayed behavioural and cognitive similarities to patients diagnosed with anorexia nervosa (H. G. Pope & Katz, 1994). The bodybuilders in H. G. Pope and Katz’s (1994) study displayed a distorted body image and believed that they were small and thin, although they were in reality quite muscular, which is basically a reversal of the perceptions and beliefs of individuals with anorexia nervosa.

In further research by H. G. Pope et al. (1997), the condition was renamed muscle dysmorphia, diagnostic criteria were constructed, and the suggestion was made that it be located within the body dysmorphia spectrum. Olivardia et al. (2000) proposed that MD may be a form of BDD, where the preoccupation is overall muscularity, as opposed to a perceived physical defect. Various studies had shown that men with BDD also displayed symptoms of
MD. C. G. Pope et al. (2005) found that 14 of the 63 male participants with BDD also had MD, and H. G. Pope et al. (1997) found that 18 of the 193 participants with BDD also had MD. Another study found that 5 of 15 participants with MD also displayed other classic BDD symptoms, in contrast to none of the 13 participants without MD (Hitzeutz et al., 2001). Research has found that males with BDD who also had MD symptoms were similar to those with BDD but without MD symptoms on many variables, such as BDD severity and delusionality, preoccupation with non-muscle-related body parts, and non-MD-related BDD behaviours (C. G. Pope et al., 2005). Researchers found that individuals who had BDD with MD symptoms had clinically significantly higher rates of attempted suicide, and higher prevalence of AAS use compared with individuals with BDD but without MD symptoms (C. G. Pope et al., 2005). Individuals with both BDD and MD symptoms were also more likely to weight train excessively, and have a strict diet, compared to those with BDD but without MD symptoms (C. G. Pope et al., 2005). According to Phillips et al. (2010), these differences are important in the identification and treatment of BDD with MD symptoms. Research had found that BDD symptomatology was positively correlated with obligatory (compulsive) exercise, which reflects the relationship between obligatory exercise and MD (Boroughs et al., 2010), as a type of BDD.

Despite an array of symptomatology, MD was not listed in the DSM-IV-TR (American Psychiatric Association, 2000), and is also not listed in the 10th revision of the International Classification of Diseases (World Health Organization, 2014). In 2010, MD was defined by the American Psychiatric Association as “the belief that one’s body is too small or is insufficiently muscular”, and proposed to be included in the DSM-5 as a form of BDD (2014, “F 01 Body Dysmorphic Disorder”). Indeed, in 2013 an MD specifier was added to BDD in the DSM-5 (American Psychiatric Association, 2013). Notwithstanding that, researchers have been unable to reach agreement as to whether MD is a form of BDD, an obsessive compulsive spectrum disorder, or a type of eating disorder (e.g., Contesini et al., 2013; Grieve, 2007; Maida & Armstrong, 2005; Murray et al., 2010; Parent, 2013; H. G. Pope et al., 1997; H. G. Pope, Gruber, et al., 2000). Researchers also proposed that MD might be a type of behavioural addiction, where the addiction is body image, and activities that maintain body image are physical exercise and specific eating habits (Foster et al., 2014).

Obsessive compulsive disorder is characterised by obsessions or compulsions that are severe enough to be time consuming or cause marked distress or significant impairment in functioning (American Psychiatric Association, 2014). Some researchers argued that MD
should thus be classified as an obsessive compulsive spectrum disorder, as achieving the level of muscularity and body leanness becomes an obsession, and the compulsion is to achieve the desired level of muscularity and leanness (H. G. Pope, Jr., Gruber et al., 2000). The preoccupation with muscularity in individuals with MD causes clinically significant impairment in social, occupational, and other areas of functioning (H. G. Pope et al., 1997), with symptoms of MD related to obsessive compulsive disorder and BDD (Maida & Armstrong, 2005). It has been noted that there is some clinical and pathological overlap between BDD and obsessive compulsive disorder, such as obsessive thoughts and the performance of ritual behaviour (Pavan et al., 2008). While BDD is often comorbid with obsessive compulsive disorder, it is important to distinguish between the two disorders, as there are some differences such as social isolation and insight impairment (Phillips, Gunderson, Mallya, & Carter, 1998).

Eating disorders are characterised by severe disturbances in eating behaviour (American Psychiatric Association, 2013, 2014). The symptoms of MD may closely resemble those exhibited by men with an eating disorder (Olivardia et al., 2000), and MD was originally thought to be a form of eating disorder. Arguments against this have been partly based on the assumption that disordered eating was only a secondary feature of the condition (Olivardia, 2001), despite the repeated reference to disordered eating in the proposed diagnostic criteria (H. G. Pope et al., 1997).

There appear to be similarities between eating disorder symptoms and MD symptoms (Lamanna, Grieve, Derryberry, Hakman, & McClure, 2010; Murray, Rieger, et al., 2012; Murray et al., 2010; Olivardia et al., 2000). Murray et al. (2010) proposed that there were many similarities between MD and anorexia nervosa, such as disordered eating practices, shared etiological factors, diagnostic crossover with time, shared familial transmission, as well as response to similar treatment approaches. Further research provided support for symptomatic similarities between MD and anorexia nervosa (Murray, Rieger, et al., 2012). This is in accordance with earlier research that found participants with MD symptoms displayed behavioural and cognitive similarities to individuals diagnosed with anorexia nervosa (H. G. Pope et al., 1993).

Murray et al. (2010) have suggested that MD should be classified as an eating disorder, based on the similarities in symptomatology between anorexia nervosa and MD, such as the pathological pursuit of weight gain (MD) and weight loss (anorexia nervosa), and disordered eating. As noted earlier, MD was indeed previously named reverse anorexia (H. G. Pope &
It appears as if MD (drive for weight gain) and anorexia nervosa (drive for weight loss) exist on opposing ends of the same continuum of body image psychopathology (Murray et al., 2010).

Behar and Molinari (2010) found that a group of weight lifters with MD scored higher in the 40-item Eating Attitudes Test and Eating Disorders Inventory compared to a group of weight lifters without MD. The weight lifting groups also scored higher in the 40-item Eating Attitudes Test and Eating Disorders Inventory compared to medical students who did not do weight lifting (Behar & Molinari, 2010). Olivardia et al.’s (2000) study found that 29.0% of men with MD had a history of an eating disorder, while none of the participants in Behar and Molinari’s (2010) study had a history of eating disorders. Whether these findings indicate that MD is a type of eating disorder, or that MD is comorbid with eating disorders, is uncertain.

McFarland and Kaminski (2009) found that males with increased symptoms of MD were more likely than other males to use diet pills, to vomit, and to diet to manage their weight. A systematic literature review indicated that the majority of physically active individuals with MD follow specific eating schedules to increase muscle mass and decrease body fat—with diets consisting of high protein and low fat foods, together with nutritional and performance enhancing supplements (Contesini et al., 2013). Research suggests eating habits designed to increase muscularity can exacerbate MD symptoms (Murray et al., 2011).

2.2.2 Risks associated with muscle dysmorphia.

Some individuals spend many hours and much energy on weight training, because it is initially associated with an increase in self-esteem and body satisfaction, due to muscular development (Lantz, Rhea, & Mayhew, 2001). Normal sport participation and dedication to one’s sport is not associated with MD symptoms such as body dissatisfaction, and impaired social and occupational functioning (H. G. Pope et al., 1997). It is widely acknowledged that exercise, including weight training, has a number of psychological and health benefits (Daley, 2008; A. Thomas et al., 2014; W. R. Thompson, Gordon, & Pescatello, 2010), and may help to reduce health concerns associated with overweight and obesity, such as cardiovascular disease, type 2 diabetes mellitus, and cancer (Kujala, 2009). Weight lifting is normally a healthy activity, with MD occurring only when weight lifting becomes an obsession.

It appears as if bodybuilding is a contributing factor in the development of MD (Mosley, 2009), and the Bodybuilding Dependence Scale (Smith & Hale, 2004) and the MASS (Mayville, Williamson, White, Netemeyer, & Drab, 2002) can be used to assess bodybuilding...
dependence. Bodybuilding dependence involves the need to be in the bodybuilding social environment (social dependence), the need to lift weights (training dependence), and the need to be in control of training schedules (mastery dependence; Smith & Hale, 2004). The effects of overtraining and excessive exercise can be harmful, and can lead to various injuries, including broken bones, torn ligaments, hernias, and damaged joints (H. G. Pope et al., 1997). Therefore, even subclinical forms of MD are still of concern. Individuals with MD usually limit their aerobic exercise, because of the fear that too much aerobic exercise can break down muscle tissue and thus decrease muscle size (H. G. Pope et al., 1997).

Self-destructive behaviours include spending excessive time working out and following a strict diet at the expense of social, occupational, or recreational activities (Olivardia, 2001), which might lead to increased feelings of loneliness (Chaney, 2008). A controlled study by Olivardia et al. (2000) found that men with MD are significantly different when compared to weight lifters without MD in areas such as body dissatisfaction, eating attitudes, anxiety and eating disorders, and prevalence of AAS use. Whereas ordinary weight lifters spend approximately 40 minutes per day thinking about not being muscular enough, men with MD spend approximately 325 minutes per day thinking about not being muscular enough, and planning on how to get bigger (Olivardia et al., 2000). Men with MD look at themselves in mirrors an average of 9.2 times per day (Olivardia et al., 2000). It should be noted that weight lifting and building bigger muscles might not always lead to a reduction in MD symptoms, just as cosmetic procedures do not always lead to a reduction in BDD symptoms (Crerand, Menard, & Phillips, 2010).

Olivardia et al. (2000) found that up to 42.0% of the participants in their study had “excellent” insight, while over half of the participants had “fair” insight into their MD symptoms. Muscle dysmorphia can range from a slight annoyance to a destructive psychiatric condition with the individual often unaware of the symptoms (H. G. Pope, Phillips, et al., 2000). Individuals with MD often do not want to talk about their physical appearance (H. G. Pope et al., 1997). Clinically significant distress or impairment can be extremely hard to assess, and can often involve talking with third parties in addition to the individual concerned (American Psychiatric Association, 2000). It is possible that MD symptoms might have state-like properties and may be influenced by situational factors such as intrapersonal, interpersonal and environmental variables (L. S. Thomas, Tod, & Lavallee, 2011). Thus, symptoms of MD may be different depending on whether the individual had a weight lifting session on that day or not.
It has been found that individuals who experience symptoms associated with MD may significantly increase their vulnerability to certain psychological, environmental and biological risks (Cafri et al., 2005; McCreary & Sasse, 2000). Muscle dysmorphia may be associated with lower quality of life (C. G. Pope et al., 2005; Tod & Edwards, 2014) and higher rates of attempted suicide even compared to other forms of BDD (C. G. Pope et al., 2005). It has been suggested that MD may be not only distressing, but ultimately dangerous or even lethal (Kanayama & Pope, 2011). Some risks associated with MD include musculoskeletal injuries from overtraining and excessive exercise (H. G. Pope et al., 1997), anxiety and eating disorders, AAS use (Olivardia et al., 2000), kidney damage (Nissen et al., 1996), substance morbidity (C. G. Pope et al., 2005), infections and diseases from using dirty and/or shared needles, cardiovascular diseases, or even death (Millman & Ross, 2003).

Researchers found that men with increased symptoms of MD are more likely to use AAS (Cole, Smith, Halford, & Wagstaff, 2003; Olivardia et al., 2000), but that AAS use is not associated with bodybuilding per se (Cole et al., 2003). A number of studies have found that the risk factors for AAS use include individual factors such as personality, social factors such as weight training at gyms, and cultural factors such as body image (Nilsson, Spak, Marklund, Biagi, & Allebeck, 2005). Research posited that the regular use of nutritional supplements may act as a gateway substance for AAS use (Hildebrandt, Harty, & Langenbucher, 2012). This might be cause for concern, as nutritional supplements are often consumed by individuals who are engaged in bodybuilding and weight training to enhance the training effects (Parent, 2013).

### 2.2.3 Specific culture, age, and gender features.

Muscle dysmorphia appears to be more prevalent in men compared to women (Phillips et al., 2010; H. G. Pope et al., 1997), although there have been documented cases of women with MD (B. D. Hale, Diehl, Weaver, & Briggs, 2013; Robert, Munroe-Chandler, & Gammage, 2009). At this stage, it appears that MD is a Western culture-bound syndrome, with MD symptoms virtually nonexistent in east Asian countries such as Japan (Kanayama & Pope, 2011). Notwithstanding this finding, MD had already been reported in the year 2000 in a 24-year-old Chinese man from Singapore (Ung, Fones, & Ang, 2000). Studies of MD have been carried out primarily in the USA, though several studies from Australia, Brazil, Chile, Hungary, Italy, Mexico, Spain, South Africa, and the United Kingdom have also been conducted (e.g., Azevedo, Ferreira, Silva, Silva, & Caminha, 2011; Babusa & Tury, 2011; Baghurst & Lirgg, 2009; Behar & Molinari, 2010; Chandler, Grieve, Derryberry, & Pegg,
The average age of MD onset for men is estimated to be approximately 19.4 years of age (Olivardia et al., 2000), although further studies verifying this finding are required. No studies have been found that included children in MD research; however, a case report of adolescent MD has been presented (Murray & Griffiths, 2014).

### 2.2.4 Prevalence.

Well-founded estimates of the prevalence of MD are unknown (Babusa et al., 2015; Parent, 2013). Only a few researchers have published the MD rates found in their studies (Babusa et al., 2015; Chaney, 2008; Hitzeroth et al., 2001; Maida & Armstrong, 2005; H. G. Pope et al., 1997; Sandhu et al., 2013). Such rates ranged from 10.0% to 53.6%. However, comparisons are hampered due to the varying definitions used in these studies, different populations studied (e.g., bodybuilders, university students, weightlifters, and weight lifters), and the use of different assessment instruments. Additionally, these percentages do not take into account the millions of men who do not meet the diagnostic criteria for MD, but who may have subclinical presentations of the disorder (Grieve, Truba, & Bowersox, 2009). There is a possibility that sedentary men may also be susceptible to the development of MD (Baghurst & Kissenger, 2009).

### 2.2.5 Familial pattern.

No research to date has focused on familial tendency toward MD. A Finnish study involving multiple sets of twins found that male muscle dissatisfaction was significantly related to a genetic component (Raevouri, Keski-Rahkonen, Rose, Rissanen, & Kaprio, 2006); however, the assessment of muscle dissatisfaction was based on only one item. It is not known if this finding is relevant to MD. It is believed that psychiatric disorders are related to a genetic component; however, no distinct genetic profile has been uncovered for any disorder (Timimi, 2014).

### 2.2.6 Treatment.

There is currently no formal treatment for MD and no specific treatment studies have yet been conducted. At this stage, treatment for MD can only be extrapolated from knowledge of related disorders (Grieve et al., 2009; Kanayama & Pope, 2011) such as BDD, eating disorders and obsessive compulsive disorder. Muscle dysmorphia appears to be highly
associated with AAS abuse (H. G. Pope, Phillips, et al., 2000), and successful treatment of MD may consequently help to reduce related AAS abuse (Kanayama, Brower, Wood, Hudson, & Pope, 2010).

### 2.3 Characteristics of Body Dysmorphic Disorder

Body dysmorphic disorder is characterised by a preoccupation with a perceived defect in physical appearance causing marked impairment in functioning (American Psychiatric Association, 2013, 2014). If the perceived defect is a small or insufficiently muscular body build, an MD specifier is added to the diagnosis (American Psychiatric Association, 2013). A predominant symptom of BDD is the presence of compulsive behaviours designed to examine, improve, or hide the perceived defect (Cororve & Gleaves, 2001). These behaviours can take the form of excessive mirror checking, excessive grooming or shaving, hair styling or washing, comparing oneself with others, reassurance seeking or trying to convince others of the defect’s ugliness, and skin picking (Cororve & Gleaves, 2001). Behaviours may also include excessive exercise, dieting, using AAS, and measuring, touching or looking at the body part that may be perceived as flawed (Phillips, McElroy, Keck, Hudson, & Pope, 1994). It has been suggested that most people with BDD perform repetitive and time-consuming behaviours (Phillips et al., 1994) which can be described as compulsive (Grant & Phillips, 2005). Although compulsions are not diagnostic for BDD, it is interesting to note that more than 90% of individuals with the disorder engage in compulsive behaviours (Phillips et al., 1997). Comorbidity with obsessive compulsive disorder, substance abuse or dependence, major depression, and social phobia are common (Phillips et al., 1998; Phillips, Menard, Fay, & Weisberg, 2005).

Body dysmorphic disorder is also associated with lower levels of satisfaction with life (Bartsch, 2007), poor quality of life (Bartsch, 2007; Phillips, Menard, Fay, & Pagano, 2005), high levels of suicide ideation, suicide attempts, and completed suicide (Phillips, Coles, et al., 2005; Phillips & Menard, 2006). The level of functioning in people with BDD is widely variable. While most individuals are capable of at least limited social functioning, and utilise ways to avoid full exposure of their appearance in public, other individuals may even become housebound (Phillips, McElroy, Keck, Pope, & Hudson, 1993). Individuals with BDD may experience high levels of perceived stress (Demarco, Li, Phillips, & McElroy, 1998), they can be distraught, might lack close interpersonal relationships, and may become socially isolated (Phillips et al., 1993).
Body dysmorphic disorder is a relatively common disorder which affects 0.7%–2.4% of the general population (Buhlmann et al., 2010; Faravelli et al., 1997; Koran et al., 2008; Rief et al., 2006), and 2.0%–13.0% of student populations (Bartsch, 2007; Bohne, Keuthen, Wilhelm, Deckersbach, & Jenike, 2002; Boroughs et al., 2010; Phillips, 2001). It appears that BDD predominantly affects individuals from Western societies; however, research is lacking and more studies are required to investigate ethnic differences in BDD (Bartsch, 2007).

Body dysmorphic disorder may be equally common in women and men. While some studies have found that the rate of BDD is higher among women than men (e.g., Bartsch, 2007; Phillips, Menard, Fay, & Weisberg, 2005), other studies have found higher rates for men (Hollander, Cohen, & Simeon, 1993; Ishigooka et al., 1998), and Phillips and Diaz (1997) found no gender difference. However, the addition of an MD specifier in the DSM-5 (American Psychiatric Association, 2013) may increase the prevalence rate of BDD, especially in males. Men with BDD are more likely to be single (Phillips & Diaz, 1997; Phillips, Menard, & Fay, 2006). The onset of this disorder is usually in adolescence (Phillips, Menard, Fay, & Weisberg, 2005), but can begin earlier in childhood (American Psychiatric Association, 2000).

The level of insight about the perceived defect can range from good to delusional. One study found that the degree of insight was strongly related with symptom severity (Simeon, Hollander, Stein, Cohen, & Aronowit, 1995). Another study found that 39.0% of individuals with BDD were delusional, and poorer insight was correlated with more severe BDD symptoms (Eisen, Phillips, Coles, & Rasmusson, 2004). Eisen et al. (2004) found congruence between emotional and intellectual insight of people with BDD. Individuals with BDD often believe that other people agree with them that they do have a defect in appearance and that their appearance-related beliefs are true and not caused by a psychiatric disorder (Eisen et al., 2004).

It appears as if the clinical features of BDD are mostly the same in men and women, except for MD which is more prevalent in males (Phillips et al., 2010). Studies on gender in the symptom expression of BDD (Perugi et al., 1997; Phillips & Diaz, 1997; Phillips et al., 2006) have found more gender similarities than differences in terms of body areas of concern, as shown in Table 4. Two studies conducted in the USA (Phillips & Diaz, 1997; Phillips et al., 2006) showed that men were more likely to be worried about thinning hair and small body build, whereas women were more likely to be worried about their weight, hips, and excessive body hair. In contrast, a study conducted in Italy indicated that men were more likely to be
worried about excessive body hair (Perugi et al., 1997). The 2006 American study (Phillips et al., 2006) and the Italian study (Perugi et al., 1997) both showed that women were more likely to be worried about their breasts and legs (see Table 4). Men from the Italian study were more likely to be worried about their height (Perugi et al., 1997), while the 2006 American study (Phillips et al., 2006) illustrated that women were more likely to pick their skin, and be preoccupied with their buttocks, thighs, and toes (see Table 4). All three studies showed that men were more likely to be worried about their genitals. However, no significant gender differences were found on preoccupation with body areas such as teeth, arm/wrist, shoulders, lips, ears, hands, and feet (see Table 4). Gender differences in terms of body areas of concern that were not examined in all three of the studies include skin, acne, hair thinning, teeth, weight, eyes, buttocks, and eyebrows (see Table 4).
Table 4

*Gender Similarities and Differences in Terms of Body Areas of Concern for Individuals With Body Dysmorphic Disorder in Three Previously Published Studies*

<table>
<thead>
<tr>
<th>Body area</th>
<th>Italian study <em>(n = 58)</em> (Perugi et al., 1997)</th>
<th>USA study <em>(n = 188)</em> (Phillips &amp; Diaz, 1997)</th>
<th>USA study <em>(n = 200)</em> (Phillips et al., 2006)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin</td>
<td>–</td>
<td>M = F</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>Acne</td>
<td>M = F</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Hair</td>
<td>M = F</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Excessive body hair</td>
<td>M &gt; F</td>
<td>F &gt; M</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>Hair thinning</td>
<td>–</td>
<td>M &gt; F</td>
<td>M &gt; F</td>
</tr>
<tr>
<td>Nose</td>
<td>M = F</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Stomach/abdomen</td>
<td>M = F</td>
<td>M = F</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>Teeth</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Weight</td>
<td>–</td>
<td>F &gt; M</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>Breasts/chest</td>
<td>F &gt; M</td>
<td>M = F</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>Eyes</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Buttocks</td>
<td>–</td>
<td>M = F</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>Eyebrows</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Face (overall)</td>
<td>M = F</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Legs</td>
<td>F &gt; M</td>
<td>M = F</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>Body build (small)</td>
<td>–</td>
<td>M &gt; F</td>
<td>M &gt; F</td>
</tr>
<tr>
<td>Face size/shape</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Lips</td>
<td>M = F</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Chin</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Arm/wrist</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Body Area</td>
<td>M = F</td>
<td>F &gt; M</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>-----------------</td>
<td>-------</td>
<td>-------</td>
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<tr>
<td>Hips</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Cheeks</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Ears</td>
<td>M = F</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Hands</td>
<td>M = F</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Genitals</td>
<td>M &gt; F</td>
<td>M &gt; F</td>
<td>M &gt; F</td>
</tr>
<tr>
<td>Forehead</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Jaw</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Feet</td>
<td>M = F</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Head size/shape</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Neck</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Height</td>
<td>M &gt; F</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Fingers</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Shoulders</td>
<td>M = F</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Face muscles</td>
<td>–</td>
<td>M = F</td>
<td>M = F</td>
</tr>
<tr>
<td>Thighs</td>
<td>–</td>
<td>–</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>Waist</td>
<td>–</td>
<td>–</td>
<td>M = F</td>
</tr>
<tr>
<td>Calves</td>
<td>–</td>
<td>–</td>
<td>M = F</td>
</tr>
<tr>
<td>Toes</td>
<td>–</td>
<td>–</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>Back</td>
<td>–</td>
<td>–</td>
<td>M = F</td>
</tr>
<tr>
<td>Mouth</td>
<td>–</td>
<td>–</td>
<td>M = F</td>
</tr>
<tr>
<td>Knees</td>
<td>–</td>
<td>–</td>
<td>M = F</td>
</tr>
<tr>
<td>Ankles</td>
<td>–</td>
<td>–</td>
<td>M = F</td>
</tr>
</tbody>
</table>

*Note.* “–” = the study did not report on this body area; USA = United States of America; M = male; F = Female; M = F indicates that a significant gender difference was not found.

Individuals with BDD may experience such high levels of emotional distress that they may take drastic steps to correct their perceived defect (Sarwer & Crerand, 2004). Consequently, they often seek the help of cosmetic surgeons or dermatologists (Sarwer & Crerand, 2004). It seems that the use of cosmetic procedures is positively correlated with body dissatisfaction in Western culture (Sarwer & Crerand, 2004). The prevalence of BDD in plastic surgery and dermatologic settings ranges from 3.2% to 15.0% (Crerand, Franklin, & Sarwer, 2006; Phillips, Dufresne, Wilkel, & Vittorio, 2000; Sarwer & Crerand, 2002; Vulink et al., 2006), and 2.9%–53.6% in cosmetic procedure settings (Conrado et al., 2010; Crerand et al., 2006; Ishigooka et al., 1998), with males and females equally likely to seek and receive cosmetic treatment for their BDD concerns (Phillips et al., 2010). However, cosmetic procedures do not always lead to an improvement in BDD symptoms. One study found that 7.3% of all non-psychiatric treatments resulted in an improvement of BDD symptoms (Phillips, Grant, Siniscalchi, & Albertini, 2001), while another study (Phillips & Diaz, 1997) found that 83.0% of people with BDD had no change or an increase in BDD symptoms after cosmetic procedures.

2.4 Characteristics of Eating Disorders

Eating disorders are characterised by severe disturbances in eating habits and a disturbance in the perception of body weight and shape (American Psychiatric Association, 2000), with eating being the main component (Treasure, Cardi, & Kan, 2012). Under- or over-control of eating, extreme behaviours to attempt to control body weight or shape (Dakanalis, Timko, Clerici, Zanetti, & Riva, 2014; Striegel-Moore & Bulik, 2006), and body image disturbances are central to eating disorders (Striegel-Moore & Bulik, 2006). The emotions of individuals suffering from eating disorders revolve around food, shape, and weight (Treasure, 2012). Eating disorders are serious mental illnesses that cause significant physical impairment, and are associated with increased risk of mortality (National Eating Disorders Collaboration, 2012). It has been estimated that approximately 2 million Australians (8.7%) were experiencing a form of eating disorder at the end of 2012 (National Eating Disorders Collaboration, 2012). The estimated lifetime prevalence of eating disorders is 5.6% (Hudson et al., 2007).

It appears as if women and men are equally dissatisfied with their bodies, and are generally similar with regard to the core experiences of eating disorders and in terms of comorbidity with other disorders (Hudson et al., 2007; Olivardia, Pope, Mangweth, & Hudson, 1995). Eating disorders are often comorbid with obsessive compulsive disorder (Altman &
Shankman, 2009), BDD (Fenwick & Sullivan, 2011), depression, post-traumatic stress disorder (Blinder, Cumella, & Sanathara, 2006), and bipolar disorder (McElroy, Kotwal, & Keck Jr, 2006; Wildes, Marcus, & Fagiolini, 2008). Exercise addiction is also associated with eating disorders (Lichtenstein, Christiansen, Elklit, Bilenberg, & Stoving, 2014).

Eating disorders are more frequent in women compared to men (Boerner, Spillane, Andersen, & Smith, 2004). Eating disorders stereotypically affect middle class Caucasian women and adolescent girls (Freeman, 2005), and gay men (A. E. Anderson, 1999). As a result, heterosexual males suffering from an eating disorder have been stigmatised (Strother, Lemberg, Stanford, & Turberville, 2012). General population surveys from 1998 to 2008 showed that disordered eating in males is increasing (Mitchison, Hay, Slewa-Younan, & Mond, 2014). Research suggests that the rate of males diagnosed with an eating disorder is increasing from 10.0% in previous years to about 25.0% in 2007 (Hudson et al., 2007). Researchers cautioned that this number could be an underestimation, as most eating disorder assessment tools have been developed and validated for females (Stanford & Lemberg, 2012), and the diagnostic criteria of the DSM-IV-TR were inappropriate and non-inclusive (Wonderlich, Gordon, Mitchell, Crosby, & Engel, 2009). Nevertheless, research found that eating disorder assessment tools are valid and adequate for men, although they may yield less reliable scores (Boerner et al., 2004). The increasing rate of males diagnosed might also be because more men are seeking help or because more men are being identified in treatment (Strother et al., 2012). Previously, only 16.0% of males with eating disorders sought treatment (Olivardia et al., 1995).

According to the DSM-IV-TR, eating disorders were diagnosed as either anorexia nervosa or bulimia nervosa (American Psychiatric Association, 2000). An eating disorder not otherwise specified (EDNOS) category was also provided if the criteria for a specific eating disorder was not met (American Psychiatric Association, 2000). Anorexia nervosa is characterised by a refusal to maintain a normal body weight for age and height, and bulimia nervosa is characterised by binge eating episodes followed by compensatory behaviours such as self-induced vomiting, fasting, misuse of laxatives, diuretics, and other medications (American Psychiatric Association, 2000).

The recent publication of the DSM-5 (American Psychiatric Association, 2013) has brought about many changes for eating disorder classifications. One of the most important changes is the introduction of binge eating disorder as a new disorder; it had previously been classified as an EDNOS (Toto-Moriarty & Mastria, 2013). The prevalence rates of binge
eating have been estimated to be approximately 3.5% among females and 2.0% among males (Hudson et al., 2007).

Anorexia nervosa appears to be more prevalent among females than males. Prevalence rates for females are approximately 0.3% (Hoek & van Hoeken, 2003; Strumia, Emilia, Malvina, & Tatiana, 2011) to 0.5% (American Psychiatric Association, 2000). The prevalence among males is approximately 10.0% of female rates (American Psychiatric Association, 2000), with a lifetime prevalence of 0.3% (Hudson et al., 2007). About 5.0%–10.0% of anorexia nervosa clinical cases are male (Boerner et al., 2004). Although the symptoms of eating disorders are similar in females and males, anorexia nervosa was more difficult to diagnose in men when utilising DSM-IV-TR diagnostic criteria, due to the absence of the symptom of amenorrhea (Harvey & Robinson, 2003). The amenorrhea criterion has been removed from the anorexia nervosa diagnostic criteria in the DSM-5 (Brewin, Baggott, Dugard, & Arcelus, 2014).

It has been suggested that the low prevalence rates of anorexia nervosa in males might be accounted for by gender bias in the diagnostic criteria (Freeman, 2005). Another possibility is that the low prevalence rates of anorexia nervosa might be accounted for by the prevalence of MD symptoms, as MD is believed to be a disorder similar to anorexia nervosa in females (H. G. Pope et al., 1993). However, the prevalence rates of anorexia nervosa may be increased when applying the DSM-5 criteria as a result of the change in the diagnostic benchmarks (Ekeroth, Clinton, Norring, & Birgegard, 2013).

The prevalence rates of bulimia nervosa among females are approximately 1.0% (American Psychiatric Association, 2000; Hoek & van Hoeken, 2003) to 3.0%, and an estimated 10.0%–15.0% of all bulimia nervosa cases are male (Boerner et al., 2004). The lifetime prevalence of bulimia nervosa among males is approximately 0.5% (Hudson et al., 2007). The frequency threshold for purging and binge eating has been lowered for the bulimia nervosa diagnostic criteria in the DSM-5 (Brewin et al., 2014). The prevalence rate of bulimia nervosa may be increased when applying the DSM-5 criteria as a result of the lowering of the diagnostic criteria (Ekeroth et al., 2013).

In cases of EDNOS, the presence of an eating disorder of clinical severity must be determined (Fairburn & Bohn, 2005). There are no positive diagnostic criteria for EDNOS, as it is based on diagnosis by exclusion (Fairburn & Bohn, 2005), when the individual does not meet the full diagnostic criteria for anorexia nervosa or bulimia nervosa (Phillips et al., 2010). While EDNOS is the most common category of eating disorder seen in outpatient settings, the
prevalence of this category in the community is not clear (Fairburn & Bohn, 2005). In outpatient settings, EDNOS cases account for an average of 60.0% of all diagnosed eating disorder cases (Fairburn & Bohn, 2005). A community survey in Portugal found that EDNOS accounted for 77.4% of all diagnosed cases of eating disorders (Machado, Machado, Goncalves, & Hoek, 2007). It was found that between 1995 and 2005 there was a two-fold increase in the prevalence of eating disorders in South Australia, with EDNOS being the most common diagnosis in 2005 (Hay, Mond, Buttner, & Darby, 2008). Although EDNOS is the most common type of eating disorder, it has been neglected by researchers (Fairburn & Bohn, 2005). For example, there are no studies on the treatment of EDNOS (Fairburn & Bohn, 2005).

The frequency of EDNOS may be reduced when applying the DSM-5 criteria due to the changes made to the eating disorder classifications (Brewin et al., 2014; Smink, van Hoeken, & Hoek, 2013). Research provided initial evidence for the reduction of the frequency of residual diagnoses (Sysko et al., 2012). The EDNOS category has been renamed as “other specified feeding or eating disorder” in the DSM-5 (Brewin et al., 2014), and now includes sub-categories for night eating syndrome, purging disorder, sub threshold bulimia nervosa, and atypical anorexia nervosa (Ekeroth et al., 2013). A new category named “unspecified feeding or eating disorder” has also been added to the DSM-5 (Ekeroth et al., 2013).

The criteria for diagnosing eating disorders have been criticised for placing too much emphasis on pathoplastic features such as the fear of fat, which are not present in many cases (Collier & Treasure, 2004). The fear of fat was based on societal obsessions with thinness (Collier & Treasure, 2004) as pertaining to the ideal female body. Since the late 1980s, the media have started to promote an idealised lean and muscular body for males (Labre, 2005). It has been proposed that, instead of a drive for thinness, men may exhibit a drive for weight gain (i.e., increase in muscle mass), which exists on opposing ends of the same continuum of body image psychopathology (Murray et al., 2010).

Both genders engage in high levels of compensatory behaviours to prevent weight gain (Striegel-Moore, Rosselli, et al., 2009). Men appear to have lower levels of purging compared to women, while the rate of excessive exercise appears to be similar (Striegel-Moore, Rosselli, et al., 2009). However, men may also use exercise to increase muscle mass (C. B. Anderson & Bulik, 2004). In order to increase muscle mass, individuals may exhibit disordered eating behaviours such as very high levels of protein consumption, severe restriction of non-protein related dietary components (e.g., carbohydrates and fats),
interrupting important activities to accommodate frequent eating (eating every two to three hours), continued food consumption despite feeling full, consuming a large proportion of calories in liquid (blended) form, and the use of nutritional supplements (Mosley, 2009; Murray, Rieger, et al., 2012). The pursuit of this idealised lean and muscular male body may lead to bulimia nervosa, anorexia nervosa, or MD (Freeman, 2005).

Research has suggested that strict dieting and eating-related disturbances are common among male bodybuilders, with those engaged in serious recreational and competitive bodybuilding at increased risk of eating disorders (Goldfield, Harper, & Blouin, 1998). Goldfield, Blouin, and Woodside (2006) ascertained that it is impossible for a bodybuilder to meet criteria for anorexia nervosa, but it is possible to meet criteria for bulimia nervosa. Symptoms of bulimia nervosa are highly prevalent in recreational male bodybuilders, with no differences found between males with bulimia nervosa and male bodybuilders in the lifetime prevalence of using diuretics, vigorous exercise, or strict dieting to lose fat or weight (Goldfield et al., 2006).

2.5 Muscle Dysmorphia: Potential Classification as a New Disorder

As stated previously, researchers are unable to reach agreement about whether MD should be classified as a type of eating disorder, a form of BDD, or an obsessive compulsive spectrum disorder. It is also possible that MD is a disorder that can be differentiated from eating disorders, BDD, and obsessive compulsive disorder.

Blashfield, Sprock, and Fuller (1990) proposed criteria to be used in reviewing the scientific literature for evidence in support of the inclusion of a new disorder into a classification system for mental disorders, and these criteria have subsequently been used by several researchers (e.g., Keel & Striegel-Moore, 2009; Striegel-Moore, Franko, & Garcia, 2009; Striegel-Moore et al., 2006). Blashfield et al.’s (1990) criteria are: (1) there should be at least 50 journal articles in the last 10 years, and at least 25 of them should be empirical; (2) a set of diagnostic criteria should exist and assessment devices should exist for ascertaining whether these criteria are met or not; (3) there should be at least two independent, empirical studies demonstrating high inter-clinician agreement levels ($\kappa \geq .70$); (4) there should be at least two independent, empirical studies that show that the proposed category represents a syndrome of frequently co-occurring symptoms; and (5) there should be at least two independent, empirical studies demonstrating differentiation of the syndrome from other similar categories.
2.5.1 Findings and discussion.

Nieuwoudt et al. (2012) conducted a literature review in 2011 to assess MD against Blashfield et al.’s (1990) criteria for including diagnostic categories in a classification system for mental disorders. The specific findings and observations are reported below.

2.5.1.1 Criterion 1: Ample literature over the past 10 years.

Peer-reviewed journal articles were identified by searching databases (MEDLINE, PsycARTICLES, Psychology & Behavioral Sciences Collection, PsycINFO, SPORTDiscus, ProQuest 5000, PubMed Psychology & Behavioural Sciences Collection, SAGE Premier, Scopus, ScienceDirect, Web of Science) for articles published (in print and electronically) from 2001 to 2011, using the following search terms: “muscle dysmorphia”, “bigorexia”, “vigorexia”, and “reverse anorexia”. The reference lists of various journal articles published on MD were reviewed for any articles the database search might have missed. The search identified 59 journal articles that specifically focused on MD, of which 39 were empirical journal articles, including three case studies. These MD research studies were conducted in various countries including the USA (e.g., Baghurst & Lirgg, 2009; Chandler et al., 2009), United Kingdom (e.g., T. A. Ryan & Morrison, 2010), South Africa (Hitzeroth et al., 2001), Australia (e.g., Murray, Maquire, et al., 2012; Murray et al., 2011), Hungary (e.g., Babusa, Urban, Czeglebi, & Tury, 2012), Italy (e.g., Segura-Garcia et al., 2010), Spain (e.g., Rodriguez Molina & Rabito Alcon, 2011), Chile (e.g., Behar & Molinari, 2010), and Brazil (e.g., Azevedo et al., 2011).

It can thus be concluded that the proposed syndrome has attracted scholarly attention and fulfilled the requirement for 50 journal articles in the last 10 years. The requirement for at least 25 empirical studies has also been met and the existing literature provides a base for evaluating the merit of MD as a diagnostic category.

However, it should be acknowledged that limitations in some studies may reduce the strength of inferences that can be drawn from the data. Comparisons were hampered due to the varying definitions used in these studies, different populations, and the use of different assessment instruments. The majority of the empirical studies (i.e., 24 of 39) were conducted in North America, with eight studies carried out in Europe, four studies in South America, two studies in Australia, and one study in Africa. Muscle dysmorphia research participants typically consisted of male competitive bodybuilders (AAS user and nonuser), non-competitive bodybuilders, power lifters, weight lifters (AAS user and nonuser), college athletes and non-athletes, and university students. Almost half of the studies (approximately
49.0% of the studies) had participants involved in power or strength sports (including weight training), with sample sizes ranging from 28 to 413 ($M = 117$). In 23.0% of the studies the participants were university students, with sample sizes ranging from 78 to 823 ($M = 318$). Tod and Lavallee (2010) stated that in only 15.0% of the studies the researchers examined participants who had been diagnosed with MD, with the mean number of participants diagnosed with MD being 19. Thus, they concluded that much of the research had probably been conducted on participants who did not have MD (Tod & Lavallee, 2010).

2.5.1.2 Criterion 2: Is there a common set of diagnostic criteria for muscle dysmorphia and are there assessment tools available for measuring the syndrome?

Diagnostic criteria for MD (see Appendix A) have been proposed by H. G. Pope et al. (1997) using the same style as the DSM-IV-TR (American Psychiatric Association, 2000). These diagnostic criteria were based on BDD diagnostic criteria, and were presented as specific working criteria for MD (H. G. Pope et al., 1997). The diagnostic criteria have been accepted by researchers as is, although there is a lack of empirical support for the criteria.

In much of the MD research, investigators used self-report questionnaires and interview schedules. In MD questionnaires participants were asked to respond to an item based on a Likert scale rating, or a series of “yes or no” questions. Questionnaires typically consisted of subscales, gathering information on features of MD. Researchers have developed several instruments (see Table 5) to assess MD symptoms, such as the Muscle Dysmorphia Symptom Questionnaire (Olivardia et al., 2000), the MASS (Mayville et al., 2002), three different Muscle Dysmorphia Inventories (Lantz, Rhea, & Cornelius, 2002; Rhea, Lantz, & Cornelius, 2004; Short, 2005), the Muscle Dysmorphic Disorder Inventory (Hildebrandt, Langenbucher, & Schlundt, 2004), Hale’s Scale (W. D. Hale, 2008), and the Muscle Dysmorphia Questionnaire (Cubberley, 2009).

The use of BDD assessment instruments might be reasonable given that MD is proposed to be a subtype of BDD, and instruments such as the Body Dysmorphic Disorder Modification of the Yale-Brown Obsessive Compulsive Scale (Phillips et al., 1997) and the Body Dysmorphic Disorder Examination (Rosen & Reiter, 1996) could be utilised to measure appearance concerns. However, measures of BDD were not designed to detect the presence of MD symptoms, and therefore may not be sufficiently sensitive to identify the presence of MD (Cafri & Thompson, 2007).

While a few instruments measuring MD had demonstrated good internal reliability, test-retest reliability and construct validity, as seen in Table 5, further validation using a clinical
sample was generally lacking. The vagueness associated with MD assessment was a major concern, and had been voiced by researchers such as Kuennen and Waldron (2007). Muscle dysmorphia assessment instruments were typically used by summing the item scores for each subscale, with higher scores translating into higher risk of characteristics associated with MD (Lantz et al., 2002; Rhea et al., 2004; Short, 2005). However, it was uncertain how many specific characteristics an individual must possess to be diagnosed with MD (Lantz et al., 2002).

Lantz et al. (2002) proposed cut-off scores for each of the subscales of the Muscle Dysmorphia Inventory in order to identify individuals who expressed extreme concerns with each of the characteristics of MD as measured by the subscale. These cut-off scores could be used to identify an individual with at-risk levels of MD, but not to diagnose a person with MD. Lantz et al. (2002) also warned against attempting to explain MD based on high scores in only one subscale of the Muscle Dysmorphia Inventory. Lantz et al. (2002) asserted that if an individual scored high in four out of the six subscales of the Muscle Dysmorphia Inventory, then the individual could be identified with strong characteristics associated with MD.

Not all researchers, however, proposed cut-off scores for each of the subscales of the scales measuring MD (e.g., Mayville et al., 2002; Rhea et al., 2004; Short, 2005). While some researchers had warned against summing the entire scale (Lantz et al., 2002; Rhea et al., 2004), because each subscale measured a conceptually independent characteristic of MD, one researcher found that the total score of the scale was closely related to the construct of MD (Mayville et al., 2002), and could thus be used to identify an individual’s at-risk level of MD.

At this stage it can be concluded that the criterion of a common set of diagnostic criteria for MD has been met and that there are assessment tools available for measuring MD. However, further research is needed in support of both the diagnostic criteria and the assessment tools.
Table 5

*Instruments Developed for the Assessment of Muscle Dysmorphia Symptoms*

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Year</th>
<th>Developed by</th>
<th>Participants</th>
<th>Reliability (Cronbach’s alpha)</th>
<th>Validity</th>
<th>Subsequently used by</th>
<th>Participants</th>
<th>Reliability (Cronbach’s alpha)</th>
</tr>
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<tbody>
<tr>
<td>Diagnostic criteria for MD</td>
<td>1997</td>
<td>(H. G. Pope et al., 1997)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>(Hitzeroth et al., 2001)</td>
<td>24 male competitive amateur bodybuilders, 4 female competitive amateur bodybuilders. Aged 17–40 years (South Africa)</td>
<td>–</td>
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<tr>
<td>MDSQ</td>
<td>2000</td>
<td>(Olivardia et al., 2000)</td>
<td>24 male weight lifters with MD symptoms, 30 male weight lifters without MD symptoms. Aged 18–30 years (USA)</td>
<td>–</td>
<td>–</td>
<td>(C. G. Pope et al., 2005)</td>
<td>63 males with BDD (USA)</td>
<td>Inter-rater reliability: kappa = .83</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>(Maida &amp; Armstrong, 2005)</td>
<td>106 male weight lifters. Aged 18–45 years (USA)</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>(Cafri et al., 2008)</td>
<td>51 males. Aged 18–40 years (USA)</td>
<td>–</td>
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<tr>
<td>MDI</td>
<td>2000</td>
<td>(Schlundt, Woodford, &amp; Brownlee, 2000)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>(Wolke &amp; Sapouna, 2008)</td>
<td>100 male bodybuilders. Aged 16–62 years (South England &amp; South Wales)</td>
<td>MDI: .89</td>
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<tr>
<td>MASS</td>
<td>2002</td>
<td>(Mayville et al., 2002)</td>
<td>223 male weight lifters. Aged 18–58 years (USA)</td>
<td>MASS: .82 Factor 1: .80 Factor 2: .79 Factor 3: .75 Factor 4: .76 Factor 5: .73</td>
<td>Test-retest r=.76–.89 Construct &amp; convergent validity</td>
<td>(Chaney, 2008)</td>
<td>304 gay &amp; bisexual males. Aged 18–63 years (USA)</td>
<td>MASS: .88</td>
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<tr>
<td>Sardinha, Oliveira, &amp; Araujo (2008)</td>
<td>100 male bodybuilders, 313 male weight lifters.</td>
<td>Male MASS: .89</td>
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<td></td>
<td>Aged 18–35 years (Brazil)</td>
<td>Female MASS: .82</td>
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<td>Robert et al. (2009)</td>
<td>55 male, 59 female weight trainers.</td>
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<td></td>
<td>Aged 18–64 years (Canada)</td>
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<td></td>
<td>Aged 18–74 years (UK)</td>
<td>resulted in a unidimensional 6-item scale:</td>
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<td>.79 (Irish)</td>
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<td>.80 (British)</td>
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<tr>
<td>Babusa et al. (2012)</td>
<td>289 male weight lifters, 240 male undergraduate</td>
<td>289 Weight lifters:</td>
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<td>university students, 43 male weight lifters.</td>
<td>MASS: .87</td>
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<td>Aged 18–74 years (Hungary)</td>
<td>Factor 1: .75</td>
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<td>Factor 2: .73</td>
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<td>Factor 3: .80</td>
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<td>Factor 4: .83</td>
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<td>Factor 5: .81</td>
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<td>240 students:</td>
<td>Exploratory factor analysis</td>
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<td>resulted in 3 factors</td>
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<td>MASS: .81</td>
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<td>Factor 1: .88</td>
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<td>Factor 2: .76</td>
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<td>Factor 3: .79</td>
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<td>43 male weight lifters:</td>
<td>Test-retest r=0.84–0.91</td>
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<td>Boyda &amp; Shevlin (2011)</td>
<td>51 male bodybuilders (UK)</td>
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<td>MDI</td>
<td>Year</td>
<td>Sample Description</td>
<td>MDI – Factor 1:</td>
<td>MDI – Factor 2:</td>
<td>MDI – Factor 3:</td>
<td>MDI – Factor 4:</td>
<td>MDI – Factor 5:</td>
<td>MDI – Factor 6:</td>
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<td>MDI</td>
<td>2002</td>
<td>68 Elite-level power lifters (63 male, 5 female) (USA)</td>
<td>.73</td>
<td>.84</td>
<td>.51</td>
<td>.55</td>
<td>.91</td>
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<td>MDI</td>
<td>2004</td>
<td>45 male &amp; 13 female bodybuilders aged 21–40 years, 93 male weight lifters aged 20–38 years (USA)</td>
<td>.92</td>
<td>.88</td>
<td>.94</td>
<td>.72</td>
<td>.94</td>
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<td>MDDI</td>
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<td>MDDI (adaptation of MDI 2000)</td>
<td>2004</td>
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<tr>
<td>Measure</td>
<td>Year</td>
<td>Author(s)</td>
<td>Sample Description</td>
<td>MDI</td>
<td>Factor Loadings</td>
<td>Rest Day</td>
<td>Training Day</td>
<td>MDDI</td>
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<tr>
<td>Functional impairment</td>
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<td>(Cafri et al., 2008)</td>
<td>Test-retest: .83</td>
<td>51 males. Aged 18–40 years (USA)</td>
<td>Used only functional impairment subscale: .85</td>
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<td>(L. S. Thomas et al., 2011)</td>
<td>(L. S. Thomas et al., 2011)</td>
<td>30 male weight lifters. Mean age 20.93 years (UK)</td>
<td>Rest day: drive for size .78 appearance intolerance .78 functional impairment .91 Training day: drive for size .81 appearance intolerance .70 functional impairment .88</td>
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<td>Hale’s Scale</td>
<td>2008</td>
<td>(W. D. Hale, 2008)</td>
<td>MDI: .87 Factor 1: .89 Factor 2: .84 Factor 3: .74 Factor 4: .74 Factor 5: .75 Factor 6: .72 Factor 7: .92 Factor 8: .83</td>
<td>304 male college students. Mean age 20.64 years (USA)</td>
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<td>(Grieve &amp; Helmick, 2008)</td>
<td>(Grieve &amp; Helmick, 2008)</td>
<td>23 male athletes, 51 male non-athletes, mean age 27.54 years (USA)</td>
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<td></td>
<td></td>
<td>(Chandler et al., 2009)</td>
<td>(Chandler et al., 2009)</td>
<td>97 male college students. Mean age 21.75 years (USA)</td>
<td>MDDI: .82</td>
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<tr>
<td>Hale’s Scale</td>
<td>2005</td>
<td>(Short, 2005)</td>
<td>MDI: .87 Factor 1: .89 Factor 2: .84 Factor 3: .74 Factor 4: .74 Factor 5: .75 Factor 6: .72 Factor 7: .92 Factor 8: .83</td>
<td>101 male undergraduate students, 247 female undergraduate students. Aged 17–44 years (USA)</td>
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<td></td>
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<td>(Lamanna et al., 2010)</td>
<td>(Lamanna et al., 2010)</td>
<td>101 male undergraduate students, 247 female undergraduate students. Aged 17–44 years (USA)</td>
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<td>(Grieve &amp; Helmick, 2008)</td>
<td>(Grieve &amp; Helmick, 2008)</td>
<td>23 male athletes, 51 male non-athletes, mean age 27.54 years (USA)</td>
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<td>(Chandler et al., 2009)</td>
<td>(Chandler et al., 2009)</td>
<td>97 male college students. Mean age 21.75 years (USA)</td>
<td>MDDI: .82</td>
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<td>Measure</td>
<td>Year</td>
<td>Description</td>
<td>Sample Size</td>
<td>Sample Characteristics</td>
<td>Test Characteristics</td>
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<td>MDS</td>
<td>2008</td>
<td>(Kaminski, McFarland, &amp; Chapman, 2008)</td>
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</table>
| MDQ (adaptation of MDI 2005) | 2009 | (Cubberley, 2009)                                                         | 78 male college students. Mean age 25.16 years (USA) | Time 1: MDQ: .85  
Factor 1–10: .36–.84  
Time 2: MDQ: .90  
Factor 1–10: .36–.91 | Test-retest: .59  
Concurrent validity (Nieuwoudt, 2011) | 116 male weight lifters. Aged 18–66 years (Australia) | MDQ: .85  
Factor 1: .45  
Factor 2: .67  
Factor 3: .60  
Factor 4: .76  
Factor 5: .59  
Factor 6: .83  
Factor 7: .54  
Factor 8: .78  
Factor 9: .75  
Factor 10: .57 |

Note. “−” = data not reported. MD = muscle dysmorphia; BDD = body dysmorphic disorder; USA = United States of America; MDSQ = Muscle Dysmorphia Symptom Questionnaire; MDI = Muscle Dysmorphia Inventory; MASS = Muscle Appearance Satisfaction Scale; UK = United Kingdom; MDDI = Muscle Dysmorphic Disorder Inventory; MDS = Muscle Dysmorphia Scale; MDQ = Muscle Dysmorphia Questionnaire.
2.5.1.3  **Criterion 3: Are there at least two independent, empirical studies demonstrating high inter-clinician agreement levels (κ ≥ .70)?**

The issue for consideration is whether different clinicians would arrive at the same diagnostic judgement when applying the diagnostic criteria. Reliability of assessment instruments and diagnostic criteria is thus important. To answer the question of diagnostic reliability of MD, the literature was searched for inter-clinician/inter-rater reliability of the diagnostic criteria.

Of the 39 studies reviewed, only one study reported on inter-rater reliability (C. G. Pope et al., 2005). Information from a sample of 63 men, all meeting the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.) criteria for lifetime BDD, was presented to one of the investigators (HGP), who was blinded to all other information aside from knowing that the men had some form of BDD. Investigator HGP assigned a diagnosis of MD to the men who appeared to meet the diagnostic criteria as proposed by H. G. Pope et al. (1997). The same information from the sample of 63 men was presented to a second independent and blinded investigator (RO), who assigned a diagnosis of MD by using the same criteria as investigator HGP. The investigators exhibited 93.6% agreement, with κ = .83 (C. G. Pope et al., 2005).

It can be concluded that the criterion for inter-clinician reliability has not been met, with only one study reporting inter-rater reliability (C. G. Pope et al., 2005).

2.5.1.4  **Criterion 4: Are there at least two independent, empirical studies that show that the proposed category represents a syndrome of frequently co-occurring symptoms?**

This criterion is intended to insure that the proposed new category represents a syndrome that consists of symptoms that frequently co-occur (Blashfield et al., 1990). If a patient exhibits one diagnostic symptom, then the same patient will have at least a .50 probability that he/she will exhibit another symptom of the disorder. Criterion 4 has not been met, since no study has addressed this criterion.

However, one study was found to be instructive. Research conducted in South Africa found that 15 of the 28 participants met the proposed diagnostic criteria for MD (as seen in Appendix A). All 15 participants met criteria A and C, 14 of the 15 participants met criterion B1, two of the 15 participants met criterion B2, 13 of the 15 participants met criterion B3, and 11 of the 15 participants met criterion B4 (Hitzeroth et al., 2001). The participants in this...
study were amateur competitive bodybuilders, which might explain why most participants did not meet criterion B2, as competitive bodybuilders compete in competitions showing their muscular physiques.

2.5.1.5 **Criterion 5: Are there at least two independent, empirical studies demonstrating differentiation of the syndrome from other similar categories?**

This criterion is included to make sure that the proposed category represents an independent disorder (Blashfield et al., 1990). If distinctiveness is not demonstrated, then it may be better captured by expanding criteria for existing syndromes.

One study compared characteristics of men with MD who also had BDD, with men who had BDD but not MD (C. G. Pope et al., 2005). Of 14 men with MD, 12 had additional non-muscle-related BDD. Of these 12 men, nine had current MD and current non-muscle-related BDD, two had past MD and current non-muscle BDD, and one had past MD and past non-muscle BDD (C. G. Pope et al., 2005). The researchers found that men with BDD plus MD were similar to those with BDD but not MD on many variables, such as BDD severity and delusionality, preoccupation with non-muscle-related body parts, and non-MD-related BDD behaviours. However, the men with MD were more likely to engage in several compulsive behaviours, and exhibited significantly greater psychopathology in terms of quality of life, suicide attempts, and prevalence of substance use disorders and AAS use (C. G. Pope et al., 2005). The researchers did not compare a group of men with MD but not other forms of BDD, to men with BDD but not MD.

There is insufficient evidence to conclude that the criterion of differentiation of the syndrome from other similar categories has been met.

2.5.2 **Options for the Diagnostic and Statistical Manual of Mental Disorders fifth edition.**

The literature review discussed in section 2.5.1 (Nieuwoudt et al., 2012) was conducted and published prior to the publication of the DSM-5 in 2013. The review offered some options in terms of the status of MD in the DSM-5, despite MD not yet meeting all of the criteria suggested by Blashfield et al. (1990) for inclusion in a classification system for mental disorders. The options that were proposed are outlined below.
2.5.2.1 Option 1: Introduce muscle dysmorphia as an example of an eating disorder not otherwise specified.

The symptoms of MD may closely resemble those exhibited by men with an eating disorder (Olivardia et al., 2000), thus the introduction of MD as an example of an EDNOS may be warranted. However, while MD was originally thought to be a form of eating disorder, arguments against this have been partly based on the assumption that disordered eating was only a secondary feature of the condition (Olivardia, 2001), despite the repeated reference to disordered eating in the proposed diagnostic criteria (H. G. Pope et al., 1997).

The introduction of MD as an EDNOS would acknowledge both disturbances in eating and the way in which changes in body weight and shape are experienced by men (Murray et al., 2010). It would also stimulate further research in this area. However, it may be premature to introduce MD as an example of EDNOS, as disordered eating is likely to be only a secondary characteristic and there is a lack of literature investigating the relationship of MD to eating disorders. Future research should investigate any symptomatic overlap between MD and eating disorders, as well as differences in the profiles of individuals with MD and individuals with eating disorders.

2.5.2.2 Option 2: Retain muscle dysmorphia as a form of body dysmorphic disorder.

It had been suggested that MD may be a form of BDD, where the preoccupation is overall musculature, as opposed to a perceived physical defect (Olivardia et al., 2000). Indeed, it had been proposed to include MD as a form of BDD, and with MD defined as “the belief that one’s body build is too small or is insufficiently muscular” in the DSM-5 (American Psychiatric Association, 2014, “F 01 Body Dysmorphic Disorder”).

The introduction of MD as a BDD might also lead to a greater proportion of individuals meeting the criteria for this diagnosis. However, if MD is not clearly defined, this option may lead to a diverse category conveying insufficient information to be of clinical utility. Also, if MD is not differentiated from BDD, it might lead to incorrect prevention and treatment.

The introduction of MD as a BDD might stimulate research in this area. Future research should investigate symptomatic overlap between MD and BDD, as well as differences in the profiles of individuals with MD and individuals with BDD. Large scale studies assessing MD

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1 In 2013, the American Psychiatric Association indeed added an MD specifier to BDD in the DSM-5; that is, when the perceived defect is a small or insufficiently muscular body build.
and BDD in clearly defined non-clinical populations consisting of different ethnic groups and sexual orientations should also be undertaken.

2.5.2.3 Option 3: Introduce muscle dysmorphia as a new disorder.

The current literature has shown that a set of diagnostic criteria (as seen in Appendix A) and assessment instruments have been developed for MD (as seen in Table 5), and that the disorder can be recognised reliably and is associated with impairment and distress. However, research is lacking on the course, outcome, and treatment of the condition. Large scale epidemiological studies on clearly defined populations are also scarce. As the majority of work on MD has been carried out in North America, future research could include cross-cultural and comparative studies involving participants from other geographic regions.

The introduction of a new disorder into a classification system for mental disorders generally promotes empirical studies that otherwise might not have been conducted (Blashfield et al., 1990). Blashfield et al. (1990), however, warned against the introduction of a new disorder into a classification system for mental disorders without extensive scientific evidence, as disorders are not easily deleted once introduced. The review found that only two of the five criteria suggested by Blashfield et al. (1990) had been met, indicating that there was insufficient scientific evidence to support introduction of MD as a new disorder into the DSM-5.

2.5.2.4 Option 4: Introduce muscle dysmorphia as a provisional diagnosis in need of further study.

Another option would be to introduce MD as a provisional diagnosis in need of further study, as occurred in the DSM-IV-TR for binge eating disorder. The criteria for MD as proposed by H. G. Pope et al. (1997), as shown in Appendix A, and assessment instruments, as shown in Table 5, could be utilised for the assessment of MD symptoms. However, further validation with a clinical sample is needed. The introduction of MD as a provisional diagnosis in need of further study would prompt rigorous research in MD in order to confirm clinical validity and utility, as it also did for binge eating disorder.²

² As noted by Toto-Moriarty and Mastria, 2013, binge eating disorder was indeed introduced as a new eating disorder in the DSM-5.
2.6 Conclusion

Previous research indicates that men who are exposed to media images of the ideal male physique experience greater discrepancy between their ideal body size and their actual body size (Berry & Howe, 2005). This may lead to body dissatisfaction, more specifically dissatisfaction with their current level of muscul arity rather than body fat (Leit et al., 2002), and is related to a desire to increase muscul arity (Lorenzen et al., 2004). During a quest to become more muscular, it is suggested that the perceived disparity between the body ideal and reality might cause some men to become obsessively preoccupied with weight lifting and dieting (Babusa et al., 2015; H. G. Pope et al., 1997), and with associated poorer psychological wellbeing (Mishkind et al., 1986). Researchers agree that men who are exposed to media images of the ideal male muscular physique may be at increased risk of symptoms of BDD (Hobza et al., 2007), disordered eating and symptoms of eating disorders, excessive exercise such as weight lifting (Cafri et al., 2005; Hobza et al., 2007; Myers & Crowther, 2009), and use of performance-enhancing supplements and AAS (Cafri et al., 2005; Myers & Crowther, 2009). It appears as if a drive for muscularity is associated with symptoms of MD (Chittester & Hausenblas, 2009; Olivardia et al., 2000).

Despite researchers not agreeing on whether MD is a type of BDD or eating disorder, an MD specifier has been added to BDD in the DSM-5 (American Psychiatric Association, 2013). It is also possible that MD might be a new disorder that can be differentiated from BDD and eating disorders. A review by Nieuwoudt et al. (2012) utilising Blashfield et al.’s (1990) criteria for the inclusion of MD in a classification system for mental disorders indicated that only two of the five criteria had been met. Blashfield et al.’s (1990) criteria 3, 4, and 5 have not been met. The current research project will provide new evidence by: (a) examining inter-rater reliability of the proposed MD criteria, (b) investigating if MD represents a syndrome consisting of frequently co-occurring symptoms, and (c) investigating whether MD can be sufficiently separated from BDD and eating disorders.

The relationships between MD and BDD, and MD and eating disorders have received limited investigation in previous research. The addition of the MD specifier may increase the prevalence rate of BDD, especially in men. MD was originally thought to be a form of eating disorder, and there appear to be similarities between eating disorder symptoms and MD symptoms. Research has suggested that strict dieting and eating-related disturbances are
common among male bodybuilders. However, the rates of symptoms of BDD, symptoms of eating disorders, and symptoms of MD are largely unknown among male weight lifters. The current research project will investigate the rates of MD, BDD, and eating disorder symptoms among male weight lifters in Australia. The current research project will contribute towards understanding the phenomenon of men who want to be more muscular, and will contribute towards enhancing the understanding of MD, BDD, and eating disorders in adult men. The current research project will advance the understanding of MD symptomatology, by exploring the symptomatic relationships among MD, BDD, and eating disorders.
Chapter 3 – Evaluating the Reliability and Validity of the Proposed Muscle Dysmorphia Criteria in a Non-Clinical Sample of Adult Male Weight Lifters in Australia

3.1 Study Outline

A review of the current research and potential classification of MD as a disorder in a classification system for mental disorders indicated that several significant limitations and gaps exist in the scientific literature on MD (Nieuwoudt et al., 2012). Results of the review showed that Blashfield et al.’s (1990) criteria 3 and 4 addressing whether MD should be introduced as a new disorder into a classification system for mental disorders have not been met. Criterion 3 states there should be at least two independent, empirical studies demonstrating high inter-rater agreement levels (κ ≥ .70); therefore, future research should examine diagnostic reliability and validity, including inter-rater reliability. Blashfield et al.’s (1990) criterion 4 states there should be at least two independent, empirical studies that show that the proposed category represents a syndrome of frequently co-occurring symptoms; thus, future research should address whether MD represents a syndrome that consists of symptoms that frequently co-occur. Although Blashfield et al.’s (1990) criterion 2 has been met—remembering that criterion 2 states that a set of diagnostic criteria and assessment devices should exist—further research is needed in support of both the diagnostic criteria for MD and the assessment tools (e.g., the MASS).

The present study was designed to determine the inter-rater reliability of the proposed MD criteria, to investigate if MD represented a syndrome of frequently co-occurring symptoms, and to assess if there was a high and significant level of correlation between the proposed MD criteria and the MASS. A number of research questions have been proposed to address gaps in the current knowledge, with corresponding null hypotheses. Aims have been developed to test the null hypotheses.

3.1.1 Research questions.

1. Are high inter-rater agreement levels (κ ≥ .70) achieved among investigators utilising the proposed diagnostic criteria for muscle dysmorphia?
2. Does muscle dysmorphia represent a syndrome of frequently co-occurring symptoms?
3. Is there a high and significant correlation between the assessments using the proposed muscle dysmorphia criteria and the Muscle Appearance Satisfaction Scale, as methods of diagnosis for muscle dysmorphia?

3.1.2 Null hypotheses.
1. When the same information is presented to two independent and blinded investigators who assign a diagnosis of muscle dysmorphia by using the proposed criteria for muscle dysmorphia, high inter-rater agreement levels ($\kappa \geq .70$) will not be demonstrated, because the proportion of agreement between the raters will not be beyond chance.
2. A participant with one diagnostic symptom of muscle dysmorphia will not exhibit another symptom of the disorder, because muscle dysmorphia does not represent a syndrome of frequently co-occurring symptoms.
3. When assessing symptoms of muscle dysmorphia, a high and significant level of correlation will not be found between the assessments using the proposed muscle dysmorphia criteria and the Muscle Appearance Satisfaction Scale, as it is not known if the Muscle Appearance Satisfaction Scale and the proposed diagnostic criteria measure the same construct.

3.1.3 Aims.
1. To determine the inter-rater reliability of the proposed muscle dysmorphia criteria.
2. To investigate if muscle dysmorphia represents a syndrome of frequently co-occurring symptoms.
3. To determine the level of correlation between the assessments using the proposed muscle dysmorphia criteria and the Muscle Appearance Satisfaction Scale in a non-clinical population of adult male weight lifters in Australia.

3.1.4 Structure of the chapter.
This chapter consists of six main sections. Section 3.1 presents the outline of the study. Section 3.2 presents the methodology and research design, and includes a description of survey research, the ethics approval, sample size, participants, the procedures, potential problems and methods used to lessen or eliminate them in this project, and a description of the treatment of the data and statistical analysis.
The first aim of the current study was to determine the inter-rater reliability of the proposed MD criteria. The results and discussion of the findings are presented in section 3.3.

The second aim of the current study was to investigate whether MD represented a syndrome of frequently co-occurring symptoms. The results and discussion of the findings are presented in section 3.4.

The third aim of the present study was to determine whether there was a high and significant level of correlation between the proposed MD criteria and the MASS. The results and discussion of the findings are presented in section 3.5. Section 3.6 concludes the chapter.

3.2 Methodology and Research Design

A positivistic paradigm was used in order to examine the objective nature of phenomena, and thus a quantitative approach was followed (Williams, Unrau, Grinnell, & Epstein, 2011). A quantitative approach is most appropriate when the researcher wants to test an objective hypothesis (Newman & Benz, 1998), and seeks to avoid bias that could influence the findings (Bryman, 2012). The research design utilised a cross-sectional survey methodology, as the primary purpose was descriptive. The purpose of the design was to determine inter-rater reliability of the proposed MD criteria, to determine if the symptoms of MD co-occur frequently, as well as to determine the level of correlation between the assessments using the proposed MD criteria and the MASS. Therefore, a survey administered by a one-on-one (face-to-face) interview and a self-completion (paper-and-pencil) questionnaire were deemed most appropriate.

3.2.1 Survey research.

Survey research was used in this project. The term “survey” is used in a number of ways, but generally refers to the selection of a relatively large sample of people from a pre-determined population, followed by the collection of a relatively small amount of data from those individuals (Kelley, Clark, Brown, & Sitzia, 2003). The information gathered from a sample of individuals is then generalised to the wider population (Kelley et al., 2003). A survey can be defined as a broad-based information gathering procedure that is designed to measure variables such as opinions or practices (Berg & Latin, 2004). It is important to recognise that the survey approach is not a research method, but a research strategy (Denscombe, 1998).
Data are usually collected by a questionnaire or interview (Kelley et al., 2003). Surveys can be administered by mail self-completion questionnaires, telephone interviews, one-on-one (face-to-face) interviews (Kelley et al., 2003; Schofield & Forrester-Knauss, 2013), self-completion questionnaire (i.e., paper-and-pencil), group self-completion questionnaire, online (internet-based) self-completion questionnaire, and online (internet) interview (Schofield & Forrester-Knauss, 2013).

Mail self-completion questionnaires involves mailing questionnaires to participants who are asked to complete the questionnaire and mail it back to the researcher (Kelley et al., 2003; Schofield & Forrester-Knauss, 2013). In a telephone interview, the researcher conducts an interview over the telephone using an interview schedule (Kelley et al., 2003; Schofield & Forrester-Knauss, 2013). In a one-on-one (face-to-face) interview, the researcher approaches the participant in person to conduct an interview face-to-face using an interview schedule (Kelley et al., 2003; Schofield & Forrester-Knauss, 2013). A self-completion questionnaire involves the researcher asking a participant to complete the questionnaire, and provide instructions to the participant (Schofield & Forrester-Knauss, 2013). Group self-completion questionnaires involve each participant completing his or her own questionnaire, but in a group situation (Schofield & Forrester-Knauss, 2013), such as a class of undergraduate university students. In online self-completion questionnaires, participants are asked to complete a questionnaire online. Participants are provided with a link to the questionnaire (Schofield & Forrester-Knauss, 2013). An online interview involves the researcher conducting an interview using an internet-based voice communications product (e.g., Skype). An interview schedule is used (Schofield & Forrester-Knauss, 2013).

The advantages and disadvantages of some of the administering methods are listed in Table 6.
### Table 6

**Advantages and Disadvantages of Some of the Survey Administering Methods**

<table>
<thead>
<tr>
<th></th>
<th>One-on-one interview</th>
<th>Telephone interview</th>
<th>Mail self-completion</th>
<th>Online self-completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed of data collection</td>
<td>Moderate</td>
<td>Very fast</td>
<td>Slow</td>
<td>Instantaneous, 24/7</td>
</tr>
<tr>
<td>Geographic flexibility</td>
<td>Limited to moderate</td>
<td>High</td>
<td>High</td>
<td>High, worldwide</td>
</tr>
<tr>
<td>Respondent cooperation</td>
<td>Excellent</td>
<td>Good</td>
<td>Moderate</td>
<td>Varies</td>
</tr>
<tr>
<td>Versatility of questioning</td>
<td>Quite versatile</td>
<td>Moderate</td>
<td>Not</td>
<td>Extremely versatile</td>
</tr>
<tr>
<td>Questionnaire length</td>
<td>Long</td>
<td>Moderate</td>
<td>Varies</td>
<td>Moderate</td>
</tr>
<tr>
<td>Item non-response rate</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>Software can assure none</td>
</tr>
<tr>
<td>Possibility of misunderstanding</td>
<td>Low</td>
<td>Average</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Degree of influence</td>
<td>High</td>
<td>Moderate</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Cost</td>
<td>Highest</td>
<td>Low to moderate</td>
<td>Lowest</td>
<td>Low</td>
</tr>
</tbody>
</table>

*Note. Adapted from “Business research methods” by W. G. Zigmund, p. 208.*

Surveys are cost effective, and are frequently being used in research. Surveys are based on self-report, which may be a limitation, as the participant may not respond truthfully or may not understand the question (Berg & Latin, 2004). Surveys usually include questions that are open-ended and/or closed-ended. Open-ended questions allow the participant an opportunity for free expression and to supply additional information (Berg & Latin, 2004). Open-ended questions can be more difficult to analyse and quantify, as they are highly subjective and open to interpretation (Berg & Latin, 2004). Closed-ended questions take less time for both the interviewer and the participant to complete (Weiten, 2013). These questions are easier to analyse and quantify because they are objective (Berg & Latin, 2004) and thus can be analysed using a standard statistical analysis package, for example, IBM SPSS Statistics.
Furthermore, closed-ended questions are more specific, and as a result, similar meanings can be obtained and compared. However, the data collected can be limited as participants can only answer within a given framework, and the participant can be forced into answering a question that approximates his or her thought or view.

3.2.2 Ethics approval.
Ethics approval was sought and granted by the Southern Cross University Human Research Ethics Committee, with approval number ECN-12-004 (see Appendix B3.1). Participants were provided with an Information Sheet (see Appendix B4) to read prior to signing an Informed Consent statement (see Appendix B5) before commencement of the research.

3.2.3 Sample size.
Sample size calculation for kappa coefficient is multifaceted, as the researcher needs to decide on the number of raters, what kappa coefficient is anticipated, as well as the proportion of positive ratings for the raters (Hadzi-Pavlovic, 2010). A sample size calculation indicated that the total sample size needed in a two-rater study to detect a kappa coefficient of .70 (two-tailed, \( p \leq .05 \)), with statistical power of .70, and proportion of positive ratings of .50, is 17 (Sim & Wright, 2005), while Hadzi-Pavlovic (2010) suggested the minimum sample size needed is approximately 50. Generally speaking, as sample size increases so does the power of the test (Field, 2009). Because the same sample was used not only for the Kappa coefficient, but also for the Binomial test and the Point-biserial correlation coefficient, the sample size of approximately 50 was preferred in order to increase the power of these tests. It was thus concluded that a sample size of approximately 50 participants was to be used in Study 1.

3.2.4 Participants.
Potential participants were recruited from the local university student population and individuals who use the university’s gym. Potential participants were approached by the researcher, and the aim of the research study was explained to them. The inclusion criteria that were used in recruitment of participants were: (a) adult males at least 18 years of age; and (b) individuals who are working out with weights (i.e., free weights or machines) at least once per week.
Potential participants were asked if they would like to participate in a research study about weight lifting, diet and body image. It was explained to them that the study consisted of one questionnaire and a one-on-one interview, which would be audio-recorded with their permission. It was explained to the participants that some of the questions might be personal and confronting, and that they could refuse to answer any more questions at any point during the interview. An appointment, of 15 minutes’ duration was made with potential participants. The research was conducted at the university’s gym in a private room.

3.2.5 Procedures.

This study consisted of administering the self-completion paper-and-pencil questionnaire (MASS) and a one-on-one interview. Participants completed the questionnaire (MASS) before being interviewed. Investigator A assigned a diagnosis of probable MD to those participants who appeared to meet diagnostic criteria as proposed by H. G. Pope et al. (1997). Subsequently, investigator B, who was blinded to the participants, was later provided with the audio-recorded interviews, and separately and independently, assigned a diagnosis of probable MD to those participants who appeared to meet the proposed diagnostic criteria. The investigators assigned a diagnosis of probable MD, but not a clinical diagnosis, as the assessments were based on the proposed diagnostic criteria for MD.

3.2.5.1 Interview.

One-on-one interviews were conducted by investigator A. An interview schedule was designed with 13 key questions (see Appendix B2) addressing the diagnostic criteria for MD that were proposed by H. G. Pope et al. (1997), using the same style as the DSM-IV-TR (American Psychiatric Association, 2000). These diagnostic criteria were based on BDD diagnostic criteria as applied to preoccupations with muscularity (C. G. Pope et al., 2005), and were presented as specific working criteria for MD (H. G. Pope et al., 1997). The 13 questions were formulated by the researcher and approved by an experienced registered psychologist (investigator A).

3.2.5.2 Muscle Appearance Satisfaction Scale.

The MASS (Mayville et al., 2002) is a self-report measure for the assessment of MD symptoms (see Appendix B1). The questionnaire consists of 19 items, and the response to each item is rated on a seven-point Likert-type scale from 1 (strongly disagree) to 7 (strongly
63

agree). Total scores range from 19 to 133. Results from a principal component analysis using data obtained from a sample of weight lifting students in the USA indicated that the MASS consisted of five factors (Mayville et al., 2002). These were: Bodybuilding Dependence, Muscle Checking, Substance Use, Injury Risk, and Muscle Satisfaction.

The first factor, Bodybuilding Dependence, reflects excessive weight lifting activity with some compulsive tendencies towards weight lifting. The second factor, Muscle Checking, entails reassurance seeking and mirror checking behaviour to check the appearance of muscles. The third factor, Substance Use, reflects the willingness to try out AAS and other muscle-enhancing substances. The fourth factor, Injury Risk, assesses the symptoms of overtraining and attitudes towards unsafe weight lifting behaviour. The fifth factor, Muscle Satisfaction, measures the satisfaction with one's own muscle size and definition.

The scores from each question under each factor are summed. According to the author of this instrument, there is no cut-off score with a clinical population (S. B. Mayville, personal communication, November 7, 2011). Although there are not cut-off scores, this instrument provides a dimensional description, with higher scores in the subscales indicating greater risk for MD. Some researchers have suggested that it is not appropriate to use the sum or average of an entire scale or factors of the scale (Ironson, Smith, Brannick, Gibson, & Paul, 1989; Rhea et al., 2004). Based on this, it was decided that a participant must exhibit concerns on three of the five subscales of the MASS to be identified at risk of MD. In the current study, quartiles (25th and 75th percentiles) were identified for each subscale to determine the degree of MD symptoms among the participants. Participants whose score was at and above the 75th percentile on the subscales were considered as reporting high symptoms, and individuals whose score was at and below the 25th percentile were regarded as reporting low symptoms. The participants whose score was between the 25th and 75th percentiles were considered to be moderately symptomatic. Participants who had high scores in three or more subscales of the MASS were considered as being at greater risk of MD in the current study.

The MASS was chosen to identify individuals who are at increased risk of MD in the current research, as the MASS is a psychometrically sound instrument and has been validated across different languages, cultures, and countries. The MASS has been translated into many different languages and used in a number of countries, such as Spain (González-Martí, Bustos, Jordán, & Mayville, 2012), Hungary (Babusa & Tury, 2011), United Kingdom (T. A.
In previous studies with male participants, the MASS showed good internal consistency in the USA, but varied internal consistency in other countries. The MASS had good test-retest reliability ($r$ ranged from .76 to .89) and showed construct validity between the MASS and measures of body image disturbance such as the Body Image Rating Scale, Social Physique Anxiety Scale, and Body Dysmorphic Disorder Examination Self Report (Mayville et al., 2002).

Confirmatory factor analysis (CFA) of the MASS was conducted in the USA using a sample of 223 self-identified weight lifters (Mayville et al., 2002). Goodness-of-fit statistics for a five factor model for the 19-item MASS were: $\chi^2 = 275.47$, $df = 142$, $p = .00$, Root Mean Square Error of Approximation (RMSEA) = .065, Goodness-of-Fit Index = .89, Non-Normed Fit Index = .87, and Comparative Fit Index (CFI) = .89 (Mayville et al., 2002). Exploratory factor analysis and CFA of the MASS has also been conducted on a sample of British and Irish males from the general population (T. A. Ryan & Morrison, 2010). Exploratory factor analysis resulted in a two-factor model with 11 items (T. A. Ryan & Morrison, 2010). A CFA was subsequently conducted, and goodness-of-fit statistics provided poor fit. The model was respecified. A one factor model with 6 items emerged, with excellent fit statistics: $\chi^2 (9) = 5.54$, $p = ns$, $Q = 0.62$, RMSEA = .00 (90% CI: .00–.04), CFI = 1.0, Akaike information criterion = 29.54, and delta Akaike information criterion = 23.74 (T. A. Ryan & Morrison, 2010). The psychometric properties of a Hungarian version of the MASS were also investigated by conducting exploratory factor analyses, using a sample of Hungarian weight lifters and undergraduate students (Babusa et al., 2012). The exploratory factor analysis on the undergraduate sample ($n = 240$) provided support for a three factor model with 19 items, with fit indices: $\chi^2 = 221.0$, $df = 117$, CFI = .965, and Tucker-Lewis Fit Index (TLI) = .949 (Babusa et al., 2012). The exploratory factor analysis on the weight lifter sample ($n = 289$) provided support for a five factor model with 18 items, with fit indices: $\chi^2 = 180.1$, $df = 86$, CFI = .980, and TLI = .960 (Babusa et al., 2012).

Written permission was obtained from the copyright owner S. B. Mayville (personal communication, November 08, 2011) for the use of the MASS in this project. Refer to Appendix D for copyright information.
3.2.6 Potential problems, and methods used to lessen or eliminate them in this project.

3.2.6.1 Different levels of experience of investigators.
It is possible that when undertaking diagnostic assessments, the level of experience of investigators may contribute to variability in results. In an attempt to minimise this risk, the current study utilised two registered psychologists to perform the MD assessments. To be registered as a psychologist, practitioners must have the skills and qualifications to provide psychological services to the community across a number of domains, including training and interpretation of psychological tests and assessments (Mental Health Commission, 2010). Investigators A and B were registered psychologists with specialist training and experience in the use of the *Diagnostic and Statistical Manual of Mental Disorders* in assessment.

3.2.6.2 Sample generation.
Convenience sampling from only one study site can lead to a biased sample. A sample was generated by recruiting potential participants from the local university student population and individuals who used the university’s gym. Initial contact was made at undergraduate classes of Southern Cross University (Sport and Exercise Science programme), and at the university’s gym in the weight lifting section. Potential participants were recruited from undergraduate classes between 9 am and 4 pm. Recruitment at the university’s gym was conducted from 4 pm to 6 pm, to include potential participants who were not university students but adult males in the work force who were going to the gym after normal office hours. This was done in order to reduce convenience sampling of male university students. A total of 48 adult males participated in the survey.

3.2.6.3 Social desirability bias.
Interviews can increase respondent bias due to social desirability, the tendency to agree with others, and other social norms (Dillman et al., 2009). Self-completion questionnaires can have a tendency toward social desirability bias (Dillman et al., 2009), and the bias may have been increased as the questionnaires were completed in the presence of the researcher. Participants might have wanted to create a favourable impression if they were influenced by social desirability bias.
Common techniques to reduce social desirability bias were used, such as avoiding referring explicitly to the subject matter of the research, and reassuring participants that there is no right or wrong answer (Davidson, 2012). Investigator A, who conducted the interviews, was trained and experienced in discussing sensitive topics, which likely reduced the tendency for participants to answer in a socially acceptable manner.

3.2.7 Treatment of the data and statistical analysis.

Data were entered into IBM SPSS Statistics version 20.0, where it was coded and statistically analysed. Cohen’s kappa was calculated to assess the proportion of agreement between the investigators when applying the proposed diagnostic criteria for MD. Inter-rater reliability was calculated for the diagnoses assigned by investigator A (one-on-one interviews) and investigator B (audio records). Cross tabulations were used to examine frequencies of variables to determine if MD represented a syndrome of frequently co-occurring symptoms. Binomial tests were used to determine if the proportion of individuals who exhibited one diagnostic symptom of MD had an equal chance (.50 probability) of exhibiting another symptom of the disorder. Point-biserial correlation coefficient was used to assess the level of correlation between the MASS and the proposed diagnostic criteria for MD. The level of significance was set at $p \leq .05$. Primary analyses were based on diagnoses of probable MD assigned by investigator A; the analyses were subsequently repeated by using the diagnoses of probable MD made by investigator B. Statistical analyses were performed using IBM SPSS Statistics version 20.0.

3.3 Inter-Rater Reliability

3.3.1 Results.

Two investigators assigned diagnoses of probable MD to seven (14.6%) participants ($N = 48$), according to the diagnostic criteria as proposed by H. G. Pope et al. (1997). Diagnoses of probable MD were assigned to six (12.5%) participants by investigator A, and to three (6.3%) participants by investigator B. Only two cases were identified by both investigators A and B. The inter-rater reliability for investigators A and B was found to be $\kappa = .39 (N = 48, p = .038)$.

3.3.2 Discussion.

Cohen’s kappa was calculated and the proportion of agreement between investigators was found to be $\kappa = .39$, suggesting 40.0% agreement, with 60.0% of the dataset representing
faulty data. The low level of agreement between the investigators might be due to a number of reasons. Firstly, it is not easy to accurately define mental/psychiatric disorders (Stein et al., 2010). Diagnostic criteria lacking clear guidelines are an important source of diagnostic unreliability (Ward, Beck, Mendelson, Mock, & Erbaugh, 1962). It has been found that although the diagnostic criteria of mental disorders have become detailed and precise (Aboraya, Rankin, France, El-Missiry, & John, 2006), the reliability of psychiatric diagnoses remains poor (Aboraya et al., 2006; Kitamura, Shima, Sakio, & Kato, 1989). The proposed criteria for MD are somewhat open to personal interpretation; they are subjective and lack clear guidelines (Baghurst, 2012). For instance, the clinician has to define excessive versus not excessive weight lifting behaviour (Murray & Baghurst, 2013). The questions used in the interview were somewhat imprecise and lacking clarity, as they were based on the proposed diagnostic criteria for MD. Muscle dysmorphia as a diagnostic entity is compounded by the large degree of symptomatic overlap between MD, BDD and eating disorders (Murray & Baghurst, 2013).

The reliability of psychiatric diagnoses increases when clinicians have the same level of experience (Sandifer, Pettus, & Quade, 1964). Although both investigators in the current study were experienced in the use of the Diagnostic and Statistical Manual of Mental Disorders in assessments, their levels of experience were different. The reliance on direct observation is a critical component in psychiatric diagnoses (Aboraya et al., 2006). In the current study, only investigator A was able to directly observe the participants. Investigator B was provided with audio-recorded interviews, and was therefore not able to directly observe the participants. These factors might have led to the varied interpretations and subsequent diagnoses made by investigators A and B. Furthermore, Kottner (2009) suggested that low inter-rater reliability could be linked to the instrument’s ability to differentiate between participants. If the variance between the participants is very small, the reliability coefficient would be near zero. Sim and Wright (2005) explained that the prevalence of a disorder may also influence the kappa value, as clinicians could be influenced by the prevalence of a disorder. If the prevalence of a disorder is low, clinicians might be predisposed to not diagnose it (Sim & Wright, 2005).

Only one previous study reported inter-rater reliability for the proposed MD criteria. The study reported 93.6% agreement ($\kappa = .83$) between two investigators when utilising the
proposed diagnostic criteria for MD to assign a diagnosis of probable MD to a sample of 63 male participants (C. G. Pope et al., 2005). All participants in the sample were meeting the Diagnostic and Statistical Manual of Mental Disorders fourth edition criteria for lifetime BDD (C. G. Pope et al., 2005). There is a large amount of symptomatic overlap between MD and BDD (Murray & Baghurst, 2013); in fact, an MD specifier has been added to BDD in the DSM-5 (American Psychiatric Association, 2013). The higher level of agreement between the investigators may thus be due to the higher likelihood of the presentation of MD symptoms in clinical BDD cases compared to nonclinical cases as found in this research project. In fact, the applicability of the proposed diagnostic criteria for MD to nonclinical settings has been questioned by Lantz, Rhea, and Mayhew (2001), as the set of criteria has been based on limited clinical case studies. Murray and Baghurst (2013) also suggested that the proposed diagnostic criteria for MD should be revisited, because of the increasing knowledge concerning MD which has emerged since H.G. Pope et al. (1997) proposed the diagnostic criteria some 16 years ago.

Null hypothesis 1 stated that when the same information is presented to two independent investigators who assign a diagnosis of muscle dysmorphia by using the proposed criteria for muscle dysmorphia, high inter-rater agreement levels (κ ≥ .70) will not be demonstrated, because the proportion of agreement between the raters will not be beyond chance. High inter-rater agreement levels (κ ≥ .70) were not demonstrated, as the inter-rater reliability for investigators A and B was found to be κ = .39 (N = 48, p = .038). Since κ < .70, the researcher failed to reject null hypothesis 1.

3.4 Syndrome of Frequently Co-Occurring Symptoms

3.4.1 Results.

Participants were interviewed by investigator A, and six (12.5%) of the 48 participants were rated as having met the diagnostic criteria for MD. By definition these participants met criteria A and C, as well as two of the four criteria from B. As seen in Table 7, all six participants met criteria A and C. In addition to meeting criteria A and C, four of the six participants met criteria B1 and B4, one of the six participants met criteria B1, B3 and B4, and one of the six participants met criteria B2, B3 and B4.
Table 7

Participants Identified by Investigator A as Having met the Diagnostic Criteria for Muscle Dysmorphia. The Criteria They Have Met Are Indicated by a Tick (✓)

<table>
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<th>B3</th>
<th>B4</th>
<th>C</th>
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<td>✓</td>
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<td>✓</td>
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<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
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</table>

In the present study, 26 of the 48 participants met criterion A, 11 met criterion B1, four met criterion B2, four met criterion B3, 27 met criterion B4, and 23 participants met criterion C. Nine of the 48 participants met one of the six MD criteria, 12 met two criteria, nine met three criteria, 10 met four criteria, three met five criteria, and none of the participants met all six criteria.

Cross tabulations were used to examine frequencies of variables to determine if MD represented a syndrome of frequently co-occurring symptoms, as shown in Table 8 and Table 9.
Table 8

Cross Tabulations Investigating the Probability of Exhibiting Diagnostic Symptoms From Criteria B1–B4 in Addition to Criteria A and C

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<th>Criterion B3</th>
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Table 9

*Cross Tabulations Investigating the Probability of Co-Occurring Diagnostic Symptoms of Muscle Dysmorphia*

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<th>Criterion B3</th>
<th>Criterion B4</th>
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Criterion B1

<p>| | | | | | | |
|                |             |              |              |              |              |             |
| No count       | 21          | 16           | –            | –            | 35           | 2           | 36          | 1           | 18          | 19          | 20          | 16         |
| %              | 56.8        | 43.2         | –            | –            | 94.6         | 5.4         | 97.3        | 2.7         | 48.6        | 51.4        | 55.6        | 44.4       |
| Yes count      | 1           | 10           | –            | –            | 9            | 2           | 8           | 3           | 3           | 8           | 4           | 7          |
| %              | 9.1         | 90.9         | –            | –            | 81.8         | 18.2        | 72.7        | 27.3        | 27.3        | 72.7        | 36.4        | 63.6       |</p>
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<td></td>
</tr>
<tr>
<td>Yes count</td>
<td>6</td>
<td>17</td>
<td>16</td>
<td>7</td>
<td>21</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21</td>
<td>2</td>
<td>21</td>
<td>2</td>
<td>8</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes %</td>
<td>26.1</td>
<td>73.9</td>
<td>69.6</td>
<td>30.4</td>
<td>91.3</td>
<td>8.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>91.3</td>
<td>8.7</td>
<td>34.8</td>
<td>65.2</td>
<td>–</td>
<td>–</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Participants with one diagnostic symptom of MD (criterion C) had a significant probability (.74) to exhibit another symptom (criterion A) of MD ($p = .035$; see Table 10). There was also a significant probability (.91) of a participant with one diagnostic symptom of MD (criterion B1) to exhibit another symptom (criterion A) of the disorder ($p = .012$).

Table 10

<table>
<thead>
<tr>
<th>Group</th>
<th>Category</th>
<th>Number</th>
<th>Observed proportion</th>
<th>Test proportion</th>
<th>Exact Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>If Criterion C = yes</td>
<td>Criterion A 1</td>
<td>No</td>
<td>6</td>
<td>.26</td>
<td>.5</td>
</tr>
<tr>
<td>If Criterion B1 = yes</td>
<td>Criterion A 1</td>
<td>Yes</td>
<td>10</td>
<td>.91</td>
<td>.5</td>
</tr>
</tbody>
</table>

3.4.2 Discussion.

The primary analyses investigating MD as a syndrome of frequently co-occurring symptoms were based on the diagnostic assessments assigned by investigator A. The six participants identified with probable MD met criteria A and C, as well as two of the four criteria of criterion B of the proposed MD criteria. Based on the six participants rated as having met the diagnostic criteria for MD, the frequencies cross tabulated in Table 8 indicated that participants who exhibited diagnostic symptoms A, B2, and C had the highest likelihood of exhibiting another two diagnostic symptoms from criterion B. Participants who exhibited diagnostic symptoms A, B4, and C had the lowest probability of exhibiting other diagnostic symptoms from criterion B. As seen by the frequencies cross tabulated in Table 9, based on the 48 participants, a participant who exhibited diagnostic symptom B3 had the highest likelihood of exhibiting other diagnostic symptoms of MD.

A Binomial test revealed that there was a significant probability (.91) of a participant with one diagnostic symptom of MD (criterion B1) to exhibit another symptom (criterion A) of the
disorder \((p = .012)\). As seen in Table 10, the Binomial test also revealed that there was a significant probability \((.74)\) of a participant with one diagnostic symptom of MD (criterion C) to exhibit another symptom (criterion A) of the disorder \((p = .035)\). Blashfield et al.’s (1990) criterion 4 has been met, as this criterion stated that if an individual exhibited one diagnostic symptom then the same individual would have at least a .50 probability that he/she would exhibit another symptom of the disorder.

With reference to Blashfield et al.’s (1990) criterion 4, no previous study has been found that addressed the co-occurrence of MD symptoms. However, one study was found to be instructive. Research conducted by Hitzeroth et al. (2001) found that 15 of the 28 participants in a South African sample met the proposed diagnostic criteria for MD. All 15 participants met criteria A and C, 14 of the 15 participants met criterion B1, two met criterion B2, 13 met criterion B3, and 11 met criterion B4 (Hitzeroth et al., 2001).

Cross tabulations revealed that participants were least likely to meet criterion B2 in addition to any of the other criteria that they have met. Only one of the four participants identified with probable MD by investigator A met criterion B2. Hitzeroth et al. (2001) found that only two of 15 participants with MD met criterion B2. The participants in Hitzeroth et al.’s (2001) study consisted of amateur competitive bodybuilders, which might explain why most participants did not meet criterion B2, as competitive bodybuilders are required to exhibit their muscular physiques. This was not the case in the current study, as the participants consisted of adult males who were recreational weight lifters.

It appeared that the men in the current study did not avoid situations where their bodies were exposed to others. H. G. Pope et al. (1997) found that 42.0% of their participants with MD had excellent insight in that they recognised that their perception of their body size was inaccurate, while 50.0% had fair insight and 8.0% lacked insight completely. It might thus be that the participants in Hitzeroth et al.’s (2001) investigation, as well as the current study, had good insight into their actual body and muscle size, and therefore did not avoid situations where their bodies were exposed to others.

The proposed MD criteria do not discuss the individual’s current level of muscularity (Murray & Baghurst, 2013). It is thus not known whether the participants were more muscular than the average adult male, as it is often the case with individuals suffering from MD. Baghurst (2012) explained that physique protection, as in criterion B2, might stem from the fear of being evaluated for body fat and not muscularity. The results from the current study provided some evidence for the need for future research to question the inclusion of
criterion B2 as part of the MD criteria—remembering that criterion B2 states “the individual avoids situations where his or her body is exposed to others, or endures such situations only with marked distress or intense anxiety” (H. G. Pope et al., 1997, p. 556).

Null hypothesis 2 stated that a participant with one diagnostic symptom of muscle dysmorphia will not exhibit another symptom of the disorder, because muscle dysmorphia does not represent a syndrome of frequently co-occurring symptoms. It was found that there was a significant probability (.91) of a participant with one diagnostic symptom of MD (criterion B1) to exhibit another symptom (criterion A) of the disorder \( p = .012 \). There was also a significant probability (.74) of a participant with one diagnostic symptom of MD (criterion C) to exhibit another symptom (criterion A) of the disorder \( p = .035 \). Since the results of the Binomial test revealed that a participant with one diagnostic symptom of MD did have the probability of exhibiting another symptom of the disorder, null hypothesis 2 was rejected.

### 3.5 Correlation Between Methods of Assessing Muscle Dysmorphia

#### 3.5.1 Results.

The mean score of the MASS for the total sample was 67.76 \( (SD = 14.88) \). The mean score for the total sample on the subscale of Bodybuilding Dependence was 18.11 \( (SD = 5.47) \), Muscle Checking was 11.23 \( (SD = 5.02) \), Substance Use 11.96 \( (SD = 5.02) \), Injury Risk 10.94 \( (SD = 3.94) \), and Muscle Satisfaction 15.19 \( (SD = 2.24) \). Participants who had high scores in three or more subscales of the MASS were considered as being at greater risk of MD in the current study (see Table 11). Three participants were identified as being at high risk of MD utilising the MASS.
Table 11

Participants Identified as Having met the Diagnostic Criteria for Muscle Dysmorphia by Investigator A, and Being at High Risk for Muscle Dysmorphia as Identified by the Muscle Appearance Satisfaction Scale. Also Shown is the Level of Muscle Dysmorphia Symptoms of These Participants as Indicated by the Subscales of the Muscle Appearance Satisfaction Scale

<table>
<thead>
<tr>
<th>Participant</th>
<th>Investigator A</th>
<th>MASS</th>
<th>BD</th>
<th>MC</th>
<th>SU</th>
<th>IR</th>
<th>MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>✓</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>2</td>
<td>✓</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>✓</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>✓</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>✓</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>✓</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>7</td>
<td>✓</td>
<td>High</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>

Note. MASS = Muscle Appearance Satisfaction Scale; BD = Bodybuilding Dependence subscale; MC = Muscle Checking subscale; SU = Substance Use subscale; IR = Injury Risk subscale; MS = Muscle Satisfaction subscale.

The Cronbach alpha coefficient for the MASS was .82, indicating a high level of internal consistency. However, the Cronbach alpha coefficient for two of the five were acceptable (.70 – .79), and poor (< .70) for three of the five subscales of the MASS (see Table 12).
Table 12

*Internal Consistency for the Muscle Appearance Satisfaction Scale as well as the Subscales of the Muscle Appearance Satisfaction Scale as Indicated by Cronbach Alpha (α)*

<table>
<thead>
<tr>
<th>Scale</th>
<th>α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle Appearance Satisfaction Scale</td>
<td>.82</td>
</tr>
<tr>
<td>Bodybuilding Dependence</td>
<td>.68</td>
</tr>
<tr>
<td>Muscle Checking</td>
<td>.82</td>
</tr>
<tr>
<td>Substance Use</td>
<td>.63</td>
</tr>
<tr>
<td>Injury Risk</td>
<td>.70</td>
</tr>
<tr>
<td>Muscle Satisfaction</td>
<td>.37</td>
</tr>
</tbody>
</table>

Point-biserial correlation coefficient ($r_{pb}$) was used to investigate the relationship between MD as identified by investigator A and the subscales of the MASS, as well as the total score of the MASS. It was also used to assess the relationships between the criteria of the proposed MD criteria, the subscales of the MASS and the total score of the MASS (see Table 13).
Table 13

Point-Biserial Correlation Between Muscle Dysmorphia as Assessed by Investigator A, and the Subscales of the Muscle Appearance Satisfaction Scale and its Total Score, as well as Relationships Between the Criteria of the Proposed Muscle Dysmorphia Criteria and the Subscales of the Muscle Appearance Satisfaction Scale and its Total Score

<table>
<thead>
<tr>
<th></th>
<th>Bodybuilding Dependence</th>
<th>Muscle Checking</th>
<th>Substance Use</th>
<th>Injury Risk</th>
<th>Muscle Satisfaction</th>
<th>MASS Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle Dysmorphia</td>
<td>.33*</td>
<td>.05</td>
<td>.24</td>
<td>.27</td>
<td>.02</td>
<td>.29</td>
</tr>
<tr>
<td>Criterion A</td>
<td>.50**</td>
<td>.40**</td>
<td>.56**</td>
<td>.23</td>
<td>-.27</td>
<td>.51**</td>
</tr>
<tr>
<td>Criterion B1</td>
<td>.36*</td>
<td>.28</td>
<td>.32*</td>
<td>.35*</td>
<td>-.00</td>
<td>.42**</td>
</tr>
<tr>
<td>Criterion B2</td>
<td>.14</td>
<td>.15</td>
<td>.03</td>
<td>.18</td>
<td>-.10</td>
<td>.14</td>
</tr>
<tr>
<td>Criterion B3</td>
<td>.42**</td>
<td>.37*</td>
<td>.24</td>
<td>.34*</td>
<td>.01</td>
<td>.45**</td>
</tr>
<tr>
<td>Criterion B4</td>
<td>.27</td>
<td>.13</td>
<td>.29*</td>
<td>.09</td>
<td>-.06</td>
<td>.28</td>
</tr>
<tr>
<td>Criterion C</td>
<td>.32*</td>
<td>.10</td>
<td>.28</td>
<td>.03</td>
<td>-.06</td>
<td>.27</td>
</tr>
</tbody>
</table>

Note. Muscle Dysmorphia = as identified by investigator A; MASS Total = total score on the Muscle Appearance Satisfaction Scale.

* p < .05. ** p < .01.

3.5.2 Discussion.

In the current study, the Cronbach alpha coefficient for the MASS was .82, indicating a high level of internal consistency. However, the MASS consists of five subscales or constructs; therefore, it does not make sense to report only the alpha value for the whole scale. The Cronbach alpha coefficients for the Bodybuilding Dependence (α = .68), Substance Use (α = .63), and the Muscle Satisfaction (α = .37) subscales were poor. The Cronbach alpha coefficients for the Muscle Checking subscale (α = .82) and the Injury Risk subscale (α = .70) were acceptable, as shown in Table 12. Due to the relatively small number of participants, a factor analysis was not conducted to investigate the reasons for a low value of alpha. However, a low number of questions per subscale could be contributing to a low alpha value.

The proposed MD diagnostic criteria were based on BDD diagnostic criteria as applied to preoccupations with muscularity (C. G. Pope et al., 2005). The MASS was developed based on the cognitive, behavioural, and affective features of BDD that are specific to MD (Mayville et al., 2002). It could thus be assumed that there would be relationships between the measures; that is, the proposed MD criteria and the MASS. No previous studies were
found that assessed the level of correlation between the subscales of the MASS and the proposed criteria for MD.

Point-biserial correlation coefficient was used to investigate the relationship between MD as identified by investigator A and the subscales of the MASS, as well as the total score of the MASS. It was also used to assess the relationships between the proposed MD criteria, and the subscales of the MASS and the total score of the MASS. Significant correlations were found between criteria A, B1, B3, B4, and C, and the Bodybuilding Dependence, Muscle Checking, Substance Use, and Injury Risk subscales of the MASS, as well as the total score of the MASS in a non-clinical population of adult male weight lifters in Australia.

Although significant correlations were found, these correlations ranged from small to high, with only criterion A being highly correlated to the Bodybuilding Dependence and Substance Use subscales as well as with the total score of the MASS. Nevertheless, this provides evidence that the MASS and the proposed criteria for MD both assessed constructs of MD. Muscle dysmorphia, as identified by investigator A, was found to be significantly correlated to the Bodybuilding Dependence subscale of the MASS, but not to any of the other subscales of the MASS or the total score of the MASS, as seen in Table 13. This indicated that the construct bodybuilding dependence was most closely related to MD as identified by the proposed MD criteria, compared to the other constructs of MD as measured by the MASS. The Bodybuilding Dependence subscale describes an extreme self-investment in the activity of weight lifting in addition to compulsive weight training habits (Mayville et al., 2002).

Criterion B2 was not significantly correlated with any of the subscales of the MASS or the total score of the MASS in a non-clinical population of adult male weight lifters in Australia. None of the items of the MASS asks if the individual avoids situations where his or her body is exposed to others, or if it causes the individual distress or intense anxiety, as stated in criterion B2. The Muscle Satisfaction subscale of the MASS was not significantly correlated to any of the proposed MD criteria (see Table 13), indicating that the extent to which one found satisfaction with one's own muscle size and definition was not integrally related to the proposed MD criteria. This may be because these criteria do not discuss the individual’s current level of muscularity (Murray & Baghurst, 2013), or the extent to which the individual is satisfied with his/her own muscle size and definition. Murray and Baghurst (2013) proposed that a muscularity-based criterion should be included in the diagnostic criteria for MD. Future research should investigate whether physique protection is an indication of MD,
and if the individual’s current level of muscularity and his or her satisfaction with their muscle size is an important factor in the diagnosis of MD.

Null hypothesis 3 specified that when assessing symptoms of muscle dysmorphia, a high and significant level of correlation will not be found between the assessments using the proposed MD criteria and the MASS, as it is not known if the MASS and the proposed diagnostic criteria measure the same construct. As shown in Table 13, high and significant correlations were found between criterion A of the proposed MD criteria and the Bodybuilding Dependence subscale ($r_{pb} (47) = .50, p < .001$), the Substance Use subscale ($r_{pb} (47) = .56, p < .001$), and the total score of the MASS ($r_{pb} (46) = .51, p < .001$).

Small and medium significant correlations were found between the proposed MD Criteria B1, B3, B4, and C, and the subscales of the MASS and the total score of the MASS. Criterion B2 was not significantly correlated with the subscales of the MASS or the total score of the MASS, and the Muscle Satisfaction subscale of the MASS was not significantly correlated to any of the proposed MD criteria. Since only criterion A was found to be highly correlated ($p < .001$) with the total score of the MASS and with only two of the five subscales of the MASS, the researcher failed to reject null hypothesis 3.

### 3.6 Conclusions

To the researcher’s knowledge, the current research project was the first study to investigate whether MD represented a syndrome of frequently co-occurring symptoms. It was also the first study to assess the correlations between the proposed MD criteria and the MASS, and only the second study to investigate inter-rater agreement levels for the proposed diagnostic criteria for MD.

The findings indicated that: (a) high inter-rater agreement levels for the proposed diagnostic criteria for MD were not met; (b) MD did represent a syndrome of frequently co-occurring symptoms; and (c) the proposed MD criteria A, B1, B3, B4, and C were significantly correlated with the subscales of the MASS and the total score of the MASS, but criterion B2 was not significantly correlated with the subscales of the MASS or the total score of the MASS. The Muscle Satisfaction subscale of the MASS was not significantly correlated with any of the proposed MD criteria.

The results from the present study did not provide support for Blashfield et al.’s (1990) criterion 3; however, it did provide support for criterion 4—remembering that criterion 3 states there should be at least two independent, empirical studies demonstrating high inter-
clinician agreement levels (κ ≥ .70), and criterion 4 states there should be at least two
independent, empirical studies that show that the proposed category represents a syndrome of
frequently co-occurring symptoms. Support was not provided for both the diagnostic criteria
for MD and the MASS, as a high and significant level of correlation was not found between
the assessments using the proposed MD criteria and the MASS.

The study failed to reject null hypothesis 1, as high inter-rater agreement levels (κ ≥ .70)
were not demonstrated. The inter-rater reliability for investigators A and B was found to be
κ = .39 (N = 48, p = .038). Null hypothesis 2 was rejected, since the results of the Binomial
test revealed that there was a significant probability of at least .50 for a participant with one
diagnostic symptom of MD (criteria B1 or C) to exhibit another symptom (criterion A) of the
disorder. The study also failed to reject null hypothesis 3, as only criterion A was found to be
highly correlated with the total score of the MASS (r.pb (46) = .51, p < .001), the Bodybuilding
Dependence subscale (r.pb (47) = .50, p < .001), and the Substance Use subscale
(r.pb (47) = .56, p < .001).

The diagnostic criteria for MD were presented as specific working criteria for MD (H. G.
Pope et al., 1997). The criteria have been accepted by researchers as is, although there has
been a lack of empirical support for these criteria. The results of the current study lend
support to the suggestion made recently by Murray and Baghurst (2013) that the proposed
diagnostic criteria for MD should be revisited. More specifically, future research should
question the inclusion of criterion B2 as part of the MD criteria, as no significant correlation
was found between criterion B2 of the proposed criteria for MD and subscales of the MASS
or the total score of the MASS. Furthermore, the internal consistency of the Bodybuilding
Dependence (α = .68), Substance Use (α = .63), and the Muscle Satisfaction (α = .37)
subscales of the MASS were low. Future research needs to address the psychometric
properties of the MASS and its subscales in Australia.
Chapter 4 – Investigating the Symptoms of Muscle Dysmorphia, Body Dysmorphic Disorder, and Eating Disorders in a Non-Clinical Sample of Adult Male Weight Lifters in Australia

4.1 Study Outline

A review of the literature indicated that few studies have explored the relationships between MD, BDD, and eating disorder symptomatology. In addition, prevalence rates of symptoms of MD, BDD, and eating disorders in non-clinical populations of adult male weight lifters are not known. The current study was designed to determine if MD can be differentiated from BDD and eating disorders; and to investigate the prevalence rates of MD symptoms, BDD symptoms, and eating disorder symptoms in a non-clinical population of adult male weight lifters in Australia. Research questions have been proposed to address the gaps in the current knowledge, with corresponding null hypotheses, and aims to test the null hypotheses.

4.1.1 Research questions.

4. Are symptoms of muscle dysmorphia more prevalent than symptoms of body dysmorphic disorder and eating disorders in a non-clinical population of adult male weight lifters in Australia?
5. Can muscle dysmorphia be differentiated from body dysmorphic disorder and eating disorders?

4.1.2 Null hypotheses.

4. Symptoms of muscle dysmorphia will not be more prevalent than symptoms of body dysmorphic disorder and symptoms of eating disorders in a non-clinical population of adult male weight lifters in Australia.
5. Muscle dysmorphia symptoms cannot be differentiated from symptoms of body dysmorphic disorder and symptoms of eating disorders, because muscle dysmorphia does not represent a set of symptoms characteristic of a unique mental disorder.

4.1.3 Aims.

4. To determine the prevalence of, and factors contributing to, muscle dysmorphia symptoms, body dysmorphic disorder symptoms, and eating disorders symptoms in a non-clinical population of adult male weight lifters in Australia.
5. To provide a comprehensive comparison of symptoms of muscle dysmorphia, body dysmorphic disorder, and eating disorders in a non-clinical population of adult male weight lifters.

4.1.4 Structure of the chapter.

This chapter consists of five main sections. Section 4.1 presents the outline of the study. Section 4.2 presents the methodology and research design, and includes a description of online survey research, the ethics approval, sample size, participants, the procedures, the measures in the online survey, potential problems and methods used to lessen or eliminate such issues in this project, and a description of the treatment of the data and statistical analysis.

The first aim of the current study was to investigate the prevalence rates of MD symptoms, BDD symptoms, and eating disorder symptoms among adult male weight lifters in Australia. The results and discussion of the findings are presented in section 4.3.

The second aim of the current study was to determine if MD can be differentiated from BDD and eating disorders. The results and discussion of the findings are presented in section 4.4. Section 4.5 concludes the chapter.

4.2 Methodology and Research Design

A positivistic paradigm was used in order to examine the objective nature of phenomena, and thus a quantitative approach was followed (Williams et al., 2011). A quantitative approach is most appropriate when the researcher wants to avoid bias that could influence the findings (Bryman, 2012), and wants to test an objective hypothesis (Newman & Benz, 1998). The purpose of the design was to assess the symptoms of MD, BDD, and eating disorders in adult male weight lifters in Australia. As the primary purpose was descriptive, the research design was correlational, utilising a cross-sectional survey methodology. The survey was administered online and included a number of self-completion questionnaires. The advantages of an online survey include geographic flexibility, quick delivery and low cost (see Table 6); thus, a survey administered by online self-completion was the most appropriate choice for collecting large amounts of data.

Limitations of sample populations of previous studies on MD include being locally based, involving limited sample size, and comprising participants without MD symptoms. In order to maximise the sample size and capture a diverse range of participants from numerous locations in Australia in a relatively short period of time and with limited financial resources,
an online survey was chosen as a research strategy. To ensure valid responses to the quantitative form of data gathering, access to a wide range of participants would be necessary. Facebook and bodybuilding forums were chosen for locating and communicating with research participants, as social networking sites are valuable in identifying hard to reach populations and increasing sample size (Baltar & Brunet, 2012). Invitations to participate were also sent via the Southern Cross University bulk email system to all staff and students.

4.2.1 Online survey.

In the past, the paper-and-pencil questionnaire has been used as the primary means for collecting large amounts of data relative to other available data collection techniques, due to it being more efficient and economical (E. Wood, Nosko, Desmarais, Ross, & Irvine, 2006). Details about survey research were provided in an earlier section (see section 3.2.1). The prevalence and accessibility of computer technology, especially the internet, has made it possible to reach huge numbers of participants even more economically and efficiently than through paper-and-pencil questionnaires (Pasveer & Ellard, 1998). Internet research protocols involving online or web survey questionnaires are becoming more prevalent. A survey of 750 University Human Research Ethics Committees (HRECs) in the USA found that 94.0% of the HRECs indicated that online survey research was the type of internet research reviewed most often (Buchanan & Hvizdak, 2009).

Creating and conducting a questionnaire to be utilised in an online survey used to be a time-consuming task, requiring familiarity with web authoring programs, HTML code, and scripting programs (Wright, 2005). Today, online survey research is much easier and faster because of the availability of survey authoring software packages and online survey services (Wright, 2005).

There are two main types of online survey questionnaires: (a) e-mail survey questionnaires, and (b) survey questionnaires created using a programming language such as HTML or FrontPage in packaged survey software (Payne, 2010). E-mail survey questionnaires incorporate the questions within the body of the e-mail or via an attachment (Payne, 2010). E-mail survey questionnaires are quick and easy to create, as the researcher does not need to learn a new program. However, it may be difficult for the participants to remain anonymous, and data entry and coding errors can occur. Survey questionnaires created using survey software (herewith referred to as online surveys) can be more difficult and time consuming to set up compared to e-mail survey questionnaires, as the researcher
often needs to learn a new program if it is her/his first time using the program. However, software packages, such as SurveyMonkey and Qualtrics Research Suite, include simple instructions on how to create a questionnaire, with full technical support and questionnaire design templates. Participants can remain anonymous, and data entry and coding errors are limited. When using an online survey, a link to the questionnaire can be e-mailed, posted on social media, or a “pop-up” can be embedded on a website that links to the questionnaire. Mailed invitations can also be used, in which a URL is included in a letter or postcard that participants have to type into a browser (Dykema, Stevenson, Klein, Kim, & Day, 2013). This method is less common because it requires more effort from the participant, requires mailing addresses, and is potentially more expensive (Dykema et al., 2013).

4.2.1.1 Online recruitment.

Social interaction between people commonly occurs via the internet. Social networking sites therefore offer a promising way to recruit participants into research (Fenner et al., 2012). Social network sites such as Facebook, Twitter, MySpace, Google+, and LinkedIn have attracted millions of users since their introduction (Boyd & Ellison, 2008). Social network sites are “web-based services that allow individuals to construct a public or semi-public profile within a bounded system, articulate a list of other users with whom they share a connection, and view and traverse their list of connections and those made by others within the system” (Boyd & Ellison, 2008, p. 1). These characteristics of social networking sites make it ideal for internet based snowball sampling (Baltar & Brunet, 2012). Social network sites are useful in identifying hard to reach populations and increasing sample size, and can minimise some barriers associated with online techniques in collecting data (Baltar & Brunet, 2012).

Facebook was one of the social network sites chosen for locating and communicating with research participants. Facebook is used by people to stay connected with their family and friends, to share and express what is important to them, and to discover what is going on in the world (Facebook, 2013c). Facebook was founded in 2004 and has rapidly grown to include 1.19 billion monthly active users, and 728 million daily active users (Facebook, 2013b). Registration for Facebook profiles is free, and accounts can be accessed from any location and any device with an internet connection. Facebook is currently the second most frequently visited website on the internet (Alexa Internet Inc., 2014). Facebook has the potential to be a valuable tool for locating and communicating with research participants.
Registered users of Facebook can create profiles, which are quick summaries of who they are, and Facebook is an online facility through which users can upload and share photos, videos, and other information (e.g., links to web pages), send messages and keep in touch with “friends”. Each Facebook profile has a “wall” where friends can post comments, and these comments can be seen and commented on by other friends. Facebook users can send another user a private message, similar to an email message, which will show up in the recipient’s private inbox. Individual profiles can link to others to create online communities of friends who show public information or send private messages. Furthermore users can also create new groups or join existing groups based on shared experiences and interests (e.g., a certain sport, hobby, students from a particular university, and fans of a particular celebrity). Pages can be created for a business, company, brand, product, or public figure or celebrity, to connect with customers or fans.

Research that examined 721 million Facebook users with a combined 69 billion friendships indicated that 50.0% of users had over 100 friends, 20.0% of users had less than 25 friends, and a small percentage of users had close to 5 000 friends, which is the maximum number of friends allowed by Facebook (Backstrom, Boldi, Rosa, Ugander, & Vigna, 2012). Users’ friends were most likely from the same country and of similar age (Ugander, Karrer, Backstrom, & Marlow, 2011).

Recruitment on Facebook can occur by posting invitations to participate on Facebook profile walls and, because it is free, this is a cost effective strategy for researchers. Baltar and Brunet (2012) found that Facebook was more effective in increasing sample size than traditional snowball sampling. Using Facebook as a recruitment strategy increases the participants’ level of confidence about the purpose of the research in which they are going to participate, as the participants have access to the researcher’s profile information (Baltar & Brunet, 2012). They are also able to see the researcher’s Facebook friends and activities. Another alternative for participant recruitment utilising Facebook is by placing advertisements on Facebook. This is not a free service. An Australian study indicated that recruitment through Facebook advertisements in 2010 cost an average of US $20.00 in advertising fees per participant (Fenner et al., 2012). Due to funding constraints, only free-of-charge methods were used to distribute the invitations to participate in the online survey; thus, advertisements were not placed on Facebook.
4.2.1.3 Main benefits of using an online survey.

4.2.1.3.1 Distribution.

An advantage of online survey research is that it takes advantage of the ability of the internet to provide access to groups and individuals who share specific interests, attitudes, beliefs, and values regarding an issue, problem, or activity (Wright, 2005). These individuals can often be reached on the internet in larger numbers than would be possible using one-on-one (face-to-face) research methods (Wright, 2005). For example, individuals who are interested in working out in the gym can be found on the internet-based community Aussie Gym Junkies, which had 6992 members in November 2014 (Aussie Gym Junkies, n.d.). The internet allows the researcher to reach a large number of individuals in a short period of time, despite possibly being separated by vast geographical distances (Bachmann, Elfrink, & Vazzana, 1996; Garton, Haythornthwaite, & Wellman, 1999; Taylor, 2000; Yun & Trumbo, 2000). Quick access can be gained to sizable numbers of individuals by posting invitations to participate to forums, chat rooms, and newsgroups (Wright, 2005). It would take much longer in the one-on-one (face-to-face) research environment to find an equivalent number of people who share specific interests, attitudes, beliefs and values in one location (Wright, 2005).

4.2.1.3.2 Time efficient.

Administration and distribution tasks are decreased for online surveys, and consequently the survey can be placed in the field much more quickly than traditional surveys (Evans & Mathur, 2005). Online surveys are also time efficient, as researchers can work on other tasks while collecting data (Llieva, Baron, & Healey, 2002). Once an invitation to participate in an online survey is posted online or emailed, researchers may collect data while working on other tasks (Andrews, Nonnecke, & Preece, 2003). The survey can be completed at a time and place convenient for the participant, thus data can be collected continuously regardless of the time, day or geographic location. Responses to online surveys can be transferred to the researcher immediately via email, or posted to an HTML document or database file (Wright, 2005). Preliminary analyses can be conducted while waiting for the desired number of responses to accumulate (Llieva et al., 2002).

4.2.1.3.3 Accuracy of data entry, coding, and analysis.

Traditional surveys require that data be entered manually with the possibility of data entry and coding errors (Payne, 2010). Online survey creation software packages, such as Qualtrics Research Suite (Qualtrics Inc, 2009), provide a platform for building, distributing, analysing,
and reporting online surveys. Raw data can be downloaded into Microsoft Excel or IBM SPSS Statistics, or exported in XML or HTML formats (Qualtrics Inc, 2009), thereby decreasing data entry and coding errors. Data can be scored, graded, and analysed in Qualtrics Research Suite, or downloaded into statistical software, such as IBM SPSS Statistics for more advanced statistical analyses.

4.2.1.3.4 Cost efficient.

Paper-and-pencil surveys have been used in the past as the primary means for collecting survey data, as it was a cost efficient way of collecting large amounts of data compared to other available data collection techniques, such as interviewing (E. Wood et al., 2006). However, in recent times it has been demonstrated that costs are much lower for online surveys compared to a paper format—especially when compared to the cost of a large-scale survey using mailed questionnaires. Costs for a mail survey can include printing and postal costs, as well as labour costs involved in inserting the survey form and preparing the envelope for posting. Online surveys reduce cost by eliminating the need for paper, postage, printing, and data entry (Llieva et al., 2002; J. H. Watt, 1999; Witmer, Colman, & Katzman, 1999). Online surveys are self-administered and do not require personal interviews, thus reducing the cost (Evans & Mathur, 2005). By being paperless, this method is also more environmentally friendly. Online survey creation software and web survey services costs can vary from zero to thousands of dollars, depending upon the types of features and services selected. This is relatively inexpensive compared to the cost of traditional paper-and-pencil surveys (Wright, 2005). Furthermore, these costs are often one-off costs: for example, once the software has been acquired, then future surveys can be conducted without the need for further on-going expenditure.

4.2.1.3.5 Convenience.

Online surveys can be completed at a time and place convenient for the participant, and not only as determined by the researcher. Participants can also take as much time as they need to answer questions (Evans & Mathur, 2005). Some surveys also allow participants to save a survey and return to it at a later time. Participants can respond to surveys on the go, as new online survey creation software (such as Qualtrics Research Suite) adapts to the participant’s platform, whether it is a desktop or laptop computer, tablet, or smartphone. Some survey software, such as Qualtrics Research Suite, has offline functionality, allowing participants to complete a survey when an internet connection is not available.
4.2.1.3.6 Diversity of question style.

Online surveys can consist of different types of questions, such as textbox questions, multiple-choice, rating scales, checkbox questions, radio button questions, drop-down menus, text entry, ranking questions, file upload, slider bar, grouping, and many more. With Qualtrics Research Suite, over 100 different questions types can be created. Images, audio or video clips can be included to make the survey visually more appealing, as well as giving diversity and variance to the survey. Participant engagement can be increased by including visuals to enhance surveys and visual response methods (Downes-Le Guin, Baker, Mechling, & Ruylea, 2012).

Online surveys reflect four styles of presentation: (a) text only, (b) decoratively visual, (c) functionally visual, and (d) gamified (Downes-Le Guin et al., 2012). Text only presentation style typically uses no images at all. It usually consists of black text on white background, with the extensive use of tick boxes, grids and radio buttons (Downes-Le Guin et al., 2012). Decoratively visual presentation style uses visual elements primarily to provide visual stimulation in order to enhance the participant experience, and is not integrated into the way questions and responses are presented (Downes-Le Guin et al., 2012). Functionally visual presentation style integrates visual and motion elements into the way questions and responses are presented (Downes-Le Guin et al., 2012). Gamified presentation style incorporates qualities common in most games such as avatars, missions, rules, progress indicators, and badges or rewards to make the survey engaging (Downes-Le Guin et al., 2012). The survey or sections of the survey may become game-like, in order to increase participant engagement (Downes-Le Guin et al., 2012).

4.2.1.3.7 Control of answer order.

The participant usually answers the questions in the order intended by the researcher (Evans & Mathur, 2005). Unlike traditional surveys, online survey participants usually cannot look in advance at the rest of the questions asked in the survey. This can reduce survey bias as participants are prohibited from having prior knowledge of questions and thereby adapting their answers, thus resulting in a bias or skew (Evans & Mathur, 2005). Software allows for question randomisation, which can help to eliminate order bias (Payne, 2010). Online surveys can be constructed so that the participant can skip questions, or so that the participant must answer a question before moving on to the next question (Evans & Mathur, 2005), thereby increasing data quality by reducing item non-response (Bech &
Kristensen, 2009). However, forcing participants to answer questions may lead to “don’t know” answers, thereby decreasing data quality and introducing a measurement error that could bias the results (Bech & Kristensen, 2009).

In traditional surveys, the participant can flip ahead and see how much of the survey is still to be completed. If dissatisfied, he or she may then not complete the survey. This can be prevented in online surveys, as the participant cannot flip ahead. Instead, a graphical progress indicator may indicate completion (Evans & Mathur, 2005).

4.2.1.3.8 Go to and skip capabilities.

Skip, display, and branch logic can be used in online survey design to skip, show and hide, and control the flow of the survey. For example, skip logic can be used to skip a participant past a question that is not relevant, to the next relevant question. Or the participant can be skipped to the end of the survey, if the participant does not qualify for the survey. This can lessen confusion about the navigation of the survey for the participant, as well as reduce errors as the software manages the skip and not the participant (Payne, 2010). For the participants, the completion of the survey is simpler and less confusing, and can be perceived as being personalised for them (Evans & Mathur, 2005).

4.2.1.3.9 Alert function for mandatory completion of questions.

Online survey software can include an alert function if a participant does not answer a question or if the question is not answered in the correct manner. If a participant attempts to skip a question, a message appears reminding the participant that he/she needs to answer the current question before being able to move onto the next question. This eliminates item non-response (Evans & Mathur, 2005) and potentially means a 100.0% question completion rate. Thus, no survey has to be discarded for being incomplete or completed incorrectly (Evans & Mathur, 2005), unless the participant chooses not to complete the survey.

4.2.1.3.10 Bulk mailer.

Software such as Qualtrics has a bulk mailer feature that helps to quickly, easily, and cheaply distribute the online survey to participants. Distribution dates can be set in advance, and thank you messages can be sent automatically to participants upon completion of the survey. Reminder messages can be set in advance, which can increase survey response rates (Evans & Mathur, 2005).
4.2.1.4 **Ethical concerns of online research.**

Researchers who use online approaches need to be aware of electronic data security storage on third party servers, proper informed consent protocols in an anonymous/pseudonymous environment, the connections between autonomy, voluntariness, and survey design (e.g., being unable to skip questions), appropriate participant verification (ensuring participants are over 18 years of age), and guaranteeing informed consent through the use of click-box agreements on online surveys (Buchanan & Hvizdak, 2009). Anonymity of participants is easily maintained, as most software packages have built-in features that prevent the researcher from viewing the participants’ email or ISP addresses. Participants should not be forced to answer a question, as with the alert option included in online survey software that does not allow the participant to move to the next question before the current question has been answered. It is also important to know and act according to the “netiquette” (Flick, 2009) or etiquette of the specific internet locale and the norms and philosophies of the specific internet community, along with the requisite principles for human participation in research (Ess, 2007).

4.2.2 **Ethics approval.**

Ethics approval was sought and granted by the Southern Cross University Human Research Ethics Committee, with approval number ECN-12-169 (see Appendix C4). Participants were provided with an Information statement (see Appendix C6). Participant consent was implied by completing the survey.

4.2.3 **Sample size.**

Tabachnick and Fidell (2001) recommended that there should be at least 300 participants for factor analysis, while Field (2009) suggested the common rule is that there should be no less than 10–15 participants per variable. It has been suggested that, if the number of participants in a sample is more than 300, the test parameters tend to be stable regardless of the participant-to-variable ratio (Kass & Tinsley, 1979). Some researchers suggested that factor loadings are more important than sample size, as the factor analysis is reliable regardless of the sample size if a factor has four or more loadings greater than 0.6, and factors with 10 or more loadings greater than 0.4 are reliable if the number of participants is greater than 150 (Guadagnoli & Velicer, 1988). Other researchers suggested that, as communalities become lower, the sample size becomes more important. Communalities above 0.6 require smaller sample sizes (less than 100), communalities in the 0.5 range require 100 to 200
participants, while communalities below 0.5 need samples above 500 (MacCallum, Widaman, Zhang, & Hong, 1999). Therefore, a sample of 600 participants would satisfy the sample size requirements based on the participant-to-variable ratio and low communalities for a factor analysis.

4.2.4 Participants.

Potential participants were invited to participate in an anonymous online survey about weight lifting, diet, and male body image that would take about 20 minutes to complete (see Appendix C4). The inclusion criteria were: (a) adult males at least 18 years of age; (b) individuals who are working out with weights (i.e., free weights or machines) at least three times per week; and (c) currently residing in Australia.

4.2.5 Procedure.

Pilot study: The online survey was pilot tested with 10 participants. Results of a pilot study indicated that the survey was easy to negotiate, the questions were interesting and not difficult to understand, and the survey did not take too long to complete. Content experts were not invited to review the questions of the survey because changes to the questions of the MASS, Body Dysmorphic Disorder Questionnaire (BDDQ) and EAT-26 were not permitted, as the copyright owners did not give such permission.

Online survey: Potential participants were recruited online through Facebook, weight lifting and bodybuilding discussion forums, emails, and participant friends. A link (web address) to the survey was provided. An information statement was provided at the start of the questionnaire. Facebook searches were initiated using the words “gym” and the names of towns and cities/suburbs of cities in Australia. An invitation to participate in the research study was posted on the wall of the Facebook profile. Invitations to participate were also posted on the wall of Australian bodybuilding supplement stores’ profiles, Australian bodybuilding and fitness magazines’ profiles, and Australian bodybuilding and fitness community profiles. Potential participants were invited to participate in a survey about weight lifting, diet and male body image. Facebook users were asked to share the post. Invitations to participate were posted on Australian weight lifting and bodybuilding forums, such as Aussie gym junkie (www.aussiegymjunkies.com) and Australian bodybuilding (www.ausbb.com). Emails were sent via the Southern Cross University bulk email system to all staff and students. The outline of the online survey process is schematically portrayed in Figure 4.
The online survey was supported by Qualtrics research software (Qualtrics Inc, 2009). Participants were able to skip any questions that they did not want to answer and were free to withdraw from the survey at any stage without explanation. The survey could also be saved and continued at a later time. The survey collected self-report data and consisted of a background questionnaire (see Appendix C1), the MASS (see Appendix B1), the BDDQ (see Appendix C2), and the EAT-26 (see Appendix C3).

Figure 4. Schematic outline of the online survey process.

4.2.6 Measures in the online survey.

The survey consisted of a background questionnaire, the MASS, the BDDQ, and the EAT-26.

4.2.6.1 Background questionnaire.

The background questionnaire was designed to collect data on variables that might be related to MD. Significant relationships between variables and symptoms of MD have been
found in the literature, but research replicating these findings is lacking. This questionnaire included questions asking the participant about his date of birth, relationship status, ethnic origin, sexual orientation, weight lifting habits, past and planned cosmetic surgical procedures, and past diagnoses of mental disorders.

4.2.6.1.1 Question 1: date of birth.

Literature suggests that, for men, the average onset of MD is approximately 19.4 years of age (Olivardia, 2001). Three studies on MD (Hildebrandt et al., 2006; Hitzeroth et al., 2001; Olivardia et al., 2000) investigated age as a related variable and did not find a correlation, while one study found a negative correlation (Nieuwoudt, 2011). Results from the current study were used to investigate if age was correlated with MD, BDD, and eating disorder symptoms.

4.2.6.1.2 Question 2: relationship status.

Men with BDD are more likely to be single (Phillips & Diaz, 1997; Phillips et al., 2006). Only two studies on MD (Hitzeroth et al., 2001; Olivardia et al., 2000) investigated relationship status as a related variable, and did not find a correlation (Tod & Lavallee, 2010). The results from the present study were used to investigate whether relationship status was correlated with MD, BDD, and eating disorder symptoms.

4.2.6.1.3 Question 3: ethnicity.

Most studies on MD have failed to include ethnic minority groups, and only one MD study has yet included Australian indigenous groups (Nieuwoudt, 2011). It could be argued that it is less important to include ethnic minorities in studies because by definition they are statistically in the minority, but it could equally be argued that lack of inclusion affects comprehensiveness—and there are also equity concerns when ethnic minorities are given less emphasis (Whorley & Addis, 2006). This study gathered information from more than 600 participants from Australia, and was not limited to certain ethnic groups. The results were used to investigate if ethnicity was correlated with MD, BDD, and eating disorder symptoms.

4.2.6.1.4 Question 4: sexuality.

Men across a range of ages want to be thinner and more muscular, independent of their sexual orientation (Tiggemann, Martins, & Kirkbride, 2007). Various studies reported that in terms of muscularity, gay and heterosexual men shared the same ideals, but gay men rated
themselves as less muscular than heterosexual men (Tiggemann et al., 2007). Gay men appeared to be more dissatisfied with their perceived muscularity than heterosexual men (Kaminski, Chapman, Haynes, & Own, 2005).

Wood (2004) explained that messages and meaning were conveyed through the body and it played a symbolic role in perpetuating gender hierarchies between and within the genders. Gay men were marginalised within the hierarchy of masculinities, and were stereotypically seen as feminine and less masculine compared to heterosexual men (M. J. Wood, 2004).

Sexuality was considered for this investigation as being related to MD symptoms, as it had been identified by previous research as an individual risk factor contributing to body dissatisfaction. The results from the current study were used to investigate if sexuality was related to MD symptoms, as well as BDD and eating disorder symptoms.

4.2.6.1.5 Questions 5–8: weight lifting habits.

Long hours of lifting weights is a characteristic behaviour associated with MD (H. G. Pope et al., 1997). A predominant symptom of BDD is the presence of compulsive behaviours designed to examine, improve, or hide the perceived defect (Cororve & Gleaves, 2001). These behaviours may include excessive exercise, dieting, using AAS, and measuring, touching or looking at the body part that may be perceived as flawed (Phillips et al., 1994). Individuals with both BDD and MD symptoms are also more likely to weight train excessively, and have a strict diet, compared to those with BDD but without MD symptoms (C. G. Pope et al., 2005). The results from the present study were used to investigate whether weight lifting habits were related to MD, BDD, and eating disorder symptoms.

4.2.6.1.6 Questions 9 and 10: cosmetic surgical procedures.

Sufferers of BDD may experience such high levels of emotional distress that they may take drastic steps to correct their perceived defect (Sarwer & Crerand, 2004). Consequently, sufferers of BDD often seek the help of cosmetic surgeons or dermatologists (Sarwer & Crerand, 2004). It seems that males and females are equally likely to seek and receive cosmetic treatment for their BDD concerns (Phillips et al., 2010). One study found that 83.0% of people with BDD had no change or an increase in BDD symptoms after cosmetic procedures (Phillips & Diaz, 1997), thus cosmetic procedures do not always lead to an improvement in BDD symptoms. Eating disorders may occur with greater frequency among individuals interested in cosmetic medical treatments (Sarwer & Crerand, 2004), as body image plays a central role in eating disorders (Hrabosky et al., 2009; Rosen & Ramirez, 1998;
Sarwer & Crerand, 2004). Some case reports had shown that cosmetic surgery may lead to heightened symptoms of eating disorder among women with anorexia nervosa and bulimia nervosa (McIntosh, Britt, & Bulik, 1994; Willard, McDermott, & Woodhouse, 1996), while other research had found that cosmetic surgery might lead to an improvement in eating disorder symptoms (Losee, Serletti, Kreipe, & Caldwell, 1997). The results from this study were used to investigate whether individuals who sought and received cosmetic treatment were more likely to exhibit symptoms of BDD, eating disorders, and MD.

4.2.6.1.7 Question 11: diagnosis of eating disorder, body dysmorphic disorder, obsessive compulsive disorder, or depression.

A research study by Olivardia et al. (2000) found that 29.0% of male participants with MD had a history of an eating disorder, while none of the participants in Behar and Molinari’s (2010) study had a history of eating disorders. Body dysmorphic disorder is often comorbid with obsessive compulsive disorder, substance abuse or dependence, major depression, social phobia (Phillips et al., 1998; Phillips, Menard, Fay, & Weisberg, 2005), and MD (C. G. Pope et al., 2005). Studies had found that 18 (9.3%) of 193 participants (H. G. Pope et al., 1997), and 14 (22.2%) of 63 men (C. G. Pope et al., 2005) with BDD also had MD. Another study found that 5 (33.3%) of 15 participants with MD also displayed other classic BDD symptoms, in contrast to none of the 13 participants without MD (Hitzeroth et al., 2001). Eating disorders and BDD can be comorbid (Phillips et al., 2010). Research found that 30.1% of participants with BDD were excessively preoccupied with their weight (Didie et al., 2010) and 29.0% of participants with BDD had excessive weight concerns (Kittler, Menard, & Phillips, 2007). The results from the current study were used to investigate if MD, BDD, and eating disorders were comorbid with each other and with other disorders.

4.2.6.2 Muscle Appearance Satisfaction Scale.

The MASS (Mayville et al., 2002) consists of 19 items, and is a self-report measure for the assessment of MD symptoms (see Appendix B1). Details about psychometric properties and the component structure were provided earlier (see section 3.2.5.2).

4.2.6.3 Body Dysmorphic Disorder Questionnaire.

The BDDQ (Phillips, Atala, & Pope, 1995) is a self-report screening tool to assess the presence of BDD symptoms (see Appendix C2). It can be used for a diagnosis of probable
BDD, but not for making a clinical diagnosis of BDD. Body dysmorphic disorder diagnosis should ideally be made through a clinical interview (Bartsch, 2007).

The BDDQ (Phillips et al., 1995) consists of a series of “yes or no” questions that ask the individual about appearance concerns and the impact of these concerns on the individual’s life. If the respondent answers yes to a question, it leads to a question asking to list or describe the concern or impact of the concern. An individual is likely to have BDD if the individual answers yes to both parts of Question 1, yes to any of the questions in Question 3, and selects b or c for Question 4 (Phillips, 2005).

The BDDQ was chosen to assess the presence of BDD symptoms in the current research, as the BDDQ has had 100.0% sensitivity and 89.0% specificity in a psychiatric outpatient setting (Phillips et al., 1995), and 100.0% sensitivity and 93.0% specificity in a psychiatric inpatient setting (Grant, Kim, & Crow, 2001).

Written permission was obtained from W. E. Menard (personal communication, December 02, 2011) on behalf of the copyright owner (K. A. Phillips), for the use of the BDDQ in this research project. Refer to Appendix D for copyright information.

4.2.6.4 The 26-item Eating Attitudes Test.

The EAT-26 (see Appendix C3) is a self-report measure designed to assess symptoms and concerns that are common in eating disorder patients (Garner et al., 1982). The EAT-26 resulted from a factor analysis of the 40-item Eating Attitudes Test. While the EAT-26 can be used as a screening tool to identify individuals who are at increased risk for eating disorders, it cannot be used to make a clinical diagnosis of an eating disorder (Garner et al., 1982). The EAT-26 consists of three factors: (a) Dieting factor, (b), Bulimia and Food Preoccupation factor, and (c) Oral Control factor. The Dieting factor assesses body dissatisfaction and the want to be smaller. The Bulimia and Food Preoccupation factor reflects bulimia and is positively correlated with a heavier body. The Oral Control factor reflects the pressure felt to gain weight. It also assesses self-control over eating and food. The EAT-26 consists of 26 items, and the response to each item is rated on a six-point Likert-type scale from 1 (always) to 6 (never). Item scores for items 1 to 25 range from 3: always, 2: usually, 1: often, 0: sometimes, 0: rarely, to 0: never. Item 26 is reverse scored and range from 0: always, 0: usually, 0: often, 1: sometimes, 2: rarely, to 3: never. Scores are calculated by simply summing the values of the participant’s choices for the entire scale, with the total ranging between 0 and 75. A score of 20 or above indicates a high level of concern about dieting,
body weight, and problematic eating behaviours (Garner et al., 1982). Behavioural questions are also included in the questionnaire and determine the presence of extreme weight-control behaviours as well as providing an estimate of their frequency, as seen in Table 14. If the participant has a score in any of the checked boxes (√) shown in Table 14, it indicates risk of an eating disorder (Garner et al., 1982).

Table 14

Scores in any of the Checked Boxes (√) are Indication for Risk of an Eating Disorder

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Once a month or less</th>
<th>2–3 times a month</th>
<th>Once a week</th>
<th>2–6 times a week</th>
<th>Once a day or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binge</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Vomit</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Laxatives, diuretics</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Exercise</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lost 9 kg or more</td>
<td>Yes</td>
<td>✔</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Adapted from “Eating Attitudes Test (EAT-26) Item Scoring” by D. M. Garner, n.d.

The EAT-26 was chosen to identify individuals who are at increased risk for eating disorders in the current research, as the EAT-26 is a psychometrically sound instrument and has been extensively validated across different languages, cultures, and countries, including Australia (e.g., Jennings, Forbes, McDermott, & Hulse, 2006), the USA (e.g., Garner et al., 1982; Lamanna et al., 2010), China (e.g., Lee & Lee, 1996; Liao et al., 2010), Korea (e.g., Yang, Kim, & Yoon, 2010), Spain (e.g., Rivas, Bersabe, Jimenez, & Berrocal, 2010), and South Africa (e.g., Le Grange, Louw, Breen, & Katzman, 2004; Szabo & Allwood, 2004a, 2004b). The EAT-26 has also been shown to have good internal consistency, with Cronbach’s alpha values ranging from .83 (Lamanna et al., 2010) to .90 (Garner et al., 1982; Koslowsky et al., 1991).
Written permission was obtained from the copyright owner D. M. Garner (personal communication, November 08, 2011) for the use of the EAT-26 in this project. Refer to Appendix D for copyright information.

4.2.7 Potential problems, and methods used by this project to lessen or eliminate them in the online survey.

4.2.7.1 Sample generation.

Coverage error and sampling error are two of the unique potential problems for online survey sampling (Couper, 2000). A biased population can be the result of coverage error, as not everyone has internet access (Fan & Yan, 2010). A biased sample can be the result of sampling error, as not everyone who has internet access necessarily has an equal opportunity to participate in the survey (Fan & Yan, 2010).

Generating samples from virtual groups and organisations may be difficult if membership email lists are not provided to the researcher (Wright, 2005). If an email list is obtained, an invitation to participate and link to the online survey can be emailed to every member on the list (Wright, 2005). However, online communities, forums and chat rooms do not typically provide participant email addresses (Wright, 2005). An invitation to participate and link to the online survey can be posted in a thread. Permission should be requested from the moderator, however, as this may be in breach of the forum or chat room rules. The number of members may not be a true reflection of the active members; also not all individuals actively participate in discussions. This may contribute to a biased sample.

A sample was generated by emailing an invitation to participate to all staff and students of Southern Cross University. Threads containing invitations to participate were created in various Australian online bodybuilding forums, with the permission of forum moderators. Invitations to participate were posted on the walls of the researcher’s Facebook friends and on the walls of relevant Facebook profiles and pages—for example bodybuilding supplement stores, gyms, and profiles and pages dedicated to bodybuilding, if these pages and profiles were open to the public. Private messages were sent on Facebook to relevant Facebook pages and profiles asking to place the invitation and link to the survey on their Facebook wall, if their walls were not open to the public. These methods of sampling generation were used in an attempt to lessen coverage error and sampling error.
4.2.7.2 Technological variations.

Slow download speed, as with the use of dial-up internet connection, can adversely affect a participant’s willingness or ability to complete a survey (Evans & Mathur, 2005; Payne, 2010). Previous research noted that configuration problems may occur due to different operating systems, variations in monitor size, and differences in generations of web browsers (Evans & Mathur, 2005). Different computer configurations may result in the survey being displayed differently for participants (Fan & Yan, 2010). This may cause the questions and answers to be distorted and confusing for some participants.

It is highly unlikely that slow download speed, as with the use of dial-up internet connection, would have adversely affected a participant’s willingness or ability to complete a survey in the current study, as dial-up accounted for less than 2.0% of the proportion of internet connections in Australia as of June 2013, with over 98.0% of internet connections being broadband (Australian Bureau of Statistics, 2013b). With faster broadband or wireless connection, the time to download and complete a survey is much shorter. Furthermore, some survey software allows the participant to complete the survey offline when an internet connection is not available. The Qualtrics survey software (Qualtrics Inc, 2009) used in the current study allowed the participant to complete the survey offline when an internet connection was not available. Qualtrics survey software also adapts to the participant’s platform, whether it is a desktop or laptop computer, tablet, or smartphone. Hence configuration problems were not a weakness of the current online survey.

4.2.7.3 Online inexperience of participant.

The participation in and completion of online surveys are dependent on the participant’s technical ability and online experience/expertise (Evans & Mathur, 2005). It is possible that some participants may not be familiar with internet protocols (Evans & Mathur, 2005), and thus may experience difficulties with the survey. Computer literacy may also have an impact on survey completion, as participants with insufficient computer literacy might have trouble accessing, completing, saving and submitting an online survey.

Some participants may not be familiar with internet protocols (Evans & Mathur, 2005), but it is debatable whether online inexperience can be generalised to a whole population, as the internet population is becoming more representative (Payne, 2010). In the current study, it was made very easy to access the online survey by clicking on a link that took the participant to the survey. Questions were asked and answered in a manner similar to traditional surveys,
so for participants familiar with the style, that would likely assist in the completion of the survey.

4.2.7.4 Perception of spam or junk mail.

Reminders are often sent to potential participants in a survey through email to remind them to complete an online survey. These emails can be interpreted as spam or junk mail, which are unwanted emails sent to an individual’s email account (Payne, 2010). Non-response rates may be increased by the perception that the email is spam or junk mail (Evans & Mathur, 2005). Email and internet users are becoming more cautious in opening emails from addresses that they are unfamiliar with—that is if the email is not already blocked as suspicious email by stringent spam filtering programs (Payne, 2010). The increased use of spamming filters may contribute to a low response rate for online surveys (Fan & Yan, 2010). The more popular the survey software, the higher the likelihood that emails sent out by the software will be blocked by spamming filters (Fan & Yan, 2010).

It can be difficult to distinguish between a spam message and a legitimate survey. If the email is not blocked by spamming filters, potential participants may still perceive it as spam. Many participants may be wary to open an email attachment or click on a link for fear of being infected by a computer virus (Evans & Mathur, 2005) or the possibility of being hacked. There is also a possibility that potential participants may perceive an invitation to participate in a survey posted on social networking sites to be spam.

In order to reduce the perception of spam or junk mail in the current study, invitations to participate in the online survey were only emailed to Southern Cross University staff and students twice: once in 2012 and once in 2013. No follow-up emails or reminders were sent. The emails were sent through the university’s bulk messaging system; therefore, staff and students would have been familiar with the sending address, making it easier to distinguish between a legitimate survey and spam or junk mail.

Permission was obtained from moderators of online forums to post the invitation to participate on forum boards. The invitation to participate was only posted once in only one thread, in order to prevent members from thinking that it was spam. No reminders or follow-up messages were posted in the threads.

Invitations to participate were only posted on the walls of the researcher’s Facebook friends or on the walls of relevant Facebook profiles and pages that were open to the public. Private messages were sent on Facebook to relevant Facebook pages asking moderators to
place the invitation and link to the survey on their Facebook wall if their walls were not open to the public. Private messages were only sent once, and wall posts were only made once per Facebook profile or page. This was to prevent spamming of Facebook walls and private message inboxes.

4.2.7.6 Multiple malicious completions of surveys.

It is possible that a participant may answer a survey multiple times (Kraut et al., 2004) especially when an incentive for completion is offered. Multiple malicious completions would increase the sample size, but compromise the integrity of online surveys, affecting both the validity and quality of the data collected (Payne, 2010). Online survey software often has an option that prevents participants from taking a survey more than once. A cookie is placed on their browsers when they submit a survey, and the next time they click on the survey link, the software sees this cookie and does not permit them to take the survey (Qualtrics Inc, 2009). While this is a great deterrent, technologically advanced participants can outwit this by clearing their cookies or switching to a different web browser.

No incentives were offered for the completion of the online survey; therefore, multiple malicious completions of surveys were not thought to be a potential weakness of this research project. Although the online survey software used for this online survey had an option to prevent participants from taking a survey more than once, this option was not chosen as this would have prevented participants from completing the online survey from public access computers (where one computer terminal could potentially have been used by multiple survey respondents).

4.2.7.7 Low response rate.

It is often not possible to calculate the response rate for online surveys, as there is not a defined sampling frame (Couper, 2000). The response rates of online surveys may vary. While some studies have found that response rates in online surveys are equal to or better than those for traditional mailed surveys (Mehta & Suvadas, 1995; Stanton, 1998; L. F. Thompson, Surface, Martin, & Sanders, 2003), others have found a low response rate (Bech & Kristensen, 2009; Bosnjak & Tuten, 2001; Cook, Heath, & Thompson, 2000; Couper, 2000; Fricker & Schonlau, 2002; McDonald & Adams, 2003; Sax, Gilmartin, & Bryant, 2003). It appears that the response rate for online surveys may be lower than the response rate for telephone or traditional mail surveys (Cook et al., 2000; Kraut et al., 2004). Low response rate does not necessarily indicate inferior data (Dykema et al., 2013), as non-response bias
may be small if participants are similar to nonparticipants on characteristics of interest (Biemer & Lyberg, 2003). Non-response bias may be large if the participants surveyed differed substantially from those who were not surveyed, even with a high response rate (Biemer & Lyberg, 2003).

It has been shown that the response rate is significantly influenced by various factors such as the topic (Fan & Yan, 2010; Groves, Presser, & Dipko, 2004), the length of the survey, the order of the questions, the survey design, sampling methods, contact delivery modes, invitation designs, informed consent methods, pre-notification and reminders, incentives (Fan & Yan, 2010), and technical factors (Couper, 2000; Fan & Yan, 2010). According to Dillman (2007), social exchange theory might explain why individuals choose to participate or not to participate in surveys. Individuals are more likely to participate in a survey if they trust the originator of the request and if the perceived rewards of participating outweigh the perceived costs of participating (Dillman et al., 2009).

Long, poorly designed and dull surveys may cause the participant to speed through the questions, respond randomly to questions, and not complete the survey (Downes-Le Guin et al., 2012). However, the use of visual and motion elements are not necessarily the answer. Miller (2009) found that a significant number of participants prefer a traditional HTML-based survey over a more interactive, rich media design. The use of a slider bar in place of standard radio buttons (Couper, Singer, Tourangeau, & Conrad, 2006), and drag-and-drop ranking tasks can increase survey length (R. Thomas, Bremer, Terhanian, & Couper, 2007), causing more participants to not complete the survey.

Even when researchers are able to attract potential participants to the survey, only a small number of participants complete the survey (Porter & Whitcomb, 2003). The response rates for online surveys vary widely, with reported rates being 8.0%–44.0% (Bech & Kristensen, 2009; Cook et al., 2000; Fricker & Schonlau, 2002; Shih & Fan, 2009). Low response rate reduces the sample size, and in turn reduces the statistical power of the study (Sauermann & Roach, 2013).

In order to increase the response rate in the current project, the length of the survey was fairly short, and questions were relevant and of interest to the targeted participants. Text only presentation style was mainly used, as this is a style often used in traditional surveys. Participants would therefore be familiar with the way questions are asked and answered. Questions were concise and logically ordered for easy answering. Skip, display, and branch logic were used in the online survey to skip, show and hide, and control the flow of the
survey. It also lessened confusion about the navigation of the survey for the participant, thus improving the response rate. For example, skip logic was used to skip a participant past a question that was not relevant for that participant, to the next relevant question.

4.2.7.8 Bias of participants.

Bias or skewed attributes of participants are not unique to online survey research, as mailed surveys suffer from the same basic limitations. Online surveys are associated with selection bias related with the internet population, such as age, education level, socioeconomic level, and so forth (Evans & Mathur, 2005).

There is selection bias as only a target population uses the internet (Baltar & Brunet, 2012). Until recently, online survey results could not be generalised to the total population, as users of the internet and email were not truly representative of the general population (Evans & Mathur, 2005). However, the number of Australian households with internet connection has increased significantly over the past years. More than half \((n = 12,408,000)\) of the total Australian population were internet subscribers (excluding mobile handset) at the end of June 2013 (Australian Bureau of Statistics, 2013b). There were 19.6 million subscribers (about 85.0% of the total Australian population) with internet access connections via a mobile handset in Australia at the end of June 2013, indicating a 13.0% increase since December 2012 (Australian Bureau of Statistics, 2013b). It is debatable whether this lack of representativeness is a significant bias in Australia, as the differential between online and offline populations is quickly closing.

While traditional snowball sampling can be seen as a biased sampling technique because it is not random, virtual networks do incorporate random elements (Baltar & Brunet, 2012). These random elements include the random selection of the virtual groups, and contacting every member inside the virtual group (Baltar & Brunet, 2012).

4.2.8 Treatment of the data and statistical analysis.

Raw data from the Qualtrics Research Suite were downloaded into IBM SPSS Statistics version 20.0, where they were coded and statistically analysed. Data can be analysed using parametric or non-parametric statistical techniques. Parametric statistics have certain assumptions that have to be met in order to use the parametric test. If these assumptions are not met, data can be manipulated such that the assumptions are met; however, the possibility exists that findings may become invalid (Pallant, 2009). To reduce this risk, a non-parametric technique can be utilised (Pallant, 2009). Non-parametric procedures are appropriate and
valid to use when parametric statistics cannot be employed (Gibbons, 1985). It was decided to use non-parametric statistics in this study, as the data distributions were skewed, and controversy exists regarding transforming data to make the distribution more normal.

The data were examined first by inspecting basic frequencies. Descriptive statistics were used to explore the study population’s characteristics. Cross tabulations were used to examine frequencies of participants at risk of having both MD and BDD, both MD and an eating disorder, and both BDD and an eating disorder. Loglinear analysis was used to determine if MD, BDD, and eating disorder variables were related. Odds ratios were used to report effect sizes.

Continuous variables were not normally distributed; non-parametric tests were therefore used to compare continuous variables across groups. Kruskal Wallis tests were conducted to compare continuous variables across groups of participants with, and without, symptoms of MD, BDD, and eating disorders. Mann-Whitney U tests were undertaken to examine group differences, and effect size ($r$) was calculated by $z / \sqrt{N}$. Chi-square tests and Fisher’s exact tests were used to explore the relationships between categorical variables across groups of participants with, and without, symptoms of MD, BDD, and eating disorders. Bonferroni corrections were made to control for possible Type I error for contrast analyses, leading to a corrected critical significant level of $p < .002$.

Spearman rank order correlation ($r_s$) and point-biserial correlation ($r_{pb}$) analyses were undertaken to examine the associations between MD, BDD and eating disorder symptomatology. Cronbach’s alpha was calculated to determine the reliability and internal consistency of the MASS and the EAT-26. The level of significance was set at $p \leq .05$.

Statistical analyses were performed using IBM SPSS Statistics version 20.0.

A CFA was conducted on the MASS and the EAT-26 using Mplus version 7 (Muthen & Muthen, 1998–2010) to examine the underlying factor structure of the data and assess if the a priori model fits the data adequately. The MASS and the EAT-26 data emerged as multivariate non-normal, thus the robust maximum likelihood estimation method was used. The pattern of missingness was missing at random and displayed monotonicity. Listwise deletion was used to handle missing data. The suitability of the model was assessed using goodness-of-fit indices that possess different computational logic: (a) absolute fit was determined by Chi-square ($\chi^2$/df) ratio ($Q$), (b) approximate fit was determined by RMSEA, (c) residual-based index was determined by the Standardized Root Mean Square Residual (SRMR), and (d) incremental fit indices were examined using the CFI and the TLI.
Acceptable fit for these indices are: $Q < 3$ (Hoyle, 2000; Long & Perkins, 2003); RMSEA < .05 good fit, .05–.08 reasonable fit (Browne & Cudeck, 1993), .08–.10 mediocre fit (MacCallum, Browne, & Sugawara, 1996); SRMR < .05 (Hu & Bentler, 1995); CFI ≥ .95 (Hu & Bentler, 1999); and TLI ≥ .95 (Hu & Bentler, 1999). Post hoc model fitting was conducted as part of a model generating scenario. Modification indices (MIs) were reviewed to assess item redundancy.

4.3 Prevalence of Symptoms of Muscle Dysmorphia, Body Dysmorphic Disorder, and Eating Disorders

4.3.1 Results.

4.3.1.1 Demographic characteristics of participants.

A total of 648 adult males participated in the online survey. Participants ranged in age from 18 to 65 years ($M = 29.5$, $SD = 10.1$). Forty percent of the participants indicated that they were single (see Figure 5). The majority of participants were Caucasian (85.3%, see Figure 6) and heterosexual (93.4%, see Figure 7). Participants ranged in weight lifting experience from 2 months to 47 years ($M = 6.0$ years, $SD = 7.0$) and were engaged in weight lifting at least three days or more per week (see Figure 8). Most participants (94.8%) had one weight lifting session per day (see Figure 9), with the duration of weight lifting sessions ranging from 15 minutes to 210 minutes ($M = 70.0$, $SD = 44.2$).

Figure 5. The relationship status of participants.
Figure 6. The ethnic origin of participants.

![Ethnicity Bar Chart]

Figure 7. The sexual orientation of participants.

![Sexual Orientation Bar Chart]
Figure 8. The number of days per week participants was engaged in weight lifting.

Figure 9. The number of sessions per day participants was engaged in weight lifting.

The survey revealed that 97.2% \((n = 630)\) of participants had not had cosmetic surgery in the past, while 2.6% \((n = 17)\) of participants had. One participant did not reveal if he had undergone cosmetic surgery in the past. The most common cosmetic surgeries participants had undergone were gynecomastia, rhinoplasty, and Botox and dermal fillers for face (e.g., restalyn and collagen), as seen in Table 15. Thirty-five \((5.4\%)\) participants indicated that they were planning on having cosmetic surgery in the future, with blepharoplasty, gynecomastia, and rhinoplasty the most common planned procedures (see Table 15). The majority \((n = 611,\)
94.3%) of participants revealed that they were not planning on having cosmetic surgery in the future. Two participants did not reveal if they were planning on having future cosmetic surgery.

Table 15

*Past and Planned Cosmetic Surgeries as Indicated by Participants*

<table>
<thead>
<tr>
<th>Cosmetic surgery</th>
<th>Past procedures</th>
<th>Planned procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicep implant</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Blepharoplasty (eyelids)</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Body contouring surgery (excess skin removal)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Botox and dermal fillers for face (e.g., restalyn and collagen)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Brow lift</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Calf implants</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Dental surgery</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>FTM Top surgery (transgender chest surgery female-to-male)</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Gynecomastia (breast augmentation)</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Hair transplant</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>High definition liposculpture</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Laser skin resurfacing</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>LASIK eye surgery</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Mole removal</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Neck lift</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Otoplasty (ears)</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Pectoral implant</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Rhinoplasty (nose)</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Rhytidectomy (face lift)</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Scar tissue removal</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

*Note. N = 648.*
The survey revealed that 13.7% \((n = 89)\) of the participants had been diagnosed with a mental disorder in the past, and 85.5% \((n = 554)\) of the participants had not previously been diagnosed with a mental disorder. Depression \((34.8\%, n = 31)\) and anxiety disorders \((32.6\%, n = 29)\) were the mental disorders that participants had most often been diagnosed with in the past, as seen in Table 16.

Table 16

*The Number of Participants and the Mental Disorder They Had Been Diagnosed With in the Past*

<table>
<thead>
<tr>
<th>Mental disorder</th>
<th>(n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjustment disorder</td>
<td>1</td>
</tr>
<tr>
<td>Anxiety</td>
<td></td>
</tr>
<tr>
<td>Not specified</td>
<td>13</td>
</tr>
<tr>
<td>Generalised anxiety disorder</td>
<td>1</td>
</tr>
<tr>
<td>Acute panic attacks</td>
<td>1</td>
</tr>
<tr>
<td>Panic disorder</td>
<td>1</td>
</tr>
<tr>
<td>Agoraphobia</td>
<td>1</td>
</tr>
<tr>
<td>Post-traumatic stress disorder</td>
<td>3</td>
</tr>
<tr>
<td>Obsessive compulsive disorder</td>
<td>9</td>
</tr>
<tr>
<td>Bipolar II disorder (manic depression)</td>
<td>1</td>
</tr>
<tr>
<td>Body dysmorphic disorder</td>
<td>3</td>
</tr>
<tr>
<td>Borderline personality disorder</td>
<td>1</td>
</tr>
<tr>
<td>Depression</td>
<td>31</td>
</tr>
<tr>
<td>Eating disorders</td>
<td></td>
</tr>
<tr>
<td>Anorexia nervosa</td>
<td>2</td>
</tr>
<tr>
<td>Binge eating</td>
<td>2</td>
</tr>
<tr>
<td>Bulimia</td>
<td>3</td>
</tr>
<tr>
<td>Muscle dysmorphia</td>
<td>2</td>
</tr>
<tr>
<td>Trichotillomania</td>
<td>1</td>
</tr>
</tbody>
</table>

*Note.* \(N = 648\).
A sample was generated by emailing an invitation to participate to all staff and students of Southern Cross University, and posting invitations to participate on social networking sites. Threads containing invitations to participate were created in various Australian online bodybuilding forums, with the permission of forum moderators. However, this was not well received by some active forum members as the thread and survey were created by a female who was not part of the bodybuilding community. Invitations to participate were posted on the walls of the researcher’s Facebook friends or on the walls of relevant Facebook profiles and pages—for example profiles and pages dedicated to bodybuilding, gyms, and supplement stores, if these pages and profiles were open to the public. If these pages and profiles were not open to the public, then private messages were sent asking to place the invitation and link to the survey on their Facebook wall. The invitations posted on Facebook walls and the private messages that were sent on Facebook were well received. Due to funding constraints, no advertisements were placed on Facebook. The cost of the online survey was therefore nil. It is not known whether participants found the link to the survey on Facebook, online bodybuilding forums, or via the Southern Cross University bulk email system to all staff and students, as the survey was completed anonymously.

Seventy percent of surveys that were started (n = 880) were completed (n = 617). One hundred and seventy (19.3%) participants dropped out of the survey without having answered any questions. The highest number of drop outs (n = 44, 5.0%) occurred after answering the question “have you been diagnosed with an eating disorder or body dysmorphic disorder or obsessive compulsive disorder or depression in the past?”

Most participants (n = 555, 63.1%) completed the survey in 9 minutes, 252 (28.6%) participants completed the survey in 18 minutes, and 60 (6.8%) participants took longer than 18 minutes to complete the survey. The longest time to complete a survey was 3 hours 27 minutes (n = 2, 0.2%).

### 4.3.1.2 Prevalence of muscle dysmorphia symptoms.

The survey results indicated that 110 (17.0%) participants were at risk of having MD. It was found that 152 (23.5%) participants had high scores (i.e., above the 75th percentile) in one subscale of the MASS, 85 (13.1%) participants had high scores in two subscales, 62 (9.6%) participants had high scores in three subscales, 34 (5.2%) participants had high scores in four subscales, and 14 (2.2%) participants had high scores in all five subscales of the MASS. The mean score of the MASS for the total sample was 66.50 (SD = 19.05). The mean score for the total sample on the subscale of Bodybuilding Dependence was 18.46 (SD = 6.21), Muscle
Checking 11.62 (SD = 5.47), Substance Use 12.43 (SD = 5.55), Injury Risk 11.63 (SD = 4.40), and Muscle Satisfaction 12.61 (SD = 4.24).

The majority of participants had moderate scores in all five of the subscales of the MASS. There were 138 participants with high scores in the Bodybuilding Dependence subscale, 154 participants with high scores in the Muscle Checking subscale, 146 in the Substance Use subscale, 140 in the Injury Risk subscale, and 136 participants with high scores in the Muscle Satisfaction subscale (see Table 17). Refer to section 3.2.4.2 for information on the MASS scoring.

Table 17

*The Number of Participants (%) who had Low, Moderate, and High Scores in the Subscales of the Muscle Appearance Satisfaction Scale*

<table>
<thead>
<tr>
<th>Subscale of the MASS</th>
<th>Low score, n (%)</th>
<th>Moderate Score, n (%)</th>
<th>High score, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bodybuilding Dependence</td>
<td>178 (27.5)</td>
<td>326 (50.3)</td>
<td>138 (21.3)</td>
</tr>
<tr>
<td>Muscle Checking</td>
<td>172 (26.5)</td>
<td>317 (48.9)</td>
<td>154 (23.8)</td>
</tr>
<tr>
<td>Substance Use</td>
<td>166 (25.6)</td>
<td>333 (51.4)</td>
<td>146 (22.5)</td>
</tr>
<tr>
<td>Injury Risk</td>
<td>164 (25.3)</td>
<td>340 (52.5)</td>
<td>140 (21.6)</td>
</tr>
<tr>
<td>Muscle Satisfaction</td>
<td>176 (27.2)</td>
<td>333 (51.4)</td>
<td>136 (21.0)</td>
</tr>
</tbody>
</table>

*Note.* Low score = below the 25th percentile; Moderate score = between the 25th and 75th percentiles; High score = above the 75th percentile.

4.3.1.3 Prevalence of body dysmorphic disorder symptoms.

The survey results indicated that 69 (10.6%) of participants were at risk of having BDD. Of the 648 participants, 168 (25.9%) participants answered yes to both parts of Question 1. Of the 168 participants who continued with the BDDQ, 86 (51.2%) of the participants said that the problem with how they look did upset them a lot, 98 (58.3%) participants stated that it has gotten in the way of doing things with friends, dating, relationships with people, or social activities (see Table 18). It had caused problems with school, work, or other activities for 58 (34.5%) participants, and 90 (53.6%) participants were avoiding things because of how they look. On an average day, 51 (30.4%) participants were thinking about how they look one to
three hours per day, while 21 (12.5%) participants were thinking about it more than three hours a day, as shown in Table 18.

Table 18

Responses of Participants to the Questions of the Body Dysmorphic Disorder Questionnaire that are Indicative of Body Dysmorphic Disorder

<table>
<thead>
<tr>
<th>Description of question</th>
<th>Yes, n (%)</th>
<th>No, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you worried about how you look?</td>
<td>413 (63.7)</td>
<td>235 (36.3)</td>
</tr>
<tr>
<td>Thinking about appearance problems a lot and wish you could think about it less?</td>
<td>168 (25.9)</td>
<td>480 (74.1)</td>
</tr>
<tr>
<td>Has the problem with how you look upset you a lot?</td>
<td>86 (51.2)</td>
<td>82 (48.8)</td>
</tr>
<tr>
<td>Has it gotten in the way of doing things with friends, dating, your relationships with people, or your social activities?</td>
<td>98 (58.3)</td>
<td>70 (41.7)</td>
</tr>
<tr>
<td>Has it caused you any problems with school, work, or other activities?</td>
<td>58 (34.5)</td>
<td>110 (65.5)</td>
</tr>
<tr>
<td>Are there things you avoid because of how you look?</td>
<td>90 (53.6)</td>
<td>78 (46.4)</td>
</tr>
<tr>
<td>Think 1–3 hours a day about how you look</td>
<td>51 (30.4)</td>
<td>117 (69.6)</td>
</tr>
<tr>
<td>Think more than 3 hours a day about how you look?</td>
<td>21 (12.5)</td>
<td>147 (87.5)</td>
</tr>
</tbody>
</table>

The participants reported the body area of concern on the BDDQ, as shown in Table 19. The most frequent preoccupations were the stomach area, skin imperfections, and legs.
Table 19

Appearance Concerns of Participants as Indicated on the Body Dysmorphic Disorder Questionnaire. Participants Were Allowed to Report More Than One Appearance Concern

<table>
<thead>
<tr>
<th>Participants (n)</th>
<th>Body area of concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Arms</td>
</tr>
<tr>
<td>7</td>
<td>Back</td>
</tr>
<tr>
<td>8</td>
<td>Body hair</td>
</tr>
<tr>
<td>4</td>
<td>Body height</td>
</tr>
<tr>
<td>6</td>
<td>Buttocks</td>
</tr>
<tr>
<td>25</td>
<td>Chest</td>
</tr>
<tr>
<td>2</td>
<td>Chin</td>
</tr>
<tr>
<td>2</td>
<td>Ears</td>
</tr>
<tr>
<td>3</td>
<td>Feet</td>
</tr>
<tr>
<td>9</td>
<td>Genitals</td>
</tr>
<tr>
<td>17</td>
<td>Hair (head)</td>
</tr>
<tr>
<td>5</td>
<td>Jaw/jaw line</td>
</tr>
<tr>
<td>36</td>
<td>Legs</td>
</tr>
<tr>
<td>3</td>
<td>Lips</td>
</tr>
<tr>
<td>10</td>
<td>Nose</td>
</tr>
<tr>
<td>5</td>
<td>Shoulders</td>
</tr>
<tr>
<td>54</td>
<td>Skin (acne, paleness, wrinkles)</td>
</tr>
<tr>
<td>71</td>
<td>Stomach</td>
</tr>
<tr>
<td>11</td>
<td>Teeth</td>
</tr>
<tr>
<td>25</td>
<td>Whole body (overall shape and size)</td>
</tr>
</tbody>
</table>

Note. N = 648.
Table 20

The Impact the Appearance Concerns Had on the Participants’ Ways of Doing Things as Indicated on the Body Dysmorphic Disorder Questionnaire

<table>
<thead>
<tr>
<th>Participants (n)</th>
<th>How has it gotten in the way of doing things</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Avoid taking shirt off in front of other people</td>
</tr>
<tr>
<td>18</td>
<td>Lack of confidence</td>
</tr>
<tr>
<td>22</td>
<td>Less social</td>
</tr>
<tr>
<td>11</td>
<td>Negative impact on relationships (dating, sexual)</td>
</tr>
</tbody>
</table>

Note. N = 648.

Table 21

Activities That Participants Avoid as Indicated on the Body Dysmorphic Disorder Questionnaire

<table>
<thead>
<tr>
<th>Participants (n)</th>
<th>What do you avoid because of how you look?</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Avoid getting my photo taken</td>
</tr>
<tr>
<td>12</td>
<td>Social events</td>
</tr>
<tr>
<td>28</td>
<td>Swimming and beach because I do not want to take my shirt off</td>
</tr>
<tr>
<td>5</td>
<td>Undressing in front of someone else</td>
</tr>
<tr>
<td>3</td>
<td>Wearing certain clothes (e.g., tight clothes, sleeveless)</td>
</tr>
</tbody>
</table>

Note. N = 648.

4.3.1.4 Prevalence of eating disorder symptoms.

The survey results indicated that 219 (33.8%) participants were at risk of having an eating disorder. Fifty-six (8.6%) participants had a score at or above 20 on the 26 items of the EAT-26, while 205 (31.6%) participants were identified through the Behavioural questions of the EAT-26. Forty-two (6.5%) participants were identified through both the 26 items and the Behavioural questions of the EAT-26, while 14 (2.2%) participants were identified by the 26 items but not the Behavioural questions, and 163 (25.1%) participants were identified through the Behavioural questions but not the 26 items. Seventy-six (11.7%) participants were
identified through the binge eating question, 15 (2.3%) through the vomit question, 73 (11.3%) through the laxatives, diuretics question, 30 (4.6%) through the exercise question, and 109 (16.8%) through the weight loss question, as seen in Table 22.

Table 22

*The Number (%) of Participants Who Responded Affirmative to the Behaviour Questions of the 26-Item Eating Attitudes Test*

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Once 2–3 times</th>
<th>Once 2–6 times</th>
<th>Once a day or more</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a month or less</td>
<td>a month</td>
<td>a week</td>
<td>a week</td>
</tr>
<tr>
<td>Binge</td>
<td>34 (5.2%)</td>
<td>29 (4.5%)</td>
<td>13 (2.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Vomit</td>
<td>8 (1.2%)</td>
<td>2 (0.3%)</td>
<td>4 (0.6%)</td>
<td>1 (0.2%)</td>
</tr>
<tr>
<td>Laxatives,</td>
<td>40 (6.2%)</td>
<td>11 (1.7%)</td>
<td>5 (0.8%)</td>
<td>13 (2.0%)</td>
</tr>
<tr>
<td>diuretics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exercise</td>
<td></td>
<td></td>
<td></td>
<td>30 (4.6%)</td>
</tr>
<tr>
<td>Lost 9 kg or</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>more</td>
<td>Yes = 109</td>
<td>(16.8%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. N = 648.*

Spearman rank order correlation indicated a medium correlation between the 26 items of the EAT-26 and the Behaviour questions of the EAT-26, $r_s = .389$, $n = 574$, $p < .001$. 
4.3.1.5 Factors contributing to symptoms of muscle dysmorphia, body dysmorphic disorder, and eating disorders.

Mann-Whitney U tests revealed no significant differences in the age, weight lifting years, or weight lifting sessions per day of the participants between groups (see Table 23). Mann-Whitney U tests revealed group differences in the number of weight lifting days per week, as shown in Table E33 (see Appendix E). A significant difference was revealed between groups with MD only and eating disorders only in the number of weight lifting days per week, $U = 1823.000$, $z = -2.823$, $p < .001$, $r = .21$.

No significant associations were found between in relationship status, sexual orientation, ethnic origin, or cosmetic surgery in the past or future, of the participants between groups (see Table 23). However, a Fisher's Exact test revealed a significant association between having been diagnosed with a mental disorder in the past and whether participants were being at risk of BDD or not, $\chi^2 (1, n = 643) = 36.836$, $p < .001$, phi = -.239. A Fisher’s Exact test revealed a significant association between having been diagnosed with a mental disorder in the past and whether participants were at risk of symptoms of MD and BDD or not, $\chi^2 (1, n = 643) = 29.949$, $p < .001$, phi = -.216. A Fisher’s Exact test revealed a significant association between participants having been diagnosed with a mental disorder in the past and whether participants were at risk of symptoms of MD and BDD and eating disorders or not, $\chi^2 (1, n = 643) = 17.568$, $p < .001$, phi = -.165.
Table 23

Statistical Comparisons of Demographic Factors Across Groups of Participants With, and Without, Symptoms of Muscle Dysmorphia, Body Dysmorphic Disorder, and Eating Disorders

<table>
<thead>
<tr>
<th></th>
<th>No Disorder</th>
<th>MD only</th>
<th>BDD only</th>
<th>EAT only</th>
<th>MD &amp; BDD only</th>
<th>MD &amp; EAT</th>
<th>BDD &amp; EAT</th>
<th>MD &amp; BDD &amp; EAT</th>
<th>χ² (df)</th>
<th>p</th>
<th>99% CI</th>
<th>r/φc</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, mean (SD)</strong></td>
<td>30.4 (10.7)</td>
<td>26.5 (8.2)</td>
<td>23.2 (3.6)</td>
<td>29.9 (9.7)</td>
<td>29.7 (8.6)</td>
<td>27.4 (8.2)</td>
<td>27.0 (7.7)</td>
<td>26.8 (8.9)</td>
<td>14.096</td>
<td></td>
<td>(7, 541)</td>
<td>.61</td>
</tr>
<tr>
<td><strong>Relationship status</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single, n (%)</td>
<td>137 (37.6)</td>
<td>15 (40.5)</td>
<td>7 (53.8)</td>
<td>51 (36.7)</td>
<td>6 (46.1)</td>
<td>18 (48.6)</td>
<td>10 (50.0)</td>
<td>15 (65.2)</td>
<td>15.707</td>
<td>.317</td>
<td></td>
<td>.113</td>
</tr>
<tr>
<td>Partnered, n (%)</td>
<td>143 (39.3)</td>
<td>14 (37.8)</td>
<td>4 (30.8)</td>
<td>47 (33.8)</td>
<td>4 (30.8)</td>
<td>15 (40.5)</td>
<td>7 (35.0)</td>
<td>6 (26.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married, n (%)</td>
<td>84 (23.1)</td>
<td>8 (21.6)</td>
<td>2 (15.4)</td>
<td>41 (29.5)</td>
<td>3 (23.1)</td>
<td>4 (10.8)</td>
<td>3 (15.0)</td>
<td>2 (8.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sexual orientation</td>
<td>No Disorder</td>
<td>MD only</td>
<td>BDD only</td>
<td>EAT only</td>
<td>MD &amp; BDD</td>
<td>MD &amp; EAT</td>
<td>BDD &amp; EAT</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>$\chi^2$ (df)</td>
<td>p</td>
<td>LL</td>
<td>UL</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------</td>
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<td>----------------</td>
<td>--------------</td>
<td>------</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Heterosexual, n (%)</td>
<td>342 (94.7)</td>
<td>33 (91.7)</td>
<td>11 (84.6)</td>
<td>134 (97.1)</td>
<td>13 (100.0)</td>
<td>33 (89.2)</td>
<td>19 (95.0)</td>
<td>20 (87.0)</td>
<td>21.756 (14, 641)</td>
<td>.025</td>
<td>.147</td>
<td></td>
</tr>
<tr>
<td>Bisexual, n (%)</td>
<td>7 (1.9)</td>
<td>3 (8.3)</td>
<td>0 (0.0)</td>
<td>3 (2.2)</td>
<td>0 (0.0)</td>
<td>2 (5.4)</td>
<td>1 (5.0)</td>
<td>0 (0.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gay, n (%)</td>
<td>12 (3.3)</td>
<td>0 (0.0)</td>
<td>2 (15.4)</td>
<td>1 (0.7)</td>
<td>0 (0.0)</td>
<td>2 (5.4)</td>
<td>0 (5.0)</td>
<td>3 (13.0)</td>
<td></td>
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<tr>
<td>Ethnic origin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>64.016 (42, 647)</td>
<td>.002</td>
<td>.138</td>
<td></td>
</tr>
<tr>
<td>Caucasian, n (%)</td>
<td>326 (89.3)</td>
<td>27 (81.8)</td>
<td>12 (92.3)</td>
<td>110 (79.1)</td>
<td>13 (100.0)</td>
<td>32 (86.5)</td>
<td>19 (95.0)</td>
<td>14 (60.9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Indigenous Australian, n (%)</td>
<td>2 (0.6)</td>
<td>1 (3.0)</td>
<td>0 (0.0)</td>
<td>2 (1.4)</td>
<td>0 (0.0)</td>
<td>1 (2.7)</td>
<td>0 (0.0)</td>
<td>1 (4.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pacific Islander, n (%)</td>
<td>0 (0.0)</td>
<td>1 (3.0)</td>
<td>0 (0.0)</td>
<td>2 (1.4)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No Disorder</td>
<td>MD only</td>
<td>BDD only</td>
<td>EAT only</td>
<td>MD &amp; BDD</td>
<td>MD &amp; EAT</td>
<td>BDD &amp; EAT</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>$\chi^2$ (df)</td>
<td>p</td>
<td>LL</td>
<td>UL</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------</td>
<td>---------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
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<td>----------------</td>
<td>--------------</td>
<td>--------</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td>African, $n$ (%)</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.6)</td>
<td>(0.0)</td>
<td>(0.0)</td>
<td>(0.7)</td>
<td>(0.0)</td>
<td>(2.7)</td>
<td>(0.0)</td>
<td>(0.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bi-racial, $n$ (%)</td>
<td>11</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3.0)</td>
<td>(12.1)</td>
<td>(0.0)</td>
<td>(3.6)</td>
<td>(0.0)</td>
<td>(2.7)</td>
<td>(0.0)</td>
<td>(0.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other, $n$ (%)</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.7)</td>
<td>(0.0)</td>
<td>(0.0)</td>
<td>(2.9)</td>
<td>(0.0)</td>
<td>(2.7)</td>
<td>(0.0)</td>
<td>(21.7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight lifting years, mean (SD)</td>
<td>6.1 (7.7)</td>
<td>5.0 (5.6)</td>
<td>3.5 (3.2)</td>
<td>6.1 (7.1)</td>
<td>5.1 (3.1)</td>
<td>5.5 (6.1)</td>
<td>3.4 (2.3)</td>
<td>2.7 (3.3) (7, 648)</td>
<td>8.221 (7, 648)</td>
<td>.309</td>
<td>.297</td>
<td>.321</td>
</tr>
<tr>
<td>Cosmetic surgery in past</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20.071 (7, 647)</td>
<td>.002</td>
<td></td>
<td></td>
<td>.192</td>
</tr>
<tr>
<td>yes, $n$ (%)</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.1)</td>
<td>(2.7)</td>
<td>(7.7)</td>
<td>(2.2)</td>
<td>(7.7)</td>
<td>(13.5)</td>
<td>(5.0)</td>
<td>(4.4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no, $n$ (%)</td>
<td>361</td>
<td>36</td>
<td>12</td>
<td>136</td>
<td>12</td>
<td>32</td>
<td>19</td>
<td>22</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(98.9)</td>
<td>(97.3)</td>
<td>(92.3)</td>
<td>(97.8)</td>
<td>(92.3)</td>
<td>(86.5)</td>
<td>(95.0)</td>
<td>(95.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cosmetic surgery future</td>
<td>No Disorder</td>
<td>MD only</td>
<td>BDD only</td>
<td>EAT only</td>
<td>MD &amp; BDD</td>
<td>MD &amp; EAT</td>
<td>BDD &amp; EAT</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>$\chi^2$ (df)</td>
<td>$p$</td>
<td>LL</td>
<td>UL</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------</td>
<td>---------</td>
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<td>----------------</td>
<td>-------------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>yes, $n$ (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18.866</td>
<td>.004</td>
<td>.177</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11 (3.0)</td>
<td>3 (8.1)</td>
<td>1 (7.7)</td>
<td>8 (5.8)</td>
<td>0 (0.0)</td>
<td>5 (13.5)</td>
<td>3 (15.0)</td>
<td>4 (17.4)</td>
<td>(7, 646)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no, $n$ (%)</td>
<td>353 (97.0)</td>
<td>34 (91.9)</td>
<td>12 (92.3)</td>
<td>131 (94.2)</td>
<td>13 (100.0)</td>
<td>32 (86.5)</td>
<td>17 (85.0)</td>
<td>19 (82.6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosed with mental</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>33.456</td>
<td>&lt; .001</td>
<td>.252</td>
<td></td>
</tr>
<tr>
<td>disorder</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(7, 643)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>yes, $n$ (%)</td>
<td>37 (10.2)</td>
<td>6 (16.2)</td>
<td>4 (30.8)</td>
<td>16 (11.6)</td>
<td>6 (46.2)</td>
<td>4 (10.8)</td>
<td>6 (30.0)</td>
<td>10 (43.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no, $n$ (%)</td>
<td>325 (89.8)</td>
<td>31 (83.8)</td>
<td>9 (69.2)</td>
<td>122 (88.4)</td>
<td>7 (53.8)</td>
<td>33 (89.2)</td>
<td>14 (70.0)</td>
<td>13 (56.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight lifting days per</td>
<td>4.0 (5.0)</td>
<td>5.0 (4.0)</td>
<td>4.0 (5.0)</td>
<td>4.0 (5.0)</td>
<td>4.0 (5.0)</td>
<td>4.0 (5.0)</td>
<td>5.0 (5.0)</td>
<td>5.0 (5.0)</td>
<td>46.102</td>
<td>&lt; .001</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>week (median)</td>
<td>(7, 648)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight lifting sessions per</td>
<td>1.0 (1.0)</td>
<td>1.0 (1.0)</td>
<td>1.0 (1.0)</td>
<td>1.0 (1.0)</td>
<td>1.0 (1.0)</td>
<td>1.0 (1.0)</td>
<td>1.0 (1.0)</td>
<td>1.0 (1.0)</td>
<td>11.062</td>
<td>.133</td>
<td>.124</td>
<td>.142</td>
</tr>
<tr>
<td>day (median)</td>
<td>(7, 645)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*Note.* CI = confidence interval; LL = lower limit, UL = upper limit; MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.


4.3.2 Discussion.

4.3.2.1 Prevalence of muscle dysmorphia symptoms.

The present study found that 17.0% \( (n = 110) \) participants were at risk of MD. Previous studies have reported 10.0%–53.6% of participants were at increased risk of having MD (e.g., Babusa et al., 2015; Chaney, 2008; Hitzeroth et al., 2001; Maida & Armstrong, 2005; H. G. Pope et al., 1997; Sandhu et al., 2013). Muscle dysmorphia research participants have typically consisted of male competitive bodybuilders (AAS user and nonuser), non-competitive bodybuilders, power lifters, weight lifters (AAS user and nonuser), college athletes and non-athletes, and university students. Approximately 49.0% of the studies had participants involved in power or strength sports (including weight lifting), and in 23.0% of the studies the participants were university students. Muscle dysmorphia was first discovered in a sample of male bodybuilders (H. G. Pope et al., 1993); and MD has been found to be associated with bodybuilding activities (Babusa & Tury, 2012; Baghurst & Lirgg, 2009; Cella, Iannaccone, & Cotrufo, 2012; Giardino & Procidano, 2012; Hildebrandt et al., 2006; Hitzeroth et al., 2001; Skemp, Mikat, Schenck, & Kramer, 2013), such as long hours of lifting weights, as stipulated in the proposed MD criteria (H. G. Pope et al., 1997). It would thus be expected that samples consisting of bodybuilders and weight lifters would exhibit increased symptoms of MD compared to samples of university students.

There are currently no cut-off scores for MD questionnaires as established with a clinical population; nonetheless, higher scores indicate higher risk for MD. This makes the identification of participants at risk of MD problematic when utilising MD questionnaires, as researchers have to decide on a method for establishing a cut-off point for detecting MD. Due to the lack of standardised procedures for diagnosing individuals with MD (Tod & Lavallee, 2010), the rates of participants at risk of MD might not be comparable.

Muscle dysmorphia is often seen as an attempt to pathologise bodybuilding and recreational weight lifting (Olivardia, 2001). However, normal sport participation and dedication to one’s sport are not associated with MD symptoms such as body dissatisfaction, and impaired social and occupational functioning (H. G. Pope et al., 1997). It is widely acknowledged that exercise, including weight training, has a number of psychological and health benefits (Daley, 2008; A. Thomas et al., 2014; W. R. Thompson et al., 2010), especially given the increasing prevalence of obesity and sedentary lifestyle (Olivardia, 2001). Although MD has been found to be associated with bodybuilding activities such as weight
lifting, as stated earlier, this does not mean that most weight lifters have MD. As noted in this study, most participants had moderate scores in all five of the subscales of the MASS (see Table 17). Weight lifting is normally a healthy activity, with MD only occurring when weight lifting becomes an obsession.

4.3.2.2 Prevalence of body dysmorphic disorder symptoms.

The percentage of participants (10.6%, n = 69) who were at risk of having BDD was much higher in the present study compared to the percentage (0.7%–2.4%) of individuals affected with BDD in the general population (Buhlmann et al., 2010; Faravelli et al., 1997; Koran et al., 2008; Rief et al., 2006), but was comparable with rates reported in student populations, which have ranged from 5.0% (Bohne, Wilhelm, et al., 2002; Cansever, Uzun, Donmez, & Ozashin, 2003) to 13.0% (Biby, 1998). It could be speculated that the high rate of BDD symptoms might be due to the nature of the sample studied, as BDD rates vary significantly depending on the sample population, the assessment methods, and sample size (Buhlmann et al., 2010). Alternatively, the high rate of BDD symptoms might be because the BDDQ, a self-report screening tool, was used in the present study. It is possible that participants may be more willing to disclose their specific BDD concerns in a survey (Buhlmann et al., 2010) compared to in-person interviews that are usually conducted in making a clinical diagnosis of BDD. Body dysmorphic disorder may be difficult to diagnose, and is often underdiagnosed (Phillips, 2004). Individuals with BDD might be reluctant to discuss their appearance concerns, as they may be ashamed of their BDD symptoms (Buhlmann et al., 2010). The BDDQ can be used to assess the presence of BDD symptoms (Phillips et al., 1995), but not for making a clinical diagnosis of BDD.

The appearance concerns listed most in the current study (see Table 19) were muscle related body areas, such as stomach (n = 71), legs (n = 36), chest (n = 25), whole body (n = 25), and arms (n = 19). The appearance concerns listed most for non-muscle related body areas were skin (n = 54), hair (on head, n = 17), teeth (n = 11), nose (n = 10), genitals (n = 9), and body hair (n = 8). This is in agreement with previous studies conducted in Germany, Italy, and the USA. A German population-based survey reported men frequently disliked body areas consisting of stomach, skin, hips/buttocks, hair, and nose (Buhlmann et al., 2010). An American study found that men frequently disliked their skin, hair, nose, stomach, teeth, chest, and face (Phillips et al., 2006), as seen in Table 4. An Italian study indicated that men frequently listed excessive body hair, height, and genitals as appearance concerns (Perugi et
al., 1997), as seen in Table 4. In the USA, Phillips et al. (2006) found that men frequently disliked their skin, hair, nose, stomach, teeth, chest, and face (see Table 4), and C. G. Pope et al. (2005) found that men with comorbid BDD and MD reported musculature as the most common area of concern, followed by hair and skin.

Participants in the current study indicated that their appearance concerns had gotten in the way of doing things, for example being less social, lacking confidence, avoiding taking their shirts off in front of other people, and a negative impact on relationships (see Table 20). Participants indicated they avoided social events because of their appearance concerns. They also avoided swimming and the beach because they did not want to take their shirts off (see Table 21). Hiding the perceived defect is a symptom of BDD (Cororve & Gleaves, 2001), and in this instance the perceived defect might be an insufficiently muscular body build.

Research found that men’s bodily dissatisfaction can occur along three main dimensions, consisting of physical attractiveness, upper body strength, and physical condition (Franzoi & Shields, 1984). Physical attractiveness refers to the face and facial features, upper body strength refers to the muscle groups that men typically focus on when aiming to increase musculature, and physical conditioning refers to physical fitness (Franzoi & Shields, 1984). It appears as if participants in the current study experienced bodily dissatisfaction in physical attractiveness and upper body strength, based on the appearance concerns listed most (see Table 19). Researchers suggested that physical attractiveness can be improved with cosmetic surgery, and upper body strength can be improved through weight lifting (Mishkind et al., 1986). The survey in the current study revealed that 2.6% \((n = 17)\) of the participants had cosmetic surgery in the past, and 5.4% \((n = 35)\) were planning on having cosmetic surgery in the future (see Table 15). The participants in the current study were engaged in weight lifting three or more days per week. It can be speculated that participants in the current study had cosmetic surgery in the past in an attempt to improve physical attractiveness, and were engaged in weight lifting three or more days per week in an attempt to increase upper body strength.

Research indicated that, while men reported being satisfied with their muscles, they were not satisfied with their body shapes, suggesting that men might compartmentalise different parts of their bodies (Ey, 2009). Young men tend to focus on the upper body, especially the chest and arms, when they want to increase musculature (e.g., McCreary et al., 2006; Ridgeway & Tylka, 2005), as it is in full view of the individual which makes it easier for self-assessment of muscle development (McCreary et al., 2006). The ideal male body is
characterised by a muscular physique, with a well-developed chest and arm muscles, and broad shoulders tapering down to a narrow waist (Grogan, 2008; Maisey et al., 1999; Mishkind et al., 1986; Schooler & Ward, 2006; M. Watt & Ricciardelli, 2012). The ideal male body represents a high degree of difficulty, and likely even an impossibility, for most of the male population to achieve. It might be that most people do not know what normal men’s bodies look like, as (particularly) the media’s representation of this unrealistic ideal physique may have replaced actual knowledge of what is considered a normal man’s body (Donaghue & Smith, 2008). It is suggested that a difference between the body ideal and the body reality might cause some men to become obsessively preoccupied with weight lifting and dieting (H. G. Pope et al., 1997), and may leave them at increased risk of eating disorders (Mishkind et al., 1986).

4.3.2.3 Prevalence of eating disorder symptoms.

Results of the current study indicated that 33.8% (n = 219) participants were at risk of having an eating disorder. It could be speculated that the high rate of eating disorder symptoms might be due to the nature of the sample studied. Research indicated that male recreational gym users (Stapleton, McIntyre, & Bannatyne, 2014), and serious recreational and competitive bodybuilders may be at increased the risk of eating disorders (Goldfield et al., 1998; Helms, Aragon, & Fitschen, 2014). While bulimia nervosa, binge eating, strict dieting and eating-related disturbances are common among competitive male bodybuilders (Helms et al., 2014), little research has examined eating disturbances in this population (Goldfield et al., 1998).

This study identified participants at risk of an eating disorder through the 26 questions and Behavioural questions of the EAT-26. Previous research (e.g., Jennings et al., 2006; Lamanna et al., 2010; Le Grange et al., 2004; Liao et al., 2010) utilised only the 26 questions of the EAT-26 to identify participants at risk of eating disorders. If the current research project had utilised only the 26 questions of the EAT-26, the percentage of participants identified as being at risk of eating disorders would have been 8.6%, instead of 33.8%. Spearman rank order correlation indicated a medium significant correlation between the 26 questions of the EAT-26 and the Behaviour questions of the EAT-26, $r_s = .389$, $n = 574$, $p < .001$.

A total of 11.7% (n = 76) participants were identified as being at risk of an eating disorder through the binge eating question (as seen in Table 22). This was in agreement with previous research reporting 16.0% of recreational male bodybuilders and 33.3% of competitive male
bodybuilders engaging in binge eating once weekly; and 12.0% of recreational male bodybuilders and 18.5% of competitive male bodybuilders engaging in binge eating twice weekly (Goldfield et al., 2006). Polivy and Herman (1985) explained that restraint theory predicts that strict dieting, either by calorie restriction or by avoiding forbidden foods, would predispose individuals to binge eating by increasing deprivation of the desired forbidden foods or by decreasing sensitivity to internal cues such as hunger and satisfaction.

As seen in Table 22, the results from the present study indicated that 11.3% of participants engaged in purging behaviour (i.e., used diuretics and laxatives). Goldfield et al. (2006) reported 8.0% of recreational male bodybuilders and 18.5% of competitive male bodybuilders used diuretics, and 8.0% of recreational male bodybuilders and 4.0% of competitive male bodybuilders used laxatives for weight loss.

None of the recreational male bodybuilders or competitive male bodybuilders reported vomiting as a means of losing weight (Goldfield et al., 2006), while 2.3% of participants in the present study indicated that they used vomiting as a means to control their weight or shape (see Table 22).

Results from the current study indicated that 4.6% of participants exercised more than 60 minutes a day to lose or to control their weight, and 16.8% of participants had lost 9 kilograms or more in the past six months, as seen in Table 22. Goldfield et al. (2006) reported that 60.0% of recreational male bodybuilders and 55.5% of competitive male bodybuilders used vigorous exercise as a weight loss method, but did not specify how often they exercised for weight loss.

Researchers suggested that masculinity oriented disordered eating behaviours include very high levels of protein consumption, severe restriction of non-protein related dietary components (e.g., carbohydrates and fats), interrupting important activities to accommodate frequent eating (eating every 2 to 3 hours), continued food consumption despite feeling full, consuming a large proportion of calories in liquid (blended) form, and the use of appearance enhancing drugs such as supplements, testosterone boosters and AAS (Mosley, 2009; Murray, Rieger, et al., 2012). Harvey and Robinson (2003) cautioned that the traditional way of identifying eating disorders in men may not be effective anymore. It seems sensible to look at the cause of the disordered eating (Harvey & Robinson, 2003). Some men may engage in disordered eating behaviours as a method of coping with the pressure to attain the ideal male physique (Stapleton et al., 2014). Research has indicated that male bodybuilders and men with bulimia nervosa were similar in using vigorous exercise, strict dieting, or diuretics to
lose weight or fat (Goldfield et al., 2006), and that recreational gym users (Stapleton et al., 2014), and serious recreational and competitive bodybuilders may be at increased risk of eating disorders (Goldfield et al., 1998; Helms et al., 2014).

Nunes, Camey, Olinto, and Mari (2005) suggested that some of the items in the EAT-26—an instrument developed in the early 1980s—reflect eating habits that have since become fairly common and thus might no longer be indicative of an eating disorder. The present conceptualisation of disordered eating is concerned with thinness, weight loss and calorie restriction, and not with increased muscularity and increased calorie consumption (Griffiths, Murray, & Touyz, 2013). Many eating disorder assessment tools have been developed for use with women, and may be problematic when used with men as they do not adequately assess the different concerns of men (Cafri & Thompson, 2004; McCabe & Ricciardelli, 2004). Nevertheless, research has found that eating disorder assessment tools are valid and acceptable for men, although the scores may be less reliable (Boerner et al., 2004). It should also be taken into consideration that the high rate of eating disorder symptoms might be because the EAT-26, a self-report screening tool, was used in the present study to assess the presence of eating disorder symptoms. It was used to assess individuals who might be at risk of having eating disorders, but not for making a clinical diagnosis of an eating disorder.

4.3.2.4 Factors contributing to symptoms of muscle dysmorphia, body dysmorphic disorder, and eating disorders.

No significant differences were found in the age, weight lifting years, or weight lifting sessions per day of the participants between groups with, and without, symptoms of MD, BDD, and eating disorders (see Table 23). No significant associations were found in relationship status, ethnic origin, sexual orientation, and cosmetic surgery (past and planned) of the participants between groups with, and without, symptoms of MD, BDD, and eating disorders (see Table 23).

The current study found significant differences in the number of weight lifting days per week of participants between groups (see Table 23). In particular, participants at risk of MD only were significantly different from participants at risk of eating disorders only. Also, participants at risk of both MD and eating disorders were significantly different from participants at risk of BDD only, and at risk of eating disorders only. Long hours of weight lifting is a characteristic behaviour associated with MD (H. G. Pope et al., 1997), and behaviours associated with BDD include excessive exercise, dieting, using AAS, and
measuring, touching or looking at the body part that may be perceived as flawed (Phillips et al., 1994). Individuals with BDD and with MD symptoms are also more likely to weight train excessively, and have a strict diet, compared to those with BDD but without MD symptoms (C. G. Pope et al., 2005).

The current study found significant associations between: having been diagnosed with a mental disorder in the past and whether participants were at risk of BDD or not, whether participants were at risk of MD and BDD or not, and whether participants were at risk of MD and BDD and eating disorders or not (see Table 23). This is in support of previous research reporting comorbid diagnoses of mental disorders and past diagnoses of mental disorders. Body dysmorphic disorder is often comorbid with obsessive compulsive disorder, substance abuse or dependence, major depression, social phobia (Phillips et al., 1998; Phillips, Menard, Fay, & Weisberg, 2005), and MD (C. G. Pope et al., 2005). Individuals with MD may be susceptible to depression (McFarland & Kaminski, 2009). Studies had found that 18 of 193 participants (H. G. Pope et al., 1997), and 14 of 63 men (C. G. Pope et al., 2005) with BDD had MD. Another study found that 5 of 15 participants with MD also displayed other classic BDD symptoms, in contrast to none of the 13 participants without MD (Hitzeroth et al., 2001). One study found that 29.0% of male participants with MD had a history of an eating disorder (Olivardia et al., 2000).

4.4 Can Symptoms of Muscle Dysmorphia be Differentiated From Symptoms of Body Dysmorphic Disorder and Eating Disorders?

4.4.1 Results.

4.4.1.1 Demographic characteristics of participants.
Refer to section 4.3.1.1 for demographic characteristics of participants.

4.4.1.2 Symptomatology of muscle dysmorphia, body dysmorphic disorder, and eating disorders.
As shown in Table 24, cross tabulations indicated that 36 (5.6%) participants were at risk of having both MD and BDD, while 60 (9.3%) participants were at risk of having both MD and an eating disorder. Forty-three (6.6%) participants were at risk of having both BDD and an eating disorder.
Table 24

Cross Tabulations Indicating Participants at Risk of Having Muscle Dysmorphia, and/or Body Dysmorphic Disorder, and/or an Eating Disorder

<table>
<thead>
<tr>
<th></th>
<th>MD No</th>
<th>MD Yes</th>
<th>BDD No</th>
<th>BDD Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD No</td>
<td>–</td>
<td>–</td>
<td>505</td>
<td>33</td>
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<tr>
<td>MD Yes</td>
<td>–</td>
<td>–</td>
<td>74</td>
<td>36</td>
</tr>
<tr>
<td>BDD No</td>
<td>379</td>
<td>403</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>BDD Yes</td>
<td>159</td>
<td>176</td>
<td>60</td>
<td>43</td>
</tr>
</tbody>
</table>

Note. MD = Muscle dysmorphia; BDD = Body dysmorphic disorder; EAT = Eating disorder. N = 648.

Loglinear analysis was used to find associations between MD, BDD, and eating disorder variables. The three-way loglinear analysis produced a final model that retained the two-way interactions between MD and BDD, MD and eating disorders, and BDD and eating disorders. The likelihood ratio of the highest-order interactions (MD x BDD x eating disorders) model was not significant, $\chi^2(2.191) = 1, p = .139$. The likelihood ratio of the two-way interactions (MD by BDD; MD by eating disorders; and BDD by eating disorders) model was significant, $\chi^2(90.820) = 3, p < .001$. To break down this effect, separate Chi-square tests on the MD, BDD and eating disorder variables were performed. Significant associations were found between MD and BDD, $\chi^2(67.885) = 1, p < .001$, and MD and eating disorders, $\chi^2(25.494) = 1, p < .001$. The main effect of BDD was the most important effect in the model ($z = 12.192$). The odds of having symptoms of MD as well as symptoms of BDD were $.49$. The odds of having symptoms of MD as well as symptoms of eating disorders were 1.2. The odds ratio was .41.

Mean scores and standard deviations of groups of participants at risk of, and not at risk of, MD, BDD, and eating disorders on the subscales of the MASS, the total score of the MASS, and the total score of the EAT-26, are shown in Table 25. Participants at risk of MD, BDD, and eating disorders reported the highest mean score on the MASS total score, Bodybuilding Dependence subscale, Muscle Checking subscale, and Substance Use subscale. Participants
at risk of both MD and eating disorders reported the highest mean score on the Injury Risk subscale. On the Muscle Satisfaction subscale, participants at risk of MD only reported the highest mean score. Participants at risk of MD, BDD and eating disorders reported the highest mean score on the EAT-26 total score.

Table 25

*Mean (SD) Scores on the Muscle Appearance Satisfaction Scale Total Score, the Subscales of the Muscle Appearance Satisfaction Scale, and the 26-Item Eating Attitudes Test Total Scores*

<table>
<thead>
<tr>
<th>Measures</th>
<th>No disorder Mean (SD)</th>
<th>Only MD Mean (SD)</th>
<th>Only BDD Mean (SD)</th>
<th>Only EAT Mean (SD)</th>
<th>MD &amp; BDD Mean (SD)</th>
<th>MD &amp; EAT Mean (SD)</th>
<th>BD &amp; EAT Mean (SD)</th>
<th>MD &amp; BDD &amp; EAT Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MASS total score</td>
<td>67.39 (12.49)</td>
<td>87.75 (6.94)</td>
<td>72.17 (13.42)</td>
<td>66.77 (10.14)</td>
<td>96.87 (6.49)</td>
<td>91.75 (12.75)</td>
<td>68.80 (12.24)</td>
<td>98.09 (12.52)</td>
</tr>
<tr>
<td>Bodybuilding Dependence</td>
<td>19.24 (5.48)</td>
<td>24.25 (2.19)</td>
<td>20.08 (4.83)</td>
<td>17.61 (3.94)</td>
<td>26 (2.87)</td>
<td>23.12 (3.80)</td>
<td>19.85 (5.37)</td>
<td>26.67 (4.59)</td>
</tr>
<tr>
<td>Muscle Checking</td>
<td>11.54 (4.09)</td>
<td>12.37 (4.37)</td>
<td>14.67 (4.92)</td>
<td>12.27 (4.53)</td>
<td>17.75 (2.12)</td>
<td>17.87 (6.17)</td>
<td>12.45 (4.91)</td>
<td>18.95 (5.88)</td>
</tr>
<tr>
<td>Substance Use</td>
<td>12.00 (4.67)</td>
<td>18.50 (3.96)</td>
<td>13.00 (6.34)</td>
<td>11.04 (4.05)</td>
<td>21.00 (2.78)</td>
<td>19.12 (4.26)</td>
<td>10.95 (4.32)</td>
<td>20.52 (5.05)</td>
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<td>Injury Risk</td>
<td>10.70 (3.70)</td>
<td>16.00 (2.87)</td>
<td>10.83 (4.76)</td>
<td>11.08 (3.86)</td>
<td>16.00 (1.07)</td>
<td>16.25 (2.71)</td>
<td>11.05 (3.79)</td>
<td>15.38 (3.96)</td>
</tr>
<tr>
<td>Muscle Satisfaction</td>
<td>13.91 (3.01)</td>
<td>16.62 (3.70)</td>
<td>13.58 (3.55)</td>
<td>14.77 (3.88)</td>
<td>16.12 (3.68)</td>
<td>15.37 (4.27)</td>
<td>14.50 (4.73)</td>
<td>16.57 (3.99)</td>
</tr>
<tr>
<td>EAT-26 total score</td>
<td>5.42 (3.40)</td>
<td>9.37 (5.73)</td>
<td>11.92 (6.21)</td>
<td>12.38 (8.16)</td>
<td>8.00 (4.14)</td>
<td>15.12 (4.19)</td>
<td>19.60 (11.71)</td>
<td>24.86 (11.87)</td>
</tr>
</tbody>
</table>

*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.

Comparisons were calculated for groups of participants at risk of: (a) no disorder; (b) MD only; (c) BDD only; (d) eating disorders only; (e) both MD and BDD; (f) both MD and eating disorders; and (g) MD, BDD, and eating disorders—in order to meet the independence
assumption of the Mann-Whitney U tests, Chi-square tests, and Fisher’s Exact tests. See Tables E34–E45 in Appendix E for results of all group comparisons. However, the current discussion is limited to comparisons of the following groups: (a) at risk of MD only and BDD only, and (b) at risk of MD only and eating disorders only.

Mann-Whitney U tests revealed significant differences between groups with MD only and BDD only on the Bodybuilding Dependence subscale, $U = 81.500$, $z = -3.528$, $p < .001$, $r = .50$ (see Table E34), the Injury Risk subscale, $U = 77.000$, $z = -3.634$, $p < .001$, $r = .51$ (see Table 37), and the MASS total score, $U = 47.000$, $z = -4.284$, $p < .001$, $r = .61$ (see Table E39 in Appendix E).

Mann-Whitney U tests revealed significant differences between groups with MD only and eating disorders only on the Bodybuilding Dependence subscale, $U = 614.000$, $z = -7.097$, $p < .001$, $r = .54$ (see Table E34), the Muscle Checking subscale, $U = 866.500$, $z = -6.148$, $p < .001$, $r = .47$ (see Table E35), the Substance Use subscale, $U = 845.500$, $z = -6.251$, $p < .001$, $r = .47$ (see Table E36), Injury Risk subscale, $U = 858.000$, $z = -6.237$, $p < .001$, $r = .47$ (see Table E37), Muscle Satisfaction subscale, $U = 1226.500$, $z = -4.859$, $p < .001$, $r = .37$ (see Table E38), and the MASS total score, $U = 98.000$, $z = -8.933$, $p < .001$, $r = .68$ (see Table E39 in Appendix E).

Mann-Whitney U tests revealed no significant differences between groups on the EAT-26 total score, as shown in Table E40 (see Appendix E).

Chi-square tests and Fisher’s exact tests were used to explore the relationships between categorical variables (from the BDDQ) across groups of participants at risk of, and not at risk of, MD, BDD, and eating disorders. Chi-square tests revealed significant associations between “being worried about how you look” and whether participants were at risk of symptoms of MD only or not, $\chi^2 (1, n = 642) = 25.815$, $p < .001$, $phi = -.201$, whether participants were at risk of BDD only or not, $\chi^2 (1, n = 642) = 42.171$, $p < .001$, $phi = -.256$, and whether participants were at risk of eating disorders only or not, $\chi^2 (1, n = 642) = 16.140$, $p < .001$, $phi = -.159$ (see Table E41 in Appendix E).

Chi-square tests revealed significant associations between “thinking about your appearance problems a lot” and whether participants were at risk of symptoms of MD only or not, $\chi^2 (1, n = 412) = 19.894$, $p < .001$, $phi = -.220$, and whether participants were at risk of BDD only or not, $\chi^2 (1, n = 412) = 118.285$, $p < .001$, $phi = -.536$ (see Table E42 in Appendix E).

Chi-square tests revealed significant associations between “has it often upset you a lot” and whether participants were at risk of symptoms of MD only or not, $\chi^2 (1, n = 164) =$
14.039, \( p < .001 \), \( \phi = -.293 \), and whether participants were at risk of BDD only or not, \( \chi^2 (1, n = 164) = 26.899, p < .001, \phi = -.405 \) (see Table E43 in Appendix E).

Fisher’s Exact tests revealed significant associations between the “amount of time (you) spend thinking about how you look” and whether participants were at risk of symptoms of MD only or not, \( \chi^2 (2, n = 162) = 24.902, p = .001, \phi_c = .391 \), and whether participants were at risk of BDD only or not, \( \chi^2 (2, n = 162) = 188.356, p < .001, \phi_c = .964 \) (see Table E44 in Appendix E).

Spearman rank order and Point-biserial correlational analyses were undertaken to examine the correlations between MD, BDD, and eating disorder symptomatology (see Table E45 in Appendix E). A number of significant correlations were found. Full scale MD symptomatology was significantly correlated with eating disorder symptomatology \( (r_s = .411, p < .001) \) as identified through the EAT-26 total score. Full scale MD symptomatology was significantly correlated with BDD symptomatology \( (r_{pb} = .324, p < .001) \) as identified through the BDDQ, and with the BDDQ questions “has it upset you a lot” \( (r_{pb} = .211, p = .017) \) and “how much time do you think about it” \( (r_{pb} = .383, p < .001) \).

As seen in Table E45 (in Appendix E), the Bodybuilding Dependence subscale of the MASS was significantly correlated with eating disorder symptomatology \( (r_s = .274, p = .002) \) as identified through the EAT-26 total score. The Bodybuilding Dependence subscale of the MASS was significantly correlated with BDD symptomatology \( (r_{pb} = .315, p < .001) \) as identified through the BDDQ, with the “has it gotten in the way” \( (r_{pb} = -.219, p = .013) \) and “how much time do you think about it” \( (r_{pb} = .385, p < .001) \) questions of the BDDQ.

As seen in Table E45 (in Appendix E), the Muscle Checking subscale of the MASS was significantly correlated with BDD symptomatology \( (r_{pb} = .299, p = .001) \) as identified through the BDDQ, and with the “how much time do you think about it” question of the BDDQ \( (r_{pb} = .372, p < .001) \).

The Substance Use subscale of the MASS was significantly correlated with the laxatives, diuretics behavioural question of the EAT-26 \( (r_{pb} = .177, p = .045) \), as seen in Table E45 (in Appendix E). The Substance Use subscale of the MASS was significantly correlated with BDD symptomatology \( (r_{pb} = .218, p = .014) \) as identified through the BDDQ, and the “how much time do you think about it” question of the BDDQ \( (r_{pb} = .255, p = .005) \), but not with the “worried about how you look”, “do you think about it a lot”, “has it upset you a lot”, “has it gotten in the way”, “has it caused any problems”, and “are there things you avoid” questions of the BDDQ.
As seen in Table E45 (in Appendix E), the Injury Risk subscale of the MASS was significantly correlated with eating disorder symptomatology \( (r_s = .216, p = .014) \) as identified through the EAT-26 total score, and the vomit \( (r_{pb} = .196, p = .026) \), and exercise behavioural questions of the EAT-26 \( (r_{pb} = .226, p = .010) \). The Injury Risk subscale of the MASS was significantly correlated with BDD symptomatology \( (r_{pb} = .178, p = .045) \) as identified through the BDDQ, but not with any of the questions of the BDDQ.

The Muscle Satisfaction subscale of the MASS was significantly correlated with eating disorder symptomatology \( (r_s = .192, p = .030) \) as identified through the EAT-26 total score, with the binge eating behavioural question of the EAT-26 \( (r_{pb} = .184, p = .037) \), and with the lost ≥ 9 kg behavioural question of the EAT-26 \( (r_{pb} = -.184, p = .038) \), as seen in Table E45 (in Appendix E). The Muscle Satisfaction subscale of the MASS was significantly correlated with the “has it upset you a lot” \( (r_{pb} = -.186, p = .035) \) and “are there things you avoid” \( (r_{pb} = -.247, p = .005) \) questions of the BDDQ.

### 4.4.1.3 Psychometric properties of the Muscle Appearance Satisfaction Scale

The reliability and internal consistency of the MASS and its five subscales were tested. The MASS had good internal consistency \( (\alpha = .89) \). The subscales of the MASS had Cronbach’s alpha values ranging from .72 to .86 (see Table 26).

<table>
<thead>
<tr>
<th>Scale</th>
<th>Subscale</th>
<th>( \alpha )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscle Appearance Satisfaction Scale</td>
<td></td>
<td>.89</td>
</tr>
<tr>
<td></td>
<td>Bodybuilding dependence</td>
<td>.76</td>
</tr>
<tr>
<td></td>
<td>Muscle checking</td>
<td>.83</td>
</tr>
<tr>
<td></td>
<td>Substance use</td>
<td>.75</td>
</tr>
<tr>
<td></td>
<td>Injury risk</td>
<td>.72</td>
</tr>
<tr>
<td></td>
<td>Muscle satisfaction</td>
<td>.86</td>
</tr>
</tbody>
</table>
A final sample size of 636 (using listwise deletion) was analysed by CFA. With 209 data points and 70 unknown parameters (including the intercepts), the model was over-identified with 139 degrees of freedom. A schematic representation of the a priori hypothesized CFA model of factorial structure for the MASS is shown in Figure 10.
Figure 10. Schematic representation of the original 19-item five factor model of the Muscle Appearance Satisfaction Scale (Model 1).
Goodness-of-fit statistics based on robust maximum likelihood estimation for a first order three factor model for the a priori hypothesized MASS (Model 1) and for respecified models (2–5) are shown in Table 27.

Table 27

*Confirmatory Factor Analysis Goodness-Of-Fit Statistics for the Muscle Appearance Satisfaction Scale*

<table>
<thead>
<tr>
<th>Goodness-of-fit test</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square Test of Model Fit ($\chi^2$)</td>
<td>621.496</td>
<td>533.077</td>
<td>464.131</td>
<td>420.646</td>
<td>381.397</td>
</tr>
<tr>
<td>Degrees of freedom (df)</td>
<td>142</td>
<td>141</td>
<td>140</td>
<td>139</td>
<td>138</td>
</tr>
<tr>
<td>$\chi^2$/df ratio ($Q$)</td>
<td>4.4</td>
<td>3.8</td>
<td>3.3</td>
<td>3.0</td>
<td>2.8</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.073</td>
<td>.066</td>
<td>.060</td>
<td>.056</td>
<td>.053</td>
</tr>
<tr>
<td>CFI</td>
<td>.902</td>
<td>.920</td>
<td>.934</td>
<td>.942</td>
<td>.950</td>
</tr>
<tr>
<td>TLI</td>
<td>.882</td>
<td>.903</td>
<td>.919</td>
<td>.929</td>
<td>.938</td>
</tr>
<tr>
<td>SRMR</td>
<td>.054</td>
<td>.056</td>
<td>.047</td>
<td>.042</td>
<td>.041</td>
</tr>
</tbody>
</table>

A review of the MIs revealed a few very large values, with the largest value (MI = 91.815) representing a residual covariance between Item 19 and Item 11 (see Table 28). Because the estimation of MIs in *Mplus* was based on a univariate approach, only one parameter at a time was added to the model as MI values could change substantially from one tested parameterisation to another. Therefore the residual covariance with the largest MI (Item 19 with Item 11) was added first to the model (Model 2).
Table 28

Modification Indices for the Muscle Appearance Satisfaction Scale Model 1. Only the Largest Values are Shown

<table>
<thead>
<tr>
<th>Modification Indices</th>
<th>Expected Parameter Change (EPC)</th>
<th>Standard EPC</th>
<th>StandardYX EPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>By statements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bodybuilding Dependence by Item 5</td>
<td>41.228</td>
<td>0.695</td>
<td>0.873</td>
</tr>
<tr>
<td>Bodybuilding Dependence by Item 15</td>
<td>85.738</td>
<td>0.782</td>
<td>1.106</td>
</tr>
<tr>
<td>With statements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 18 with Item 3</td>
<td>49.375</td>
<td>0.480</td>
<td>0.480</td>
</tr>
<tr>
<td>Item 18 with Item 11</td>
<td>73.396</td>
<td>-0.567</td>
<td>-0.567</td>
</tr>
<tr>
<td>Item 19 with Item 11</td>
<td>91.815</td>
<td>0.758</td>
<td>0.758</td>
</tr>
</tbody>
</table>

Note. Standard EPC = Expected parameter change based on variances of the factors; StandardYX EPC = Expected parameter change based on background and outcome variables.

Results relevant to the testing of Model 2 revealed a substantial drop from $\chi^2$ 621.496 to 533.077, $df = 141$, $Q = 3.8$, $p < .0001$. The inclusion of this one residual covariance revealed increased values for the CFI (from .902 to .920), TLI (from .882 to .903), SRMR (from .054 to .056), and a decreased RMSEA value (from .073 to .066). The estimated value for the residual covariance of Item 19 with Item 11 was 0.783, with a standard error of 0.086 and $z$-value of 9.137, which was highly significant. Results from both the fit statistics and the estimated value for the residual covariance between Item 19 and Item 11 provided sound justification for the inclusion of this parameter in the model. Item 19 asked if the participant often finds it difficult to resist checking the size of his muscles, and Item 11 asked if the participant often spends a lot of time looking at his muscles in the mirror. There appeared to be an overlap of content between these two items. Based on the strength of the MI and expected parameter change (EPC) values for this residual covariance, together with the overlap of item content, it appeared that this residual covariance should be included in the respecified model (Model 3).
A review of the resulting MIs for Model 2 revealed a high MI value related to cross-loadings. Item 15 (MI = 67.641) was cross-loaded on the Muscle Checking factor. Item 15 stated that the participant’s self-worth was very focused on how his muscles look. This item was loaded on the Bodybuilding Dependence subscale according to the author of the MASS. It seemed reasonable that it also entailed reassurance seeking and mirror checking behaviour to check the appearance of muscles (as per Muscle Checking factor), thus this cross-loading of Item 15 was added to the model (Model 3).

Results relevant to the testing of Model 3 revealed a substantial drop from $\chi^2$ 533.077 to 464.131, $df = 140$, $Q = 3.3$, $p < .0001$. The inclusion of this cross loading revealed increased values for the CFI (from .920 to .934) and TLI (from .903 to .919), and decreased values for SRMR (from .056 to .047), and RMSEA (from .066 to .060). Item 15 was loaded on both the Bodybuilding Dependence factor (0.196) and the Muscle Checking factor (0.640). A review of the resulting MIs for Model 3 revealed a high MI value related to cross-loadings. Item 5 (MI = 40.953) was cross-loaded on the Bodybuilding Dependence factor. Item 5 stated that the participant often spent money on muscle-building supplements. This item was loaded on the Substance Use subscale according to the author of the MASS. It seemed reasonable that it also reflected compulsive tendencies towards weight lifting, thus this cross-loading of Item 5 was added to the model (Model 4).

Results relevant to the testing of Model 4 revealed a substantial drop from $\chi^2$ 464.131 to 420.646, $df = 139$, $Q = 3.0$, $p < .0001$. The inclusion of the cross-loading of Item 5 revealed increased values for the CFI (from .934 to .942) and TLI (from .919 to .929), and decreased values for SRMR (from .047 to .042), and RMSEA (from .060 to .056). Item 5 was significantly loaded on both the Bodybuilding Dependence factor (0.599) and the Substance Use factor (0.246). A review of the resulting MIs for Model 4 revealed a high MI value (34.968) representing a residual covariance between Item 18 and Item 11. Item 18 asked if the participant often seeks reassurance from others that his muscles were big enough, and Item 11 asked if the participant often spent a lot of time looking at his muscles in the mirror. There appeared to be an overlap of content between these two items. This residual covariance was added to Model 5.

Results relevant to the testing of Model 5 revealed a substantial drop from $\chi^2$ 420.646 to 381.397, $df = 138$, $Q = 2.8$, $p < .0001$. The inclusion of this one residual covariance revealed increased values for the CFI (from .942 to .950) and TLI (from .929 to .938), and decreased values for the SRMR (from .042 to .041), and RMSEA (from .056 to .053). The estimated
value for the residual covariance of Item 18 with Item 11 was -0.378, with a standard error of 0.064 and z-value of -5.930, which was highly significant. Results from both the fit statistics and the estimated value for the residual covariance between Item 18 and Item 11 provide sound justification for the inclusion of this parameter in the model. Based on the strength of the MI and EPC values for this residual covariance, together with the overlap of item content, it appeared that this residual covariance should be included in the respecified model (Model 5). A review of the resulting MIs for Model 5 revealed several remaining misspecified parameters (MIs 25.943–10.019), however these MIs were weaker than the previous acknowledged misspecified parameters. Model 5 was therefore the final model of the MASS structure.

The unstandardised solution revealed that Item 15 was significantly loaded on the Bodybuilding Dependence factor and on the Muscle Checking factor. The standardised solution indicated that Item 15 had a low loading (0.181) on the Bodybuilding Dependence factor and a moderate loading (0.477) on the Muscle Checking factor. The unstandardised solution revealed that Item 5 was significantly loaded on both the Bodybuilding Dependence factor and the Substance Use factor. The standardised solution indicated that Item 5 had a moderate loading (0.394) on the Bodybuilding Dependence factor and a lower loading (0.180) on the Substance Use factor. In reviewing the two residual covariances (Item 19 and Item 11, and Item 18 and Item 11), it was shown that they were highly significant parameters in the model, and also represent strong and moderate correlated residuals, being -0.439 and 0.332, respectively. This indicated redundant item content. Item 18 asked if the participant often seeks reassurance from others that his muscles were big enough, and Item 11 asked if the participant often spends a lot of time looking at his muscles in the mirror. There appeared to be an overlap of content between these two items. Item 19 stated that the participant often found it difficult to resist checking the size of his muscles. There was also overlap of content between Items 11 and 19.
Table 29

**Muscle Appearance Satisfaction Scale Factor Correlations From the Standardised Solution**

<table>
<thead>
<tr>
<th></th>
<th>Bodybuilding dependence</th>
<th>Muscle checking</th>
<th>Substance use</th>
<th>Injury risk</th>
<th>Muscle satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bodybuilding</td>
<td>–</td>
<td>0.622</td>
<td>0.621</td>
<td>0.546</td>
<td>-0.296</td>
</tr>
<tr>
<td>dependence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscle checking</td>
<td>–</td>
<td>–</td>
<td>0.666</td>
<td>0.481</td>
<td>-0.291</td>
</tr>
<tr>
<td>Substance use</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>0.622</td>
<td>-0.370</td>
</tr>
<tr>
<td>Injury Risk</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>-0.267</td>
</tr>
<tr>
<td>Muscle Satisfaction</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

The five factor model schematically portrayed in Figure 11 represented an adequate description of MD for this sample.
Figure 11. Schematic representation of the 19-item five factor model of the Muscle Appearance Satisfaction Scale (Model 5).
Table 30

Factor Loadings of the Muscle Appearance Satisfaction Scale – Confirmatory Factor Analysis Model 5

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Standard error</th>
<th>Two-tailed p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bodybuilding Dependence by</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 7</td>
<td>1.000</td>
<td>0.000</td>
<td>999.000</td>
</tr>
<tr>
<td>Item 2</td>
<td>0.873</td>
<td>0.052</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 8</td>
<td>0.911</td>
<td>0.058</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 12</td>
<td>0.719</td>
<td>0.055</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 15</td>
<td>0.225</td>
<td>0.069</td>
<td>0.001</td>
</tr>
<tr>
<td>Item 5</td>
<td>0.602</td>
<td>0.084</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Muscle Checking by</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 18</td>
<td>1.000</td>
<td>0.000</td>
<td>999.000</td>
</tr>
<tr>
<td>Item 19</td>
<td>0.987</td>
<td>0.051</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 11</td>
<td>0.907</td>
<td>0.053</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 3</td>
<td>0.913</td>
<td>0.048</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 15</td>
<td>0.606</td>
<td>0.067</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Substance Use by</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 9</td>
<td>1.000</td>
<td>0.000</td>
<td>999.000</td>
</tr>
<tr>
<td>Item 6</td>
<td>0.638</td>
<td>0.047</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 5</td>
<td>0.245</td>
<td>0.064</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 17</td>
<td>0.953</td>
<td>0.028</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Injury Risk by</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 16</td>
<td>1.000</td>
<td>0.000</td>
<td>999.000</td>
</tr>
<tr>
<td>Item 13</td>
<td>0.894</td>
<td>0.052</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 10</td>
<td>0.564</td>
<td>0.053</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td><strong>Muscle Satisfaction by</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 4</td>
<td>1.000</td>
<td>0.000</td>
<td>999.000</td>
</tr>
<tr>
<td>Item 1</td>
<td>0.812</td>
<td>0.032</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 14</td>
<td>0.725</td>
<td>0.035</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>
4.4.1.4 Psychometric properties of the 26-item Eating Attitudes Test.

The reliability and internal consistency of the EAT-26 and its three factors were tested. The EAT-26 had good internal consistency ($\alpha = .82$), but the three factors had poor internal consistency. The Dieting factor was $\alpha = .78$, the Bulimia and Food Preoccupation factor was $\alpha = .65$, and the Oral Control factor was $\alpha = .41$.

A final sample size of 581 (using listwise deletion) was analysed by CFA. With 377 data points and 83 unknown parameters (including the intercepts), the model was over-identified with 292 degrees of freedom (see Figure 12).
Figure 12. Schematic representation of the original 26-item three factor model of the 26-item Eating Attitudes Test (Model 1).
Goodness-of-fit statistics based on robust maximum likelihood estimation for a first order three factor model for the 26-item EAT (Model 1) provided poor fit, as seen in Table 31.

A review of the MIs revealed a few very large values, with the largest value (MI = 51.418) representing a residual covariance between Item 23 and Item 17. Because the estimation of MI's in Mplus was based on a univariate approach, only one parameter at a time was added to the model as MI values could change substantially from one tested parameterisation to another. Therefore the residual covariance with the largest MI (Item 23 with Item 17) was added first to the model (Model 2).

Results relevant to the testing of Model 2 revealed a substantial drop from $\chi^2 = 677.559$ to $624.213$, $df = 295$, $Q = 2.1$, $p < .0001$. The inclusion of this one residual covariance revealed increased values for the CFI (from .741 to .777) and TLI (from .716 to .754), and decreased values for the SRMR (from .074 to .072), and the RMSEA (from .047 to .044). The estimated value for the residual covariance of Item 23 with Item 17 was 0.184, with a standard error of 0.026 and z-value of 6.972, which was significant. Results from both the fit statistics and the estimated value for the residual covariance between Item 23 and Item 17 provided sound justification for the inclusion of this parameter in the model. Item 23 asked if the participant...
engages in dieting behaviour, and Item 17 asked if the participant eats diet foods. There
appeared to be an overlap of content between these two items. Based on the strength of the
MI and EPC values for this residual covariance, together with the overlap of item content, it
appeared that this residual covariance should be included in the respecified model (Model 3).
A review of the resulting MIs for Model 2 revealed a high MI representing a residual
covariance between Item 22 and Item 16.

Results relevant to the testing of Model 3 revealed a substantial drop from $\chi^2 = 624.213$ to
$595.274$, $df = 294$, $Q = 2.0$, $p < .0001$. The inclusion of this one residual covariance revealed
increased values for the CFI (from .777 to .796) and TLI (from .754 to .774), and a decreased
RMSEA value (from .044 to .042). The SRMR value did not change (.072). The estimated
value for the residual covariance of Item 22 with Item 16 was 0.232, with a standard error of
0.029 and $z$-value of 7.955, which was significant. Results from both the fit statistics and the
estimated value for the residual covariance between Item 22 and Item 16 provided sound
justification for the inclusion of this parameter in the model. Item 22 asked if the participant
feels uncomfortable after eating sweets, and Item 16 asked if the participant avoids foods with
sugar in them. There appeared to be an overlap of content between these two items. Based
on the strength of the MI and EPC values for this residual covariance, together with the
overlap of item content, it appeared that this residual covariance should be included in the
respecified model (Model 4). A review of the resulting MIs for Model 3 revealed a high MI
representing a residual covariance between Item 22 and Item 16.

Results relevant to the testing of Model 4 revealed a substantial drop from $\chi^2 = 595.274$ to
$565.544$, $df = 293$, $Q = 1.9$, $p < .0001$. The inclusion of this one residual covariance revealed
increased values for the CFI (from .796 to .815) and TLI (from .774 to .795), and a decreased
values for the SRMR (from .072 to .071) and the RMSEA (from .042 to .040). The estimated
value for the residual covariance of Item 19 with Item 6 was 0.359, with a standard error of
0.042 and $z$-value of 8.549, which was significant. Results from both the fit statistics and the
estimated value for the residual covariance between Item 19 and Item 6 provided sound
justification for the inclusion of this parameter in the model. Item 19 asked if the participant
displays self-control around food, and Item 6 asked if the participant were aware of the calorie
content of foods that he ate. There appeared to be an overlap of content between these two
items. Based on the strength of the MI and EPC values for this residual covariance, together
with the overlap of item content, it appeared that this residual covariance should be included
in the respecified model (Model 5). A review of the resulting MIs for Model 4 revealed a
high MI value related to cross-loadings. Item 2 (MI = 22.177) was cross-loaded on the Dieting factor. Item 2 stated that the participant avoids eating when he is hungry. This item was loaded on the Oral Control factor according to the author of the EAT-26. It seemed reasonable that it also loaded on the Dieting factor, thus this cross-loading of Item 2 was added to the model (Model 5).

Results relevant to the testing of Model 5 revealed a substantial drop from $\chi^2 = 565.544$ to 554.586, $df = 292$, $Q = 1.9$, $p < .0001$. The inclusion of this one residual covariance revealed increased values for the CFI (from .815 to .822) and TLI (from .795 to .802), and decreased values for the SRMR (from .071 to .068), and RMSEA (from .040 to .039). A review of the resulting MIs for Model 5 revealed several remaining misspecified parameters (MIs 22.951–10.025), however these MIs were weaker than the previous acknowledged misspecified parameters. Model 5 was therefore the final model of the EAT-26 structure.

The standardised solution revealed the three residual covariances (Item 23 with Item 17, Item 22 with Item 16, and Item 19 with Item 6) were highly significant parameters in the model, and also represent strong and moderate correlated residuals, being 0.446, 0.332, and 0.314. This indicated redundant item content. Item 2 was significantly loaded on the Dieting factor (0.187), but not on the Oral Control factor (0.127).

Latent factor correlations indicated that the Dieting factor was significantly correlated with the Bulimia and Food Preoccupation factor ($r = .228$), and non-significantly correlated with the Oral Control factor ($r = .062$). The Bulimia and Food Preoccupation factor was significantly correlated with the Oral Control factor ($r = .071$).
Figure 13. Schematic representation of the 26-item three factor model of the 26-item Eating Attitudes Test (Model 5).
Table 32

Factor Loadings of the 26-Item Eating Attitudes Test – Confirmatory Factor Analysis Model

<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Standard error</th>
<th>Two-tailed p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dieting by</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 12</td>
<td>1.000</td>
<td>0.000</td>
<td>999.000</td>
</tr>
<tr>
<td>Item 6</td>
<td>0.763</td>
<td>0.096</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 7</td>
<td>0.554</td>
<td>0.087</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 10</td>
<td>0.460</td>
<td>0.075</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 11</td>
<td>0.755</td>
<td>0.071</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 14</td>
<td>0.996</td>
<td>0.075</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 16</td>
<td>0.475</td>
<td>0.087</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 1</td>
<td>0.989</td>
<td>0.090</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 17</td>
<td>0.375</td>
<td>0.072</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 22</td>
<td>0.893</td>
<td>0.075</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 23</td>
<td>0.798</td>
<td>0.083</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 24</td>
<td>0.200</td>
<td>0.061</td>
<td>0.001</td>
</tr>
<tr>
<td>Item 26</td>
<td>0.079</td>
<td>0.081</td>
<td>0.331</td>
</tr>
<tr>
<td>Item 2</td>
<td>0.187</td>
<td>0.065</td>
<td>0.004</td>
</tr>
<tr>
<td>Bulimia and Food Preoccupation by</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 3</td>
<td>1.000</td>
<td>0.000</td>
<td>999.000</td>
</tr>
<tr>
<td>Item 4</td>
<td>0.412</td>
<td>0.081</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 9</td>
<td>0.040</td>
<td>0.029</td>
<td>0.158</td>
</tr>
<tr>
<td>Item 18</td>
<td>0.630</td>
<td>0.093</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 21</td>
<td>0.923</td>
<td>0.099</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 25</td>
<td>0.051</td>
<td>0.024</td>
<td>0.033</td>
</tr>
<tr>
<td>Oral Control by</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 20</td>
<td>1.000</td>
<td>0.000</td>
<td>999.000</td>
</tr>
<tr>
<td>Item 5</td>
<td>0.809</td>
<td>0.206</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 8</td>
<td>0.920</td>
<td>0.240</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Item 13</td>
<td>0.574</td>
<td>0.219</td>
<td>0.009</td>
</tr>
<tr>
<td>Item 15</td>
<td>0.826</td>
<td>0.288</td>
<td>0.004</td>
</tr>
<tr>
<td>Item 2</td>
<td>0.127</td>
<td>0.104</td>
<td>0.222</td>
</tr>
<tr>
<td>Item 19</td>
<td>0.431</td>
<td>0.230</td>
<td>0.060</td>
</tr>
</tbody>
</table>
4.4.2 Discussion.

4.4.2.1 Symptomatology of muscle dysmorphia, body dysmorphic disorder, and eating disorders.

The current study provided support for the comorbidity of symptoms of MD and BDD, symptoms of MD and eating disorders, as well as symptoms of BDD and eating disorders. It may reflect a shared pathogenesis between MD, BDD, and eating disorders. Research has suggested that body image disturbances may be the essential pathology of both eating disorders and BDD (Grant & Phillips, 2004; Phillips, 2005). Results from the current study indicated that MD symptoms were significantly associated with BDD and eating disorder symptoms, with the main effect being BDD. The odds ratio of .41 indicated that the odds of having symptoms of MD as well as symptoms of BDD was 0.41 times the odds of having symptoms of MD as well as symptoms of eating disorders. In other words, the odds of having symptoms of MD as well as symptoms of eating disorders was 2.45 times the odds of having symptoms of MD as well as symptoms of BDD, as indicated by the odds ratio.

The relationship between MD and BDD has received limited investigation in previous research (Phillips et al., 2010; C. G. Pope et al., 2005). The current study found that 36 (5.6%) of the 648 participants were at risk of having both MD and BDD, with the odds being .49 of having symptoms of both MD and BDD. Previous studies have found that 18 (9.3%) of 193 male participants, and 14 (22.2%) of 63 male participants with BDD also had MD (C. G. Pope et al., 2005; H. G. Pope et al., 1997). Another study found that five (33.3%) of 15 participants with MD also displayed classic BDD symptoms (Hitzeroth et al., 2001). Results from the current study indicated that MD symptoms were significantly associated with symptoms of BDD. Symptoms of BDD were found to be the most important effect on MD with BDD, MD with eating disorders, and BDD with eating disorders interactions.

Significant associations were revealed between BDD symptomatology (in particular between “being worried about how you look”, “thinking about your appearance problems a lot”, “being upset about it a lot”, and the “amount of time [you] spend thinking about how you look”) and whether participants were at risk of MD only or not. Also, significant correlations were found between MD symptoms and BDD symptoms. These findings provide support for research indicating similarities between MD symptoms and BDD symptoms (Hitzeroth et al., 2001; Olivardia et al., 2000; C. G. Pope et al., 2005; H. G. Pope et al., 1997).
Despite the generally comparable findings between participants at risk of MD only and at risk of BDD only, the distinguishing features for these two disorders were the weight lifting activities and unsafe weight lifting behaviours. Significant differences were found in terms of MD symptomatology between participants at risk of MD only and participants at risk of BDD only on the Bodybuilding Dependence subscale, the Injury Risk subscale, and the MASS total score. This may be because the BDDQ does not assess specific MD symptoms, in particular excessive weight lifting habits, and symptoms of overtraining, and attitudes towards unsafe weight lifting behaviour. Participants at risk of BDD only had slightly higher mean scores than participants at risk of MD only on the Muscle Checking subscale of the MASS. A predominant symptom of BDD is the presence of compulsive behaviours designed to examine a perceived defect (Cororve & Gleaves, 2001), thus explaining higher scores on the Muscle Checking subscale.

In terms of eating disorder symptomatology, no significant difference was found between participants at risk of MD only and participants at risk of BDD only. Participants at risk of BDD only had slightly higher mean scores than participants at risk of MD only on the total score of the EAT-26. Eating disorders and BDD can be comorbid (Phillips et al., 2010). Previous research found that 30.1% of participants with BDD were excessively preoccupied with their weight (Didie et al., 2010) and 29.0% of participants with BDD had excessive weight concerns (Kittler et al., 2007). The EAT-26 assesses dieting, body weight, and disordered eating relating to a drive for thinness, and may not be sensitive to dieting and disordered eating relating to a drive for muscularity.

Few studies have examined the relationship between MD and eating disorders. The present study found that 60 (9.3%) of the 648 participants were at risk of having both MD and an eating disorder. The odds of having symptoms of MD as well as symptoms of eating disorders were 1.2. Results from the current study indicated that MD symptoms were significantly associated with symptoms of eating disorders. A previous study found that a group of weight lifters with MD scored higher in the 40-item Eating Attitudes Test and the Eating Disorders Inventory compared to a group of weight lifters without MD (Behar & Molinari, 2010). Murray, Rieger, and Touyz (2011) found that eating practices alone can exacerbate MD symptoms, as MD is inclusive of central eating- and exercise-related practices.

No significant differences were identified in terms of eating disorder symptomatology between participants at risk of MD only and participants at risk of eating disorders only. In
addition, the correlational data suggested a relationship between the symptoms of MD and eating disorders, as identified through the MASS total score and the EAT-26 total score. Small but significant correlations were found between the Substance Use subscale of the MASS and the laxatives, diuretics behavioural question of the EAT-26, between the Injury Risk subscale of the MASS and the vomit and exercise behavioural questions of the EAT-26, and between the Muscle Satisfaction subscale and the binge eating, and the lost ≥ 9 kg behavioural questions of the EAT-26. The results are perhaps not unexpected, as the proposed MD diagnostic criteria repeatedly refer to disordered eating (H. G. Pope et al., 1997). These findings support the notion of similarities between MD symptoms and eating disorder symptoms (Lamanna et al., 2010; Olivardia et al., 2000), especially symptoms of anorexia nervosa (Murray, Rieger, et al., 2012; Murray et al., 2010). McFarland and Kaminski (2009) found that men with increased symptoms of MD were more likely than other men to use diet pills, to vomit, and to diet to manage their weight. A systematic literature review indicated that the majority of physically active individuals with MD follow specific eating schedules to increase muscle mass and decrease body fat, consisting of high protein and low fat foods, with nutritional and performance enhancing supplements (Contesini et al., 2013).

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

Eating disorders and BDD can be comorbid (Phillips et al., 2010). The current study found that 43 (6.6%) of the 648 participants were at risk of having both BDD and an eating disorder (as seen in Table 24). Previous research found that 30.1% of participants with BDD were excessively preoccupied with their weight (Didie et al., 2010) and, in another study, 29.0% of participants with BDD had excessive weight concerns (Kittler et al., 2007).

On a note of caution, it has been reported that when a test is applied in a population with participants who present a very small chance of developing the disease (i.e., visibly healthy), it may result in a higher identified prevalence of the disease in question (Nunes et al., 2005). The rates reported in the current study may thus be an over-estimation of the true prevalence rates of MD, BDD, and eating disorders.
4.4.2.2 Psychometric properties of the Muscle Appearance Satisfaction Scale.

This study investigated the internal consistency of the MASS and its subscales. The MASS had good internal consistency ($\alpha = .89$). Three of the subscales of the MASS had Cronbach’s alpha values above .70 (.72, .75, and .76) that were considered to be acceptable for a scale, and two of the subscales had values above .80 (.83, and .86) that were preferable for a scale (as seen in Table 26). When measuring psychological constructs, values below .70 can be expected due to the diversity of the constructs being assessed (Kline, 1999).

In this study, the factorial validity of the MASS for a weight lifting population from Australia was investigated. Although the MASS has been used in a number of different countries, researchers should not assume that validity holds from one population to another. The CFA model of the MASS structure hypothesizes a priori that: (a) responses to the MASS can be explained by the five factors; (b) each item has a nonzero loading on the MD factor it was designed to measure, and zero loadings on all other factors; (c) the five factors are correlated; and (d) the residuals associated with each indicator item variable are uncorrelated. A schematic representation of this hypothesized CFA model of factorial structure for the MASS is shown in Figure 10.

A final sample size of 636 (using listwise deletion) was analysed by CFA. With 209 data points and 70 unknown parameters (including the intercepts), the model was over identified with 139 degrees of freedom (see Figure 10). Goodness-of-fit statistics based on robust maximum likelihood estimation for a first order five factor model for the 19-item MASS (Model 1) provided poor fit (see Table 27). Based on the poor fit of the originally hypothesized model to the sample data, as well as several large misspecified parameters in the model, it seemed reasonable and logical to move into exploratory mode, rather than confirmatory, in an attempt to respecify the original model. Bentler and Chou (1987) warned that forcing large error terms to be uncorrelated is seldom appropriate with real data. Based on apparent item content overlap and Bentler and Chou’s warning, respecification of this initial model was considered justified. The primary focus of respecification is to locate the source of misfit in the model (Joreskog, 1993). Respecification should never be based on statistical data alone; rather, it should be supported by theory, content, and statistical data (J. C. Anderson & Gerbing, 1988). This decreases the likelihood of finding a well-fitting model due to sampling error (J. C. Anderson & Gerbing, 1988). The ultimate objective is to find a model that better describes the sample data, a model that is both meaningful and statistically well fitting (Joreskog, 1993).
When deciding whether or not to include additional parameters in the model it is important to consider the extent to which: (a) they are substantively meaningful, (b) the existing model exhibits adequate fit, and (c) the EPC value is substantial (Byrne, 2012). To make this decision, the researcher must also keep in mind the need for scientific parsimony (Byrne, 2012). It is unwise to keep modifying a model that fits well to achieve an even better fit, as modifications may simply be fitting small distinctive characteristics of the sample (MacCallum, Roznowski, & Necowitz, 1992). If a cross validation sample is not available, then fewer modifications are better (Ullman, 2006).

The order that parameters are added to the model can influence the significance of the remaining parameters (Ullman, 2006). Because the estimation of MI’s in Mplus was based on a univariate approach, only one parameter at a time was added to the model, as MI values could change substantially from one tested parameterisation to another. A review of the MIs revealed a few very large values, with the largest value (MI = 91.815) representing a residual covariance between Item 19 and Item 11 (see Table 28). Therefore, the residual covariance with the largest MI (Item 19 with Item 11) was added first to the model (Model 2).

The Q, SRMR, RMSEA, and CFI values of the final model (Model 5) were indicative of a good fitting model, as seen in Table 27. The TLI value represented a fairly well-fitting model, although it did not quite reach the recommended criterion of .950. Taking this into consideration, it is concluded that the five factor model schematically portrayed in Figure 11 represents an adequate description of MD for this sample.

The five factors of the MASS were correlated with each other (-0.267 to 0.666, as seen in Table 29), and this finding is in support of previous research indicating relationships between the factors (Mayville et al., 2002). Muscle Satisfaction was negatively correlated (-0.267 to -0.370) with the other four factors, indicating that, as muscle satisfaction decreases, bodybuilding dependence, muscle checking and supplement use, and injury risk tend to increase. The items of the Muscle Satisfaction factor were reverse-scored.

Item 15 was cross-loaded on the Bodybuilding Dependence factor (0.225) and on the Muscle Checking factor (0.606), as seen in Table 30 and Figure 11. Item 15 stated that the participant’s self-worth is very focused on how his muscles look. This item was originally loaded on the Bodybuilding Dependence factor (Mayville et al., 2002); however, in the final model, it was more strongly loaded on the Muscle Checking factor, which entails reassurance seeking and mirror checking behaviour to check the appearance of muscles.
Item 5 was cross-loaded on the Bodybuilding Dependence factor (0.602) and on the Substance Use factor (0.245), as seen in Table 30 and Figure 11. Item 5 stated that the participant often spends money on muscle-building supplements. This item was loaded on the Substance Use factor in the original MASS (Mayville et al., 2002). In the final model it was more strongly loaded on the Bodybuilding Dependence factor, which involves compulsive tendencies towards weight lifting.

One of the major concerns regarding post hoc model fitting is the potential for capitalisation on chance factors in the respecification of alternative models (Byrne, 2012). A number of options are available to address Type I error. A Bonferroni-type correction has been proposed (Green & Babyak, 1997; Green, Thompson, & Poirier, 2001), and the EQS program uses a Scheffé-type adjustment method to control Type I error (Bentler, 2005). A two-step modelling approach has also been suggested, which uses a series of nested models and consecutive Chi-square difference tests (J. C. Anderson & Gerbing, 1988). Another option is to apply cross-validation analysis (Byrne, 2012). In fact, it is highly recommended that the final modified model should be cross-validated with a new independent sample when possible (Ullman, 2006).

It should be remembered that a model is supported by failing to disconfirm, rather than being confirmed by data (J. C. Anderson & Gerbing, 1988). Even though a model is well fitting, it may be that other models of comparable fit may exist (J. C. Anderson & Gerbing, 1988). Researchers can have more confidence in findings related to the assessment of the hypothesised structural model if the measurement model is well-fitting (Byrne, 2012). It makes causal assumptions tentatively more probable (Bollen & Pearl, 2013). Path coefficients are only preformed under the unequivocal assumption that the model fit is very good (Ullman, 2006).

4.4.2.3 Psychometric properties of the 26-item Eating Attitudes Test.

The internal consistency of the EAT-26 and its three factors were tested in this study. The EAT-26 had good internal consistency (α = .82), but one factor had poor internal consistency. The Dieting factor was α = .78, the Bulimia and Food Preoccupation factor was α = .65, and the Oral Control factor was α = .41. Cronbach’s alpha values above .70 are considered to be acceptable for a scale, and values above .80 are preferable for a scale. Although values below .70 can be expected when measuring psychological constructs (Kline, 1999), a value of .41 is not acceptable.
This study investigated the factorial validity of the EAT-26 for an adult male weight lifting population from Australia. The CFA model of the EAT-26 structure hypothesizes a priori that: (a) responses to the EAT-26 can be explained by three factors; (b) each item has a nonzero loading on the eating disorder factor it was designed to measure, and zero loadings on all other factors; (c) the three factors are correlated; and (d) the residuals associated with each indicator item variable are uncorrelated. A schematic representation of this hypothesized CFA model of factorial structure for the EAT-26 is shown in Figure 12.

Goodness-of-fit statistics based on robust maximum likelihood estimation for a first order three factor model for the 26-item EAT (Model 1) provided poor fit (see Table 31). Based on the poor fit of the originally hypothesized model to the sample data, as well as several large misspecified parameters in the model, it seemed reasonable and logical to move into exploratory mode, rather than confirmatory, in attempt to respecify the original model.

Item 2 was cross-loaded on the Dieting factor (0.187) and on the Oral Control factor (0.127), as seen in Table 32 and Figure 13. Item 2 stated that the participant avoids eating when he is hungry. This item was originally loaded on the Oral Control factor (Garner et al., 1982). However, in the final Model 5, it was not significantly loaded on the Oral Control factor and only weakly loaded (0.187) on the Dieting factor. This might suggest that Item 2 should not be included in the EAT-26.

Reviewing the three residual covariances (Item 23 with Item 17, Item 22 with Item 16, and Item 19 with Item 6) confirmed that they were highly significant parameters in the model. They also represented moderate correlated residuals, being 0.446, 0.332, and 0.314, respectively. This indicated redundant item content. Item 23 asked if the participant engages in dieting behaviour, and Item 17 asked if the participant eats diet foods. Item 17 had a factor loading below 0.40 (see Table 32), which suggested that Item 17 should not be included in the EAT scale. Item 22 asked if the participant feels uncomfortable after eating sweets, and Item 16 asked if the participant avoids foods with sugar in them. Item 19 asked if the participant displays self-control around food, and Item 6 asked if the participant was aware of the calorie content of foods that he ate. Item 19 was not significantly loaded on any of the factors (see Table 32), which indicated that Item 19 was problematic and should perhaps not be included in the EAT-26 scale.

Six of the items of the EAT-26 had factor loadings below 0.40, and one item was not significantly loaded on any of the factors (see Table 32). The seven problematic items referred to: vomiting (Items 9 and 25), avoiding eating when hungry or when the stomach is
empty (Items 24 and 2), enjoy trying new rich foods (Item 26), eating diet foods (Item 17), and displaying self-control around food (Item 19). It can be argued that the inclusion of these items in the EAT-26 could be a result of using a clinical sample (Lane, Lane, & Matheson, 2004). Low factor loadings may be due to the low base rate of the behaviours in the sample population. However, as stated previously, the possibility of capitalisation on chance factors in the respecification of alternative models is a major concern (Byrne, 2012). Therefore cross-validation with a new independent sample is recommended (Ullman, 2006).

The present conceptualisation of disordered eating is concerned with thinness, weight loss and calorie restriction, and not with increased muscularity and increased calorie consumption (Griffiths et al., 2013). Many eating disorder assessment tools have been developed for use with women, and may be problematic when used with men as they do not adequately assess the different concerns of men (Cafri & Thompson, 2004; McCabe & Ricciardelli, 2004). Researchers have suggested that muscularity oriented disordered eating behaviours include very high levels of protein consumption, severe restriction of non-protein related dietary components (e.g., carbohydrates and fats), interrupting important activities to accommodate frequent eating (eating every two to three hours), continued food consumption despite feeling full, consuming a large proportion of calories in liquid (blended) form, and the use of appearance enhancing drugs such as supplements, “testosterone boosters” and AAS (Mosley, 2009; Murray, Rieger, et al., 2012). Harvey and Robinson (2003) cautioned that the traditional way of identifying eating disorders in men may not be effective anymore, and that it seems sensible to look at the cause of the disordered eating. On the other hand, Nunes et al. (2005) suggested that some items of the EAT-26 were not clearly formulated, and probably do not measure what they were designed to measure.

4.5 Conclusions

To the researcher’s knowledge, the current research project was the first to investigate if MD symptoms could be differentiated from symptoms of BDD and eating disorders, and to report the rate of MD, BDD, and eating disorder symptomatology in a non-clinical population of adult male weight lifters in Australia.

The findings of the current study indicated that: (a) symptoms of eating disorders were more prevalent than symptoms of MD and symptoms of BDD, and (b) symptoms of MD can be differentiated from symptoms of BDD and eating disorders. Support was provided for the comorbidity of symptoms of MD and BDD, symptoms of MD and eating disorders, as well as
symptoms of BDD and eating disorders. Null hypothesis 4 stated that symptoms of muscle
dysmorphia would not be more prevalent than symptoms of body dysmorphic disorder and
symptoms of eating disorders in a non-clinical population of adult male weight lifters in
Australia. The study failed to reject null hypothesis 4, since symptoms of MD were not more
prevalent than symptoms of BDD and symptoms of eating disorders—as 110 (17.0%) participants were at risk of MD, while 219 (33.8%) participants were at risk of an eating
disorder, and 69 (10.6%) participants were at risk of BDD. Null hypothesis 5 stated that MD
symptoms could not be differentiated from symptoms of BDD and symptoms of eating
disorders, because MD did not represent a set of symptoms characteristic of a unique mental
disorder. Thus, null hypothesis 5 was rejected, as MD symptoms were differentiated from
symptoms of BDD and symptoms of eating disorders.

Findings of CFAs demonstrated poor fit for the MASS and EAT-26. The original MASS
and EAT-26 were respecified in order to locate the source of misfit in the models, with the
ultimate objective being finding a model that better describes the sample data.
Chapter 5 – Conclusions, Implications, and Limitations

5.1 Implications of the Main Findings and Suggestions for Future Research

In assessing MD against Blashfield et al.’s (1990) criteria for including categories in a classification system for mental disorders, it was found that not all criteria have been met. A review of the literature indicated that only criteria 1 and 2 have been met (Nieuwoudt et al., 2012). Criterion 1 states that there should be a minimum of 50 journal articles in the last 10 years, with a minimum of 25 empirical journal articles; and criterion 2 states a set of diagnostic criteria should exist with assessment tools to ascertain whether these criteria are met or not (Blashfield et al., 1990).

Criterion 3 was not met—remembering that criterion 3 states there should be at least two independent, empirical studies demonstrating high inter-clinician agreement levels ($\kappa \geq .70$). A recent search of the literature (in 2014) indicated that no studies have addressed this criterion since the literature review conducted in 2012 by Nieuwoudt et al. (2012). Prior to that, only one previous study had reported high inter-rater reliability ($\kappa = .83$) for the proposed diagnostic criteria for MD (C. G. Pope et al., 2005). The present research project examined inter-rater reliability for the proposed diagnostic criteria for MD; however, high inter-rater agreement levels were not achieved, as only a 40.0% agreement level ($\kappa = .39$) between the two investigators was attained. While Blashfield et al. (1990) proposed that a new diagnostic category should have high inter-rater reliability, the reality is that inter-rater agreement levels have been found to be consistently low in the DSM-5 field trials (Timimi, 2014). This indicates that clinicians often do not agree on the same diagnoses when independently assessing patients, leading Timimi (2014) to conclude that many of the common diagnoses (e.g., generalised anxiety disorder and major depressive disorder) are meaningless. To improve the inter-rater reliability for MD, future research could focus on the design of a symptom checklist that can be introduced to identify key symptoms that may aid the diagnostic process.

Criterion 4 has not been met—remembering that criterion 4 states there should be at least two independent, empirical studies that demonstrate that the proposed category represents a syndrome with symptoms that frequently co-occur. A recent review of the literature (in 2014) indicated that no studies had investigated whether MD represents a syndrome of frequently co-occurring symptoms since the literature review conducted in 2012 by Nieuwoudt et al.
The results from the present research project showed that MD represented a syndrome of frequently co-occurring symptoms, specifically criteria B1 and A, and criteria C and A (see Appendix A for diagnostic criteria). Future research should investigate the co-occurrence of MD symptoms in order to meet criterion 4 and thus demonstrate whether MD is indeed a syndrome of co-occurring symptoms.

Criterion 5 was not met. A recent search of the literature (in 2014) indicated that no studies have specifically focused on the differentiation of MD from other similar categories since the literature review conducted in 2012 by Nieuwoudt et al. (2012). Criterion 5 states there should be at least two independent, empirical studies that show that the syndrome can be differentiated from other similar categories. The results from the present research project found that symptoms of MD were differentiated from symptoms of BDD and from symptoms of eating disorders. However, comorbidity of symptoms was indicated, with 9.3% of participants at risk of both MD and an eating disorder, 6.6% at risk of both BDD and an eating disorder, and 5.6% of participants at risk of both MD and BDD. Criterion 5 aims to ensure that the proposed new category is not redundant and that it is not “confused” with other existing categories (Blashfield et al., 1990). It has been suggested that the frequency of comorbid diagnoses indicates the lack of understanding of the boundaries of mental disorders (Anckarsäter, 2010; Middleton, 2008), and thus it might be possible that clinicians have trouble distinguishing disorders from “diagnostic nearest neighbours” (Stein et al., 2010, p. 6). Future research should investigate symptomatic overlap between MD and BDD, as well as differences in the profiles of individuals with MD and individuals with BDD. Future research should also investigate symptomatic overlap between MD and eating disorders, and differences in the profiles of individuals with MD and individuals with eating disorders. In order to meet criterion 5, future research should investigate if MD can be differentiated from BDD symptoms and from eating disorder symptoms.

Muscle dysmorphia has not yet met all of the criteria suggested by Blashfield et al. (1990) for inclusion in a classification system for mental disorders. Blashfield et al.’s (1990) criteria are stringent and conservative, with a focus on empirical scientific evidence. These criteria were not set as absolute rules, but to ensure that inclusions are based on scientific empirical evidence instead of emotional and/or political decisions (Blashfield et al., 1990).

An MD specifier has been added to BDD in the DSM-5 (American Psychiatric Association, 2013), despite limited scientific investigation into the relationship between MD and BDD. The results from the present research provided support for the comorbidity of
symptoms of MD and BDD, and symptoms of MD and eating disorders. Results indicated that MD symptoms were significantly associated with BDD and eating disorder symptoms, with the odds of having symptoms of MD as well as symptoms of eating disorders being greater than the odds of having symptoms of MD as well as symptoms of BDD. This may indicate that the decision to add an MD specifier to BDD in the DSM-5 was perhaps too hasty. Little is known about the consequences of the introduction of an MD specifier to BDD (e.g., stigma). The stigma associated with mental disorders may well hinder their diagnoses (Sayce, 2000).

One of the potential benefits of a diagnosis of a mental disorder is that it can facilitate treatment (Stein et al., 2010). However, research suggests that, despite increases in treatment of mental disorders, the prevalence of mental disorders has not decreased (Jorm, 2014). This might be due, inter alia, to lack of treatment specificity (Jorm, 2014; Timimi, 2014) and the lack of suitable quality counselling and therapies (Jorm, 2014). There is currently no formal treatment for MD and no specific treatment studies have been conducted as yet. At this stage, treatment for MD can only be extrapolated from knowledge of related disorders (Kanayama & Pope, 2011), such as BDD and eating disorders. If MD is incorrectly categorised in a classification system for mental disorders, such as the DSM-5, it might lead to incorrect prevention and treatment plans. A concern has been raised that, in Australia, the prevention of mental disorders has been neglected, as the focus has been on treatment (Jorm, 2014). Preventive interventions should be on-going and family-based, school-based, and workplace-based (Jorm, 2014). There is currently no preventive intervention for MD in Australia. Education about the benefits of weight training should be supplemented with the potential negative consequences of a preoccupation with achieving the ideal muscular male physique, and the associated obsession with weight lifting and disordered eating habits in order to increase muscularity and decrease body fat.

It has also been suggested that there needs to be a shift away from a disease model, such as is presented in the DSM-5 (Pemberton & Wainwright, 2014). A move towards a conceptual system is proposed where the use of psychological formulation is advocated (Division of Clinical Psychology, 2011) such that the assumption is that “at some level it all makes sense” (Butler, 1998, p. 2). Thus the symptoms associated with a mental disorder are then explained through interpersonal, biological, social and cultural factors, which are based on psychological theory and evidence (Division of Clinical Psychology, 2011). Researchers have argued that, instead of diagnosing non-existing diseases (Kinderman, 2013, November
1) and focusing on deficiencies (Pemberton & Wainwright, 2014), the wellbeing of the individual should be maintained (Kinderman, 2013, November 1) and clinicians should build on the individual’s strengths (Pemberton & Wainwright, 2014). Kinderman (2013, November 1) proposed that clinicians should make a list of the individual’s problems and design an individual care plan based on these, instead of relying on a diagnosis of disease.

Furthermore, Timimi (2014) cautioned that a diagnostic label can cause significant harm. However, a diagnosis of a mental disorder is more than just a label (Stein et al., 2010). Results of the present research indicate that a number of adult male weight lifters in Australia might have: severe disturbances in eating habits, and in the perception of body weight and shape (i.e., eating disorders); preoccupations with perceived or imagined defects in physical appearance (i.e., BDD); and preoccupations with overall muscularity (i.e., MD). These individuals could be at increased risk of suffering from clinically significant distress or impairment in important areas of functioning, with the associated reduced quality of life.

The results of the online survey showed that 33.8% of participants were at risk of having an eating disorder, 17.0% of participants were at risk of having MD, and 10.6% were at risk of having BDD. Thus, as was hypothesized, symptoms of MD were not more prevalent than symptoms of BDD and eating disorders. In fact, symptoms of eating disorders were more prevalent than symptoms of MD and BDD in a non-clinical population of adult male weight lifters in Australia. This might be due to aspiring to achieve a physique that looks like the ideal muscular male body that is often promoted, for example, by the media. To achieve this muscular physique, individuals have to follow a strict diet and exercise program. It is this strict diet and weight training program that is at the core of MD.

Exercise, including weight training, is associated with many psychological and health benefits (Daley, 2008; W. R. Thompson et al., 2010). Importantly, this research does not suggest that working out with weights (i.e., free weights or machines) is not a healthy activity. For most people, weight training is beneficial for psychological and physical wellbeing (A. Thomas et al., 2014). It only becomes problematic when the drive for muscularity becomes an obsession, as in MD. Muscle dysmorphia has harmful health consequences, thus strength and conditioning professionals, exercise scientists, athletic trainers, and personal trainers should be aware that some adult males who are working out with weights (i.e., free weights or machines) may be at increased risk of MD.

Individuals with MD do appear healthy, making it difficult to identify those at risk of this disorder (Kanayama & Pope, 2011). The individual may be at risk of MD if he is obsessed
with increasing muscularity and trying to achieve the ideal male body (i.e., that which is frequently promoted by the media), and exhibits symptoms of social physique anxiety as a result of the perceived discrepancy between his actual and ideal body shape and level of muscularity (A. Thomas et al., 2014). Adults who are working out with weights may also be at increased risk of BDD and eating disorders. The symptoms of these disorders may also be comorbid.

As stated previously, weight training is associated with many health benefits. In contrast, inactivity and being overweight or obese are associated with many health risks (Daley, 2008; A. Thomas et al., 2014; W. R. Thompson et al., 2010), such as cardiovascular disease, type 2 diabetes mellitus, and cancer (Kujala, 2009). In 2011–2012, there were 20.0% of adult men in Australia who were inactive, and 34.0% of adult men who did not meet the requirement of at least 150 minutes of physical activity per week (Australian Bureau of Statistics, 2013c). At the same time, 42.2% of adult men in Australia were overweight and 27.5% were obese (Australian Bureau of Statistics, 2013a). The weight training regime and strict diet to increase muscularity may seem healthy in contrast to the lack of physical activity and poor diet associated with obesity and being overweight. Education is needed on healthy nutrition and the benefits of weight training, without the emphasis on achieving a muscular physique.

Weight training does not cause MD, and only a minority of men who weight train might develop MD. The aim should not be to stop weight training in individuals at risk of MD, but to lessen the obsession with increasing muscle mass and of achieving the ideal muscular physique as often promoted by the media. The reasons why the individual feels compelled to weight train excessively and comply with a strict diet should be determined, and addressed accordingly. In keeping with the urgings of Kinderman (2013, November 1), and Pemberton and Wainwright (2014), the wellbeing of the individual should be maintained, while building on the individual’s strengths, and designing an individualised care plan based on the problems identified. The stigma associated with a mental disorder should be reduced, in this case as relating to MD, as weight training is a healthy activity associated with psychological and physical wellbeing. Instead of shunning men dedicated to weight training and increasing muscle mass, their wellbeing, exercise and eating habits should be supported, and education should be provided regarding the risks associated with excessive exercise and strict diets—while keeping in mind that MD is a serious condition with numerous negative consequences.
5.2 Limitations

The samples were not random of the population being investigated, as all participants in the research consisted of volunteers who were engaged in weight training. The studies presented in this thesis utilised convenience sampling; thus, this must be taken into consideration when generalising results to the general population. However, this subset of the population is most at risk of developing unhealthy practices to increase muscularity.

The sample presented in Chapter 3 (see section 3.2.3) consisted of a convenience sample of adult male weight lifters from the local university student population and individuals who used the university’s gym. The data presented in Chapter 4 were gathered by an online survey; therefore the sample (see section 4.2.3) consisted of adult male weight lifters who had access to the internet. Furthermore, the sample consisted of adult male weight lifters who were: (a) active members of bodybuilding forums where the invitations to participate were posted, or (b) Facebook users who were Facebook friends with the gyms/bodybuilding supplement stores/bodybuilding and fitness magazines/bodybuilding and fitness community profiles with Facebook profiles who had the invitation to participate posted on their wall, or (c) Facebook users who “liked” the Facebook profiles of gyms/bodybuilding supplement stores/bodybuilding and fitness magazines/bodybuilding and fitness community profiles that had the invitation to participate posted on their wall, or (d) staff or students of Southern Cross University during the time of the online survey.

This project used quantitative methodology only, thus limiting the depth of the information gathered. The surveys collected self-report data. Access to a wide range of participants was necessary to ensure valid responses to the quantitative form of data gathering. As this study was designed to capture as many types of weight lifters/trainers as possible from Australia, this geographic factor made it necessary to employ a quantitative method. Also, access to the necessary time and financial resources to conduct qualitative dominant research throughout Australia was prohibitive. Due to funding constraints, only free-of-charge methods were used to distribute the invitations to participate in the online survey. No paid Facebook advertisements were used. Facebook recruitment was free, as invitations to participate were posted on the wall of Facebook profiles of gyms/bodybuilding supplement stores/bodybuilding and fitness magazines/bodybuilding and fitness community in Australia. Invitations to participate were also posted in bodybuilding forums.

The reasons for weight lifting were not determined in the current research project. Future research should delineate between participants who are involved in sports that require and
focus on muscular size and strength (e.g., competitive bodybuilders, power lifters, and football), participants that weight train/lift for health reasons, and participants that weight train/lift for physique, in order to investigate if there is an association between the reason for weight lifting and the risk of developing MD, an eating disorder, or BDD.

The BDDQ and EAT-26 are screening tools, and can provide only a probable diagnosis of BDD or an eating disorder. Body dysmorphic disorder and eating disorders should ideally be diagnosed through a clinical interview (Garner, n.d.). Therefore, the rates reported in this study were based on the presence of symptoms of BDD and eating disorders, and not on clinical diagnoses. While the current findings suggested similarities between MD and BDD, and between MD and eating disorders, nosological associations could not be inferred.

Eating disorder symptoms were found highly prevalent in the sample of Australian male weight lifters. This suggests that there is a subgroup of male weight lifters that may be at increased risk of developing unhealthy eating and weight-control practices. However, the data gathered in this study did not support the factor structure of the EAT-26 in the current population. Cross-validation analysis should be applied with a new independent sample. It is possible that adult male weight lifters in Australia may have a unique conceptualisation of eating behaviours, which should be investigated in future. Instruments are needed that are sensitive to the eating disturbances motivated by the desire to increase muscle mass. Instruments should also be updated to align with the DSM-5 diagnostic criteria.

Seventeen percent of the sample of Australian male weight lifters was at risk of having MD. This suggests that there is a subgroup of male weight lifters who may be at risk of developing unhealthy practices to increase muscularity, and these may result in impaired social and occupational functioning. Researchers have suggested a tentative cut-off score of 63 for the MASS (Babusa et al., 2015). However, cut-off scores with a clinical population for the MASS do not exist. Identifying a participant with MD based on exhibiting concerns with only one of the subscales does not seem appropriate; thus, it was decided that a participant must exhibit concerns on three of the five subscales of the MASS to be identified at risk of MD. The degree to which an individual must possess specific characteristics associated with MD to be diagnosed with MD is not yet known (Lantz et al., 2002). A preliminary step taken in this research project to address this issue was the calculation of quartiles for each of the subscales of the MASS. There is currently little agreement regarding the best way to assess MD (Suffolk, Dovey, Goodwin, & Meyer, 2013). Further research is needed with a clinical sample to identify cut-off scores for the MASS and other MD assessment tools. The data
gathered in this study did not support the factor structure of the MASS in the current population. In future research, cross-validation analysis should be applied with a new independent sample.

5.3 Summary

With the escalation of men who are increasingly dissatisfied with their bodies and want to be more muscular, it is increasingly important to understand the characteristics of MD. The research work presented in this thesis contributes not only to the current knowledge regarding MD, but also BDD and eating disorders in order to understand the phenomenon of men who want to be more muscular. This project consisted of two studies. In the first study (see Chapter 3), a one-on-one (face-to-face) interview and a self-completion (paper-and-pencil) questionnaire were administered to provide new evidence on: (a) the diagnostic reliability and validity, including the inter-rater reliability, of the proposed MD criteria; (b) MD as a syndrome of co-occurring symptoms; and (c) the level of correlation between the proposed MD criteria and the MASS. In the second study (see Chapter 4), a survey was administered by online self-completion questionnaires to determine: (a) the rates of symptoms of MD, BDD, and eating disorders in adult male weight lifters in Australia; and (b) the symptomatic relationships among MD, BDD, and eating disorders to advance the understanding of MD symptomatology.

This research established that there is not yet enough scientific empirical evidence to suggest that MD should be included as a new disorder in a classification system for mental disorders, such as the Diagnostic and Statistical Manual of Mental Disorders. It also provided evidence that questions the MD specifier that has been added to BDD in the DSM-5. Incorrect classification of a disorder can have an impact on the conceptualisation, assessment and treatment of a disorder. Therefore, the correct classification of MD in a classification system for mental disorders is of the utmost importance.

This research also found that men who are weight lifting may be at increased risk of having MD, BDD and eating disorders. Support was provided for the comorbidity of, and symptomatic similarities between, symptoms of MD and BDD, and symptoms of MD and eating disorders. A better understanding and awareness of the rates and symptoms of MD, BDD, and eating disorders is important in the identification and prevention of these disorders.
References


Attitudes Test. *Journal of Personality Assessment, 58*, 27–35. doi:
http://dx.doi.org/10.1207/s15327752jpa5801_3


Appendices


A. Preoccupation with the idea that one’s body is not sufficiently lean and muscular. Characteristic associated behaviours include long hours of lifting weights and excessive attention to diet.

B. The preoccupation is manifested by at least two of the following four criteria:
   1. The individual frequently gives up important social, occupational, or recreational activities because of a compulsive need to maintain his or her workout and diet schedule.
   2. The individual avoids situations where his or her body is exposed to others, or endures such situations only with marked distress or intense anxiety.
   3. The preoccupation about the inadequacy of body size or musculature causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.
   4. The individual continues to work out, diet, or use ergogenic (performance-enhancing) substances despite knowledge of adverse physical or psychological consequences.

C. The primary focus of the preoccupation and behaviours is on being too small or inadequately muscular, as distinguished from fear of being fat as in anorexia nervosa, or a primary preoccupation only with other aspects of appearance as in other forms of body dysmorphic disorder.
Appendix B: Documents for Chapter 3

### B1 Muscle Appearance Satisfaction Scale (Mayville et al., 2002).

<table>
<thead>
<tr>
<th></th>
<th>Please respond to each of the following statements. Circle the response choice that best describe you</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Disagree somewhat</th>
<th>Neutral</th>
<th>Agree somewhat</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>When I look at my muscles in the mirror, I often feel satisfied with my current muscle size.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>2</td>
<td>If my schedule forces me to miss a day of working out with weights, I feel very upset.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>I often ask friends and/or relatives if I look big.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>I am satisfied with the size of my muscles.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>I often spend money on muscle-building supplements.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>It is OK to use steroids to add muscle mass.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>7</td>
<td>I often feel like I am addicted to working out with weights.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>If I have a bad workout, it is likely to have a negative effect on the rest of my day.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>9</td>
<td>I would try anything to get my muscles to grow.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>I often keep working out even when my muscles or joints are sore from previous workouts.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>11</td>
<td>I often spend a lot of time looking at my muscles in the mirror.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>I spend more time in the gym working out than most others who work out.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------</td>
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<td>---</td>
<td>---</td>
</tr>
<tr>
<td>12</td>
<td>To get big, one must be able to ignore a lot of pain.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>13</td>
<td>I am satisfied with my muscle tone/definition.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>14</td>
<td>My self-worth is very focused on how my muscles look.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>15</td>
<td>I often ignore a lot of physical pain while I am lifting to get bigger.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>16</td>
<td>I must get bigger muscles by any means necessary.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>17</td>
<td>I often seek reassurance from others that my muscles are big enough.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>18</td>
<td>I often find it difficult to resist checking the size of my muscles.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>
B2 Interview questions for muscle dysmorphia diagnostic criteria.

1. Are you worried that your body is not muscular and lean enough? If yes, how much of your time is occupied by thoughts about your body not being sufficiently lean and muscular? Add up all the time you spend in total in a day. (Less than 1 hour a day; 1-3 hours a day; more than 3 hours a day) (A)

2. Is your main concern that you are not thin enough or that you might get too fat? (C)

3. Is your main concern that you are not muscular enough? (C)

4. How many hours per week do you work out with weights? (A)

5. Do you have a special diet (e.g., high protein) to increase your muscle mass? If yes, please describe. Do you use protein powders and other supplements to increase your muscle mass? (A)

6. Is there anything you are not doing because of your weight lifting schedule and diet? (For example parties) If yes, please describe. (B1)

7. Has your need to work out interfere with your studies? (For example, do you often spend less time on studying or miss classes to go to the gym?) If yes, please describe (B1)

8. Are there situations you avoid where your body is exposed to others because you are not muscular enough? (For example at the beach or swimming pool.) If yes, please describe. Do you feel anxious or distressed when your body is exposed to others? (B2)

9. Do you often give up social activities because you feel that you are not muscular enough? (For example parties) If yes, please describe (B2)

10. Has your worry about not being muscular enough impacted on your studies, work, or other activities? If yes, please describe (B3)

11. Have you, or will you, continue to work out even if you are sick or have an injury, because if you stop you would lose muscle mass? (B4)

12. Have you continued to diet or use workout supplements (e.g., Beta Alanine) despite it making you feel sick? If yes, please describe. (B4)

13. Are you unhappy with some of your body areas or body parts? For example, hair, skin, hands, nose etc. (C)

If yes: please list.

Note: The letter in brackets next to the question corresponds to the proposed criteria for muscle dysmorphia.
B3.1 Ethics approval.

HUMAN RESEARCH ETHICS COMMITTEE (HREC)

HUMAN RESEARCH ETHICS SUB-COMMITTEE (HRESC)

NOTIFICATION

To: Ms Johanna Nieuwoudt / Professor Shi Zhou
School of Health and Human Sciences
johanna.nieuwoudt@scu.edu.au, shi.zhou@scu.edu.au

From: Secretary, Human Research Ethics Committee
Division of Research, R. Block

Date: 10 January 2012

Project: Reliability and validity of the proposed Muscle Dysmorphia criteria in a non-clinical sample.

NEAF Application Approval: ECN-12-004

The Southern Cross University Human Research Ethics Committee has established, in accordance with the National Statement on Ethical Conduct in Human Research – Section 5/Processes of Research Governance and Ethical Review, a procedure for expedited review and ratification by a delegated authority of the HREC.

This has been considered and approved by the Chair of the HREC, Professor Bill Boyd.

This approval is subject to the usual standard conditions of approval. Please see over.
STANDARD CONDITIONS OF APPROVAL FOR ALL ETHICALLY APPROVED RESEARCH PROJECTS

The following standard conditions of approval are mandatory for all research projects which have been approved by the HREC or a HRESC and have received an ethics approval number.

All reporting is to be submitted through the Human Research Ethics Office, either at Lismore, Coffs Harbour or Tweed/GC. Forms for annual reports, renewals, completions & changes of protocol are available at the website:

The email address is ethics.lismore@scu.edu.au  ethics.coffsharbour@scu.edu.au
ethics.tweed@scu.edu.au

Standard Conditions in accordance with the National Statement on Ethical Conduct in Human Research (National Statement) (NS).

1. Monitoring

NS 5.5.1 – 5.5.10
Responsibility for ensuring that research is reliably monitored lies with the institution under which the research is conducted. Mechanisms for monitoring can include:

(a) reports from researchers;
(b) reports from independent agencies (such as a data and safety monitoring board);
(c) review of adverse event reports;
(d) random inspections of research sites, data, or consent documentation; and
(e) interviews with research participants or other forms of feedback from them.

2. Approvals

(a) All ethics approvals are valid for **12 months** unless specified otherwise. If research is continuing after 12 months, then the ethics approval MUST be renewed. Complete the Annual Report/Renewal form and send to the ethics office.

(b) **NS 5.5.5**

The researcher/s will **provide a report every 12 months** on the progress to date or outcome in the case of completed research including detail about:

*Maintenance and security of the records.*

*Compliance with the approved proposal.*

*Compliance with any conditions of approval.*

*Changes of protocol to the research.*

3. Reporting to the HREC

(c) The researchers will immediately notify the ethics office, on the appropriate form, **any change in protocol. NS 5.5.3**
(d) A completion report, on the appropriate form, must be forwarded to the ethics office.

(e) The researchers will immediately notify the ethics office about any circumstance that might affect ethical acceptance of the research protocol. NS 5.5.3

(f) The researchers will immediately notify the ethics office about any adverse events/incidences which have occurred to participants in their research. NS 5.5.3

**B2. Research conducted overseas**

*NS 4.8.1 – 4.8.21*

Researchers conducting a study in a country other than Australia, need to be aware of any protocols for that country and ensure that they are followed ethically and with appropriate cultural sensitivity.

**B3. Participant Complaints**

*NS 5.6.1 – 5.6.7*

*General information*

Institutions may receive complaints about researchers or the conduct of research, or about the conduct of a Human Research Ethics Committee (HREC) or other review body.

Complaints may be made by participants, researchers, staff of institutions, or others. All complaints should be handled promptly and sensitively. All participants in research conducted by Southern Cross University should be advised of the above procedure and be given a copy of the contact details for the Complaints Officer. They should also be aware of the ethics approval number issued by the Human Research Ethics Committee.

The following paragraph is to be included in any plain language statements for participants in research.
Complaints about the ethical conduct of this research should be addressed in writing to the following:

Ethics Complaints Officer

HREC

Southern Cross University

PO Box 157

Lismore, NSW, 2480

Email: ethics.lismore@scu.edu.au

All complaints are investigated fully and according to due process under the National Statement on Ethical Conduct in Human Research and this University. Any complaint you make will be treated in confidence and you will be informed of the outcome.
B3.2 Change of protocol approval.

HUMAN RESEARCH ETHICS COMMITTEE (HREC)
HUMAN RESEARCH ETHICS SUB-COMMITTEE (HRESC)

NOTIFICATION

To: Ms Johanna Nieuwoudt / Professor Shi Zhou
    School of Health and Human Sciences
    johanna.nieuwoudt@scu.edu.au, shi.zhou@scu.edu.au

From: Secretary, Human Research Ethics Committee
    Division of Research, R. Block

Date: 12 March 2012

Project: Reliability and validity of the proposed Muscle Dysmorphia criteria in a non-clinical sample

Change of Protocol Approved
Approval number: ECN-12-004

The Southern Cross University Human Research Ethics Committee has established, in accordance with the National Statement on Ethical Conduct in Human Research – Section 5/Processes of Research Governance and Ethical Review, a procedure for expedited review and ratification by a delegated authority of the HREC.
Thank you for your Change of Protocol application. This has been considered and approved by the Chair of the HREC, Professor Bill Boyd. Your research may continue under the new protocol.

*This approval is subject to the usual standard conditions of approval. Please see over.*

Helen Wolton
HREC Administration
Ph: (02) 6626 9139
E. ethics.lismore@scu.edu.au

Professor Bill Boyd
Chair, HREC
Ph: 02 6620 3569
E. william.boyd@scu.edu.au
Dear Participant

**Research Project: An investigation into body image in adult males**

The following document will outline the background of the study, its objectives, and the survey, along with your rights and obligations.

**Background**

This study forms part of a PhD thesis being conducted by Ms Johanna Nieuwoudt under the supervision of Prof. Shi Zhou, Dr Rosanne Coutts, and Mr Ray Booker. The study has been approved by the Human Research Ethics Committee at Southern Cross University. The approval number is ECN-12-004.

**Participation**

To participate in this study it is necessary for you to be an adult male (18 years of age or older) who currently lifts weights at least once a week.

It is also necessary that you have the ability to read and speak English.

**Objectives of the Study**

The aim of this research is to conduct an investigation into body image and muscularity concerns in adult males.
Outline of the Research

The study will be conducted via a questionnaire and a one-on-one interview at Southern Cross University in Lismore. The survey will take approximately 10–15 minutes to complete.

Please find enclosed a copy of the Questionnaire, and the Consent Form for agreement to participate in the study.

The Consent Form is your agreement to be involved in the study, however you are free to withdraw at any time if you so desire. All information provided would be treated as anonymous and strictly confidential. Participation in the study will not necessarily benefit you directly.

The Questionnaire will provide information about your weight lifting habits, eating habits, and body image. It will take approximately 5 minutes to complete.

The interview will provide more information on body image and muscularity concerns, and will take approximately 5–10 minutes. The interview will be audio recorded with your consent.

Possible Discomforts and Risks

Given the nature of the questions, the process of data collection may bring up unpleasant feelings, and can cause distress. You are free to leave the research at any stage, especially if you believe that the data collection process is causing you distress. Conversely, if I believe that you appear to be in distress, I will stop the survey in order to protect your health and wellbeing. If either event occurs, or if you experience any later feelings of discomfort that you feel may relate to your participation in the survey, the opportunity to consult a qualified Counsellor from the Southern Cross University Counselling Service is available to you. Services are free and confidential.

Counselling is available by appointment, telephone or email. There is no need for you to contact the researcher before making an appointment, as counselling is confidential. Appointments for Lismore campus can be made by contacting the receptionist, in person or by
telephone at the Student Health and Support Service, in the north-east corner of Goodman Plaza, Monday to Friday, 9am–5pm. Contact details are:

- Direct telephone: (02) 6620 3943
- Lismore campus internal telephones: extension 3943
- University Freecall number: 1800 111 890 (call the 1800 number and ask to be transferred to the Counselling Service)
- Email: counselling@scu.edu.au

**Time Commitment of Participants**

Data Collection: You will be required to participate in data collection by completing the *Questionnaire* and participate in a one-on-one interview regarding your weight lifting habits, eating habits, body image and muscularity concerns. It will take approximately 10–15 minutes to complete. This will be conducted at Southern Cross University, at a time arranged by yourself and the researcher.

**Responsibilities of the Researcher**

The security and confidentiality of all data that is collected will be of the highest priority. As data is collected it will be stored securely by Ms Johanna Nieuwoudt at Southern Cross University. Once all the research data has been collected it will be appropriately analysed. The results of the information analysis will be de-identified, documented and used as part of a PhD dissertation and may also be published in appropriate scientific literature. At no stage will your participation in the research be identified in any published material or documentation.

**Freedom of Consent**

Participation in this study is voluntary. Non-participation will not result in any adverse consequences. You are free to withdraw consent and discontinue participation in this study at
any time without adverse consequence. During the study, you may refuse to answer any question, and stop the study at any time.

**Confidentiality**

All questionnaires, the audio recordings of the one-on-one interviews, and the data from the interviews, will be numerically coded, and no names or addresses will be used. All collected data will be kept at the University in locked cabinets with all identifying information such as name and address removed. After completion of the study data files and audio recordings will be securely stored for 7 years. After that time the stored files will be securely destroyed.

**Enquiries/Complaints**

The ethical aspects of this study have been approved by the Southern Cross University Human Research Ethics Committee. The approval number is ECN-12-004. If you have any complaints or reservations about any ethical aspect of your participation in this research, you may contact the Committee through the Ethics Complaints Officer:

The Ethics Complaints Officer  
Southern Cross University  
PO Box 157  
Lismore  NSW  2480  
Email: ethics.lismore@scu.edu.au

All complaints, in the first instance, should be in writing to the above address. All complaints are investigated fully and according to due process under the National Statement on Ethical Conduct in Research involving Humans and the University. Any complaint you make will be treated in confidence and you will be informed of the outcome.

We sincerely thank you for your time.

Yours faithfully
Ms Johanna Nieuwoudt

Principal Researcher/PhD candidate

Health and Human Sciences
Southern Cross University
Mobile: (0404) 721 996
Email: johanna.nieuwoudt@scu.edu.au

Principal Researcher/Supervisor: Prof. Shi Zhou (02) 6620 3391
shi.zhou@scu.edu.au

Principal Researcher/Supervisor: Dr Rosanne Coutts (02) 6620 3235
rosanne.coutts@scu.edu.au

Principal Researcher/Supervisor: Mr Ray Booker (02) 6620 3760
ray.booker@scu.edu.au
B5 Consent form.

PARTICIPANT CONSENT FORM

Research Project: An investigation into body image in adult males

The aim of this research is to conduct an investigation into body image in adult males.

Please read and tick the following boxes as you believe they apply to you. Once complete, please return to the researcher.

-----------------------------
NOTE: This consent form will remain with the Southern Cross University researcher for their records.
-----------------------------

Tick the box that applies, sign and date and give to the researcher

I agree to take part in the Southern Cross University (SCU) research project specified in the Participant Information Sheet. Yes ☐ No ☐

I am aware that each survey will be of approximately 10–15 minutes duration and agree to complete the questionnaire and participate in a one-on-one interview. Yes ☐ No ☐

As a participant I understand that participants in this study are required to read and speak English. I understand that I can use the service of an interpreter if I have any language concerns. Yes ☐ No ☐

I agree to complete a questionnaire asking me about weight lifting habits, eating habits, and body image. Yes ☐ No ☐

I agree to participate in a one-on-one interview asking me about body image and musculature concerns. Yes ☐ No ☐
I understand that my participation is voluntary and I can ask questions at any time. Yes ☐ No ☐

I understand I can choose not to participate in part or all of this research at any time, without consequence. Yes ☐ No ☐

I understand that any information that may identify me, will be de-identified at the time of analysis of any data. Therefore, I, or any information I have provided cannot be linked to my person. Privacy Act 1988 Cth Yes ☐ No ☐

I understand that neither my name nor any identifying information will be disclosed or published. Yes ☐ No ☐

I understand that all information gathered in this research is confidential. It is kept securely and confidentially for 7 years at the University. Yes ☐ No ☐

I am aware that I can contact the Supervisor(s) or other researchers at any time with any queries. Yes ☐ No ☐

I understand that the ethical aspects of this research have been approved by the SCU Human Research Ethics Committee. Yes ☐ No ☐

If I have concerns about the ethical conduct of this research, I understand that I can contact the SCU Ethics Complaints Officer, whose details are in the Information Statement. Yes ☐ No ☐

I have read and understood this Consent Form and the Participant Information Statement and the risks and purposes of the study. I agree to participate in this research study.
**Participant:**

Name: ____________________________________________________________

Address: __________________________________________________________

Signature: __________________________________________________________

Date: ______________________

**Guardian/Carer (If Applicable):**

Name: ____________________________________________________________

Address: __________________________________________________________

Signature: __________________________________________________________

Date: ______________________
Appendix C: Documents for Chapter 4

C1 Questions for background questionnaire.

1. What is your date of birth? dd/mm/yyyy

2. What is your current relationship status? Single, Partnered, Married


4. What is your sexual orientation? Heterosexual, Bisexual, Gay

5. How long have you been lifting weights for? years/months/weeks

6. How many days per week do you engage in weight lifting?

7. How many times (sessions) per day do you lift weights?

8. How long does each weight lifting session normally last?

9. Have you had a cosmetic surgical procedure in the past? If yes, please specify.

10. Do you plan on having a cosmetic surgical procedure in the future? If yes, please specify.

11. Have you been diagnosed with an eating disorder or body dysmorphic disorder or obsessive compulsive disorder or depression in the past? If yes, please specify.
Please read each question carefully and circle the answer that is true for you. Also write in answers where indicated.

1) Are you worried about how you look?  
   --If yes: Do you think about your appearance problems a lot and wish you could think about them less?  
   --If yes: Please list the body areas you don't like:

Examples of disliked body areas include: your skin (for example, acne, scars, wrinkles, paleness, redness); hair; the shape or size of your nose, mouth, jaw, lips, stomach, hips, etc.; or defects of your hands, genitals, breasts, or any other body part.

NOTE: If you answered "No" to either of the above questions, you are finished with this questionnaire. Otherwise continue.

2) Is your main concern with how you look that you aren't thin enough or that you might get too fat?

3) How has this problem with how you look affected your life?  
   • Has it often upset you a lot?  
   • Has it often gotten in the way of doing things with friends, dating, your relationships with people, or your social activities?
   --If yes: Describe how:

   • Has it caused you any problems with school, work, or other activities?
   --If yes: What are they?

   • Are there things you avoid because of how you look?
   --If yes: What are they?

4) On an average day, how much time do you usually spend thinking about how you look?  
   (Add up all the time you spend in total in a day, then circle one.)
   (a) Less than 1 hour a day (b) 1–3 hours a day (c) More than 3 hours a day
# C3 26-Item Eating Attitudes Test (Garner et al., 1982).

Please respond to each of the following statements. Tick the response choice that best describe you.

<table>
<thead>
<tr>
<th></th>
<th>Statements</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Usually</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Am terrified of being overweight.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>2</td>
<td>Avoid eating when I am hungry.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>3</td>
<td>Find myself preoccupied with food.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>4</td>
<td>Have gone on eating binges where I feel that I may not be able to stop.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>5</td>
<td>Cut my food into small pieces.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>6</td>
<td>Aware of the calorie content of foods that I eat.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>7</td>
<td>Particularly avoid food with a high carbohydrate content (i.e., bread, rice, potatoes, etc.).</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>8</td>
<td>Feel that others would prefer if I ate more.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>9</td>
<td>Vomit after I have eaten.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
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<tr>
<td>10</td>
<td>Feel extremely guilty after eating.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>11</td>
<td>Am preoccupied with a desire to be thinner.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>12</td>
<td>Think about burning up calories when I exercise.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>13</td>
<td>Other people think that I am too thin.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>14</td>
<td>Am preoccupied with the thought of having fat on my body.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>15</td>
<td>Take longer than others to eat my meals.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<tr>
<td>16</td>
<td>Avoid foods with sugar in them.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>17</td>
<td>Eat diet foods.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>18</td>
<td>Feel that food controls my life.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>☐</td>
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<td>19</td>
<td>Display self-control around food.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
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<td>20</td>
<td>Feel that other pressure me to eat.</td>
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<td>21</td>
<td>Give too much time and thought to food.</td>
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<tr>
<td>22</td>
<td>Feel uncomfortable after eating sweets.</td>
<td></td>
<td></td>
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<td>23</td>
<td>Engage in dieting behaviour.</td>
<td></td>
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<td>24</td>
<td>Like my stomach to be empty.</td>
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<td>25</td>
<td>Have the impulse to vomit after meals.</td>
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<td></td>
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<td>26</td>
<td>Enjoy trying new rich foods.</td>
<td></td>
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<tr>
<th></th>
<th>In the past 6 months have you:</th>
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<tr>
<td>A</td>
<td>Gone on eating binges where you feel that you may</td>
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<td></td>
<td>not be able to stop? (Binges is defined as eating</td>
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<td></td>
<td>much more than most people would under the same</td>
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<td></td>
<td>circumstances and feeling that eating is out of</td>
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<td>control).</td>
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<td>B</td>
<td>Ever made yourself sick (vomited) to control your</td>
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<td>weight or shape?</td>
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<td>C</td>
<td>Ever used laxatives, diet pills or diuretics (water</td>
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<td>pills) to control your weight?</td>
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<td>D</td>
<td>Exercised more than 60 minutes a day to lose or to</td>
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<td>control your weight?</td>
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<td>E</td>
<td>Lost 9 kilograms or more in the past 6 months.</td>
<td>No</td>
<td></td>
<td>Yes</td>
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<tr>
<th></th>
<th>Never</th>
<th>Once a month or less</th>
<th>2-3 times a month</th>
<th>Once a week</th>
<th>2-6 times a week</th>
<th>Once a day or more</th>
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</tbody>
</table>
C4 Ethics approval.

HUMAN RESEARCH ETHICS COMMITTEE (HREC)
HUMAN RESEARCH ETHICS SUB-COMMITTEE (HRESC)

NOTIFICATION

To: Professor Shi Zhou/Ms Johanna Nieuwoudt
   School of Exercise Science and Sports Management
   shi.zhou@scu.edu.au, johanna.nieuwoudt@scu.edu.au

From: Secretary, Human Research Ethics Committee
      Division of Research, R. Block

Date: 4 July 2012

Project: Symptoms of muscle dysmorphia, eating disorders, and body dysmorphic
disorder in Australia

Approval ECN-12-169

The Southern Cross University Human Research Ethics Committee has established, in
accordance with the National Statement on Ethical Conduct in Human Research – Section
5/Processes of Research Governance and Ethical Review, a procedure for expedited review
and ratification by a delegated authority of the HREC.

Thank you for your responses, dated the 29 June, to queries from the HREC at the May
meeting. The Chair, on behalf of the HREC, considers that your responses were positive and
comprehensive. This research is now approved.
All ethics approvals are subject to standard conditions of approval. These should be noted by researchers as there is compliance and monitoring advice included in these conditions.

Ms Sue Kelly  
HREC Administration  
Ph: (02) 6626 9139  
E. ethics.lismore@scu.edu.au

Professor Bill Boyd  
Chair, HREC  
Ph: 02 6620 3569  
E. william.boyd@scu.edu.au
HUMAN RESEARCH ETHICS COMMITTEE (HREC)
HUMAN RESEARCH ETHICS SUB-COMMITTEE (HRESC)

STANDARD CONDITIONS OF APPROVAL FOR ALL ETHICALLY APPROVED RESEARCH PROJECTS

The following standard conditions of approval are mandatory for all research projects which have been approved by the HREC or a HRESC and have received an ethics approval number.

All reporting is to be submitted through the Human Research Ethics Office, either at Lismore, Coffs Harbour or GC/Tweed. The email addresses are:
ethics.lismore@scu.edu.au
ethics.coffs@scu.edu.au
ethics.tweed@scu.edu.au

Forms for annual reports, renewals, completions and changes of protocol are available at the website:

Standard Conditions in accordance with the National Statement on Ethical Conduct in Human Research (National Statement) (NS).

1. Monitoring

NS 5.5.1 – 5.5.10

Responsibility for ensuring that research is reliably monitored lies with the institution under which the research is conducted. Mechanisms for monitoring can include:
(a) reports from researchers;
(b) reports from independent agencies (such as a data and safety monitoring board);
(c) review of adverse event reports;
(d) random inspections of research sites, data, or consent documentation; and
(e) interviews with research participants or other forms of feedback from them.
2. Approvals
   (c) All ethics approvals are valid for 12 months unless specified otherwise. If research is continuing after 12 months, then the ethics approval MUST be renewed. Complete the Annual Report/Renewal form and send to the ethics office.
   (d) NS 5.5.5
       The researcher/s will provide a report every 12 months on the progress to date or outcome in the case of completed research including detail about:

       Maintenance and security of the records.
       Compliance with the approved proposal.
       Compliance with any conditions of approval.
       Changes of protocol to the research.

3. Reporting to the HREC
   (c) The researchers will immediately notify the ethics office, on the appropriate form, any change in protocol. NS 5.5.3
   (d) A completion report, on the appropriate form, must be forwarded to the ethics office.
   (e) The researchers will immediately notify the ethics office about any circumstance that might affect ethical acceptance of the research protocol. NS 5.5.3
   (g) The researchers will immediately notify the ethics office about any adverse events/incidences which have occurred to participants in their research. NS 5.5.3

B4. Research conducted overseas

NS 4.8.1 – 4.8.21

Researchers conducting a study in a country other than Australia, need to be aware of any protocols for that country and ensure that they are followed ethically and with appropriate cultural sensitivity.
B5. Participant Complaints

NS 5.6.1 – 5.6.7

General information

Institutions may receive complaints about researchers or the conduct of research, or about the conduct of a Human Research Ethics Committee (HREC) or other review body.

Complaints may be made by participants, researchers, staff of institutions, or others. All complaints should be handled promptly and sensitively. All participants in research conducted by Southern Cross University should be advised of the above procedure and be given a copy of the contact details for the Complaints Officer. They should also be aware of the ethics approval number issued by the Human Research Ethics Committee.

The following paragraph is to be included in any plain language statements for participants in research.

*Complaints about the ethical conduct of this research should be addressed in writing to the following:*

*Ethics Complaints Officer*

*HREC*

*Southern Cross University*

*PO Box 157*

*Lismore, NSW, 2480*

*Email: ethics.lismore@scu.edu.au*

*All complaints are investigated fully and according to due process under the National Statement on Ethical Conduct in Human Research and this University. Any complaint you make will be treated in confidence and you will be informed of the outcome.*
C5 Invitation to participate.

The researchers at Southern Cross University are conducting a research project that aims to understand the relationships between body image, masculinity concerns, weight lifting habits, and eating habits in adult men. The study is being conducted by Johanna Nieuwoudt, PhD candidate of Southern Cross University, Lismore, under the supervision of Prof Shi Zhou, Dr. Rosanne Coutts, and Mr. Ray Booker. The study has been approved by the Human Research Ethics Committee at Southern Cross University. The approval number is ECN-12-169.

You are invited to participate in this study if you are an adult male who is living in Australia and currently lifts weights at least three times a week. It is also necessary that you have the ability to read and speak English. The study involves an on-line survey which should take you about 20 minutes to complete. All information will be treated in a confidential manner, and the survey is anonymous.

If you wish to participate in this study please follow the link below to the on-line survey. If you choose to continue, further information about the study will be provided on the initial page of the survey.

If you wish to proceed please click here to consent to the survey.

Thank you for taking the time to consider this study.

Kind regards,

Johanna Nieuwoudt
Principal Researcher/PhD candidate
Mobile: 0404 721 996; Office phone: 0266203166; Email: johanna.nieuwoudt@scu.edu.au

Principal Researcher/Supervisor: Prof. Shi Zhou (02) 6620 3391
sh.zhou@scu.edu.au

Principal Researcher/Supervisor: Dr Rosanne Coutts (02) 6620 3235
rosanne.coutts@scu.edu.au

Principal Researcher/Supervisor: Mr Ray Booker (02) 6620 3760
ray.booker@scu.edu.au
**C6 Information statement.**

This is a survey about eating habits, weight lifting habits, body image, and muscularity concerns in adult men.

**Your participation**

This survey consists of four sections containing a range of questions that require you to select the responses that best describe you. It will take approximately 20 minutes to complete. There are no right or wrong responses but it is important that you answer each question honestly.

Your participation in this survey is voluntary and by completing the survey you are effectively consenting to participate. However, you are free to skip any questions and are free to withdraw from the survey at any stage without explanation. Participation is completely anonymous.

If you have any questions concerning the survey please do not hesitate to contact one of the principal researchers whose phone numbers and contact details are given below.

If you feel discomforted as a result of your participation, or have any personal issues you may wish to discuss as a result of this study, please see your General Practitioner for a referral to a psychologist.

Alternatively, please contact the following free counselling services:

Lifeline: 131114
Lifeline’s Just Ask: 1300 13 1113

**Responsibilities of the researcher**

No information in the questionnaire will be made public in any form that could identify you. Your participation in this study is strictly voluntary and your confidentiality is assured. The results of the information analysis will be de-identified, documented and used as part of a PhD dissertation and may also be published in appropriate scientific literature. At no stage will your participation in the research be identified in any published material or documentation.
Ethical conduct of research

This research has been approved by the Southern Cross University Human Research Ethics Committee. The approval number is ECN-12-169.

If you have concerns about the ethical conduct of the research, the following procedure should occur:

Write to:
The Ethics Complaints Officer
Southern Cross University
PO Box 157
Lismore NSW 2480
ethics.lismore@scu.edu.au

If you have any questions involving this research please do not hesitate in contacting us at the following addresses:

Johanna Nieuwoudt
Principal Researcher/PhD candidate
Mobile: 0404 721 996; Office phone: 0266203166; Email:
johanna.nieuwoudt@scu.edu.au

Principal Researcher/Supervisor: Prof. Shi Zhou (02) 6620 3391
shi.zhou@scu.edu.au

Principal Researcher/Supervisor: Dr Rosanne Coutts (02) 6620 3235
rosanne.coutts@scu.edu.au

Principal Researcher/Supervisor: Mr Ray Booker (02) 6620 3760
ray.booker@scu.edu.au

Kind regards,

Johanna Nieuwoudt

PhD candidate, Southern Cross University
## Appendix D: Copyright Compliance

<table>
<thead>
<tr>
<th>Date</th>
<th>Page of thesis</th>
<th>Copyright item</th>
<th>Amount in relation to the whole work</th>
<th>Nature/Quality of item utilised (essential, important or material part of the item)</th>
<th>Substantial Part (Yes/No)</th>
<th>Fair Dealing (Yes/No)</th>
<th>Other Exception</th>
<th>Permission Required and Requested (Yes/No)</th>
<th>Permission obtained (Yes/No)</th>
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Appendix E: Results of Chapter 4

Table E33

Significant Differences in the Number of Weight Lifting Days per Week Were Found Across Groups as Indicated by Mann-Whitney U Tests

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<th>Group 1</th>
<th>$Mdn$</th>
<th>$n$</th>
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<th>$n$</th>
<th>$U$</th>
<th>$z$</th>
<th>$p$</th>
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<td>366</td>
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<td>5</td>
<td>37</td>
<td>4457.500</td>
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<td>No disorder</td>
<td>4</td>
<td>366</td>
<td>MD &amp; EAT</td>
<td>5</td>
<td>37</td>
<td>3067.500</td>
<td>-5.700</td>
<td>&lt; .001</td>
<td>.28</td>
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<td>BDD only</td>
<td>5</td>
<td>37</td>
<td>EAT only</td>
<td>4</td>
<td>139</td>
<td>1823.000</td>
<td>-2.823</td>
<td>&lt; .001</td>
<td>.21</td>
</tr>
<tr>
<td>BDD only</td>
<td>4</td>
<td>13</td>
<td>MD &amp; EAT</td>
<td>5</td>
<td>37</td>
<td>82.000</td>
<td>-3.627</td>
<td>&lt; .001</td>
<td>.51</td>
</tr>
<tr>
<td>EAT only</td>
<td>4</td>
<td>139</td>
<td>MD &amp; EAT</td>
<td>5</td>
<td>37</td>
<td>1283.500</td>
<td>-4.823</td>
<td>&lt; .001</td>
<td>.36</td>
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<td>MD &amp; BDD</td>
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<td>MD &amp; EAT</td>
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<td>37</td>
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<td>-3.227</td>
<td>.001</td>
<td>.46</td>
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<td>5</td>
<td>37</td>
<td>BDD &amp; EAT</td>
<td>4</td>
<td>20</td>
<td>165.500</td>
<td>-3.521</td>
<td>&lt; .001</td>
<td>.47</td>
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*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Mann-Whitney U tests were undertaken to examine group differences on the subscales of the MASS (see Tables E34–E38), and the total score of the MASS (see Table E39).

Table E34

*Mann-Whitney U Tests Reporting Significant Differences Between Groups on the Bodybuilding Dependence Subscale of the Muscle Appearance Satisfaction Scale*

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>U</th>
<th>z</th>
<th>p</th>
<th>r</th>
</tr>
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<td>No disorder</td>
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<td>1109.000</td>
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<td>1321.000</td>
<td>-8.057</td>
<td>&lt; .001</td>
<td>.40</td>
</tr>
<tr>
<td>No disorder</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>590.000</td>
<td>-6.720</td>
<td>&lt; .001</td>
<td>.34</td>
</tr>
<tr>
<td>MD only</td>
<td>BDD only</td>
<td>81.500</td>
<td>-3.528</td>
<td>&lt; .001</td>
<td>.50</td>
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<tr>
<td>MD only</td>
<td>EAT only</td>
<td>614.000</td>
<td>-7.097</td>
<td>&lt; .001</td>
<td>.54</td>
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<tr>
<td>MD only</td>
<td>BDD &amp; EAT</td>
<td>153.500</td>
<td>-3.632</td>
<td>&lt; .001</td>
<td>.48</td>
</tr>
<tr>
<td>BDD only</td>
<td>MD &amp; BDD</td>
<td>22.500</td>
<td>-3.190</td>
<td>.001</td>
<td>.60</td>
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<td>MD &amp; EAT</td>
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<td>-3.384</td>
<td>.001</td>
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<td>-3.510</td>
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<td>-4.935</td>
<td>&lt; .001</td>
<td>.40</td>
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<td>-6.772</td>
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<td>-5.983</td>
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<td>-3.580</td>
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<td>.47</td>
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*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Table E35

*Mann-Whitney U Tests Reporting Significant Differences Between Groups on the Muscle Checking Subscale of the Muscle Appearance Satisfaction Scale*

<table>
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<th>Group 1</th>
<th>Group 2</th>
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<th>z</th>
<th>p</th>
<th>r</th>
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<td>No disorder</td>
<td>MD only</td>
<td>1866.500</td>
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<td>No disorder</td>
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<td>.32</td>
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<td>MD only</td>
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<td>.47</td>
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<td>EAT only</td>
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<td>.55</td>
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*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Table E36

*Mann-Whitney U Tests Reporting Significant Differences Between Groups on the Substance use Subscale of the Muscle Appearance Satisfaction Scale*

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*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Table E37

*Mann-Whitney U Tests Reporting Significant Differences Between Groups on the Injury Risk Subscale of the Muscle Appearance Satisfaction Scale*

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<th>Group 1</th>
<th>Group 2</th>
<th>$U$</th>
<th>$z$</th>
<th>$p$</th>
<th>$r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>No disorder</td>
<td>MD only</td>
<td>1597.500</td>
<td>-7.651</td>
<td>&lt; .001</td>
<td>.30</td>
</tr>
<tr>
<td>No disorder</td>
<td>MD &amp; BDD</td>
<td>818.000</td>
<td>-4.008</td>
<td>&lt; .001</td>
<td>.21</td>
</tr>
<tr>
<td>No disorder</td>
<td>MD &amp; EAT</td>
<td>994.000</td>
<td>-8.556</td>
<td>&lt; .001</td>
<td>.43</td>
</tr>
<tr>
<td>No disorder</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>1444.500</td>
<td>-5.267</td>
<td>&lt; .001</td>
<td>.27</td>
</tr>
<tr>
<td>MD only</td>
<td>BDD only</td>
<td>77.000</td>
<td>-3.634</td>
<td>&lt; .001</td>
<td>.51</td>
</tr>
<tr>
<td>MD only</td>
<td>EAT only</td>
<td>858.000</td>
<td>-6.237</td>
<td>&lt; .001</td>
<td>.47</td>
</tr>
<tr>
<td>MD only</td>
<td>BDD &amp; EAT</td>
<td>94.500</td>
<td>-4.626</td>
<td>&lt; .001</td>
<td>.61</td>
</tr>
<tr>
<td>BDD only</td>
<td>MD &amp; EAT</td>
<td>55.000</td>
<td>-4.127</td>
<td>&lt; .001</td>
<td>.58</td>
</tr>
<tr>
<td>EAT only</td>
<td>MD &amp; BDD</td>
<td>410.000</td>
<td>-3.261</td>
<td>.001</td>
<td>.26</td>
</tr>
<tr>
<td>EAT only</td>
<td>MD &amp; EAT</td>
<td>608.000</td>
<td>-7.147</td>
<td>&lt; .001</td>
<td>.54</td>
</tr>
<tr>
<td>EAT only</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>720.500</td>
<td>-4.225</td>
<td>&lt; .001</td>
<td>.33</td>
</tr>
<tr>
<td>MD &amp; EAT</td>
<td>BDD &amp; EAT</td>
<td>64.500</td>
<td>-5.128</td>
<td>&lt; .001</td>
<td>.68</td>
</tr>
<tr>
<td>MD &amp; BDD &amp; EAT</td>
<td>BDD &amp; EAT</td>
<td>90.500</td>
<td>-3.407</td>
<td>.001</td>
<td>.52</td>
</tr>
</tbody>
</table>

*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Table E38

*Mann-Whitney U Tests Reporting Significant Differences Between Groups on the Muscle Satisfaction Subscale of the Muscle Appearance Satisfaction Scale*

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>U</th>
<th>z</th>
<th>p</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>No disorder</td>
<td>MD only</td>
<td>2824.500</td>
<td>-5.835</td>
<td>&lt; .001</td>
<td>.23</td>
</tr>
<tr>
<td>MD &amp; BDD</td>
<td></td>
<td>856.500</td>
<td>-3.921</td>
<td>&lt; .001</td>
<td>.20</td>
</tr>
<tr>
<td>No disorder</td>
<td>MD &amp; EAT</td>
<td>4235.500</td>
<td>-3.730</td>
<td>&lt; .001</td>
<td>.19</td>
</tr>
<tr>
<td>MD &amp; BDD &amp; EAT</td>
<td></td>
<td>1484.500</td>
<td>-5.206</td>
<td>&lt; .001</td>
<td>.26</td>
</tr>
<tr>
<td>EAT only</td>
<td>MD &amp; BDD</td>
<td>384.000</td>
<td>-3.414</td>
<td>.001</td>
<td>.28</td>
</tr>
<tr>
<td>EAT only</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>650.500</td>
<td>-4.536</td>
<td>&lt; .001</td>
<td>.36</td>
</tr>
</tbody>
</table>

*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Table E39

Mann-Whitney U Tests Reporting Significant Differences Between Groups on the Muscle Appearance Satisfaction Scale Total Score

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>U</th>
<th>z</th>
<th>p</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>No disorder</td>
<td>MD only</td>
<td>248.000</td>
<td>-9.642</td>
<td>&lt; .001</td>
<td>.38</td>
</tr>
<tr>
<td>No disorder</td>
<td>EAT only</td>
<td>192.37</td>
<td>-3.344</td>
<td>.001</td>
<td>.15</td>
</tr>
<tr>
<td>No disorder</td>
<td>MD &amp; BDD</td>
<td>38.500</td>
<td>-5.789</td>
<td>&lt; .001</td>
<td>.30</td>
</tr>
<tr>
<td>No disorder</td>
<td>MD &amp; EAT</td>
<td>230.000</td>
<td>-9.670</td>
<td>&lt; .001</td>
<td>.49</td>
</tr>
<tr>
<td>No disorder</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>90.000</td>
<td>-7.696</td>
<td>&lt; .001</td>
<td>.39</td>
</tr>
<tr>
<td>MD only</td>
<td>BDD only</td>
<td>47.000</td>
<td>-4.284</td>
<td>&lt; .001</td>
<td>.61</td>
</tr>
<tr>
<td>MD only</td>
<td>EAT only</td>
<td>98.000</td>
<td>-8.933</td>
<td>&lt; .001</td>
<td>.68</td>
</tr>
<tr>
<td>MD only</td>
<td>BDD &amp; EAT</td>
<td>35.500</td>
<td>-5.598</td>
<td>&lt; .001</td>
<td>.74</td>
</tr>
<tr>
<td>BDD only</td>
<td>MD &amp; BDD</td>
<td>10.500</td>
<td>-3.674</td>
<td>&lt; .001</td>
<td>.73</td>
</tr>
<tr>
<td>BDD only</td>
<td>MD &amp; EAT</td>
<td>44.500</td>
<td>-4.341</td>
<td>&lt; .001</td>
<td>.61</td>
</tr>
<tr>
<td>BDD only</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>23.000</td>
<td>-4.101</td>
<td>&lt; .001</td>
<td>.69</td>
</tr>
<tr>
<td>EAT only</td>
<td>MD &amp; BDD</td>
<td>12.000</td>
<td>-5.645</td>
<td>&lt; .001</td>
<td>.47</td>
</tr>
<tr>
<td>EAT only</td>
<td>MD &amp; EAT</td>
<td>83.500</td>
<td>-8.988</td>
<td>&lt; .001</td>
<td>.69</td>
</tr>
<tr>
<td>EAT only</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>33.500</td>
<td>-7.337</td>
<td>&lt; .001</td>
<td>.59</td>
</tr>
<tr>
<td>MD &amp; BDD</td>
<td>BDD &amp; EAT</td>
<td>4.500</td>
<td>-4.500</td>
<td>&lt; .001</td>
<td>.79</td>
</tr>
<tr>
<td>MD &amp; EAT</td>
<td>BDD &amp; EAT</td>
<td>31.500</td>
<td>-5.666</td>
<td>&lt; .001</td>
<td>.75</td>
</tr>
<tr>
<td>MD &amp; BDD &amp; EAT</td>
<td>BDD &amp; EAT</td>
<td>12.500</td>
<td>-5.230</td>
<td>&lt; .001</td>
<td>.81</td>
</tr>
</tbody>
</table>

Note. MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Mann-Whitney U tests were undertaken to examine group differences on the total score of the EAT-26 (see Table E40).

Table E40

*Mann-Whitney U Tests Reporting Significant Differences Between Groups on the 26-Item Eating Attitudes Test Total Score*

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Group 2</th>
<th>U</th>
<th>z</th>
<th>p</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>No disorder</td>
<td>MD only</td>
<td>2488.000</td>
<td>-3.946</td>
<td>&lt; .001</td>
<td>.16</td>
</tr>
<tr>
<td>No disorder</td>
<td>BDD only</td>
<td>835.500</td>
<td>-3.359</td>
<td>.001</td>
<td>.18</td>
</tr>
<tr>
<td>No disorder</td>
<td>EAT only</td>
<td>13356.500</td>
<td>-6.332</td>
<td>&lt; .001</td>
<td>.30</td>
</tr>
<tr>
<td>No disorder</td>
<td>MD &amp; EAT</td>
<td>1350.500</td>
<td>-7.140</td>
<td>&lt; .001</td>
<td>.39</td>
</tr>
<tr>
<td>No disorder</td>
<td>BDD &amp; EAT</td>
<td>917.500</td>
<td>-5.383</td>
<td>&lt; .001</td>
<td>.29</td>
</tr>
<tr>
<td>No disorder</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>438.500</td>
<td>-6.898</td>
<td>&lt; .001</td>
<td>.37</td>
</tr>
<tr>
<td>EAT only</td>
<td>MD &amp; EAT</td>
<td>1360.000</td>
<td>-3.784</td>
<td>&lt; .001</td>
<td>.29</td>
</tr>
<tr>
<td>EAT only</td>
<td>BDD &amp; EAT</td>
<td>676.500</td>
<td>-3.542</td>
<td>&lt; .001</td>
<td>.29</td>
</tr>
<tr>
<td>EAT only</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>457.500</td>
<td>-5.163</td>
<td>&lt; .001</td>
<td>.41</td>
</tr>
<tr>
<td>MD &amp; BDD</td>
<td>MD &amp; BDD &amp; EAT</td>
<td>19.000</td>
<td>-3.487</td>
<td>&lt; .001</td>
<td>.63</td>
</tr>
</tbody>
</table>

*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Chi-square tests and Fisher’s exact tests were used to explore the relationships between categorical variables (from the BDDQ) across groups of participants at risk of, and not at risk of MD, BDD, and eating disorders (see Tables E41–E44).

Table E41

**Chi-Square Tests Revealed Significant Association Between Being Worried About how you Look and Whether Participants Were at Risk of Symptoms of Muscle Dysmorphia, Body Dysmorphic Disorder, and Eating Disorders or not**

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>n</th>
<th>$\chi^2$</th>
<th>p</th>
<th>phi</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD only</td>
<td>1</td>
<td>642</td>
<td>25.815</td>
<td>&lt; .001</td>
<td>-.201</td>
</tr>
<tr>
<td>BDD only</td>
<td>1</td>
<td>642</td>
<td>42.171</td>
<td>&lt; .001</td>
<td>-.256</td>
</tr>
<tr>
<td>EAT only</td>
<td>1</td>
<td>642</td>
<td>16.140</td>
<td>&lt; .001</td>
<td>-.159</td>
</tr>
<tr>
<td>MD &amp; BDD</td>
<td>1</td>
<td>642</td>
<td>21.147</td>
<td>&lt; .001</td>
<td>-.181</td>
</tr>
<tr>
<td>MD &amp; EAT</td>
<td>1</td>
<td>642</td>
<td>12.323</td>
<td>&lt; .001</td>
<td>-.139</td>
</tr>
<tr>
<td>MD &amp; BDD &amp; EAT</td>
<td>1</td>
<td>642</td>
<td>213.227</td>
<td>&lt; .001</td>
<td>-.144</td>
</tr>
</tbody>
</table>

*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Table E42

*Chi-Square Tests Revealed Significant Association Between Thinking About Your Appearance Problems a lot and Whether Participants Were at Risk of Symptoms of Muscle Dysmorphia, Body Dysmorphic Disorder, and Eating Disorders or not*

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>n</th>
<th>(\chi^2)</th>
<th>(p)</th>
<th>(\phi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD only</td>
<td>1</td>
<td>412</td>
<td>19.894</td>
<td>&lt; .001</td>
<td>-.220</td>
</tr>
<tr>
<td>BDD only</td>
<td>1</td>
<td>412</td>
<td>118.285</td>
<td>&lt; .001</td>
<td>-.536</td>
</tr>
<tr>
<td>MD &amp; BDD</td>
<td>1</td>
<td>412</td>
<td>57.292</td>
<td>&lt; .001</td>
<td>-.373</td>
</tr>
<tr>
<td>MD &amp; EAT</td>
<td>1</td>
<td>412</td>
<td>11.632</td>
<td>.001</td>
<td>-.168</td>
</tr>
<tr>
<td>MD &amp; BDD &amp; EAT</td>
<td>1</td>
<td>412</td>
<td>35.380</td>
<td>&lt; .001</td>
<td>-.293</td>
</tr>
</tbody>
</table>

*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.

Table E43

*Chi-Square Tests Revealed Significant Association Between “has it Often Upset you a lot” and Whether Participants Were at Risk of Symptoms of Muscle Dysmorphia, Body Dysmorphic Disorder, and Eating Disorders or not*

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>n</th>
<th>(\chi^2)</th>
<th>(p)</th>
<th>(\phi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD only</td>
<td>1</td>
<td>164</td>
<td>14.039</td>
<td>&lt; .001</td>
<td>-.293</td>
</tr>
<tr>
<td>BDD only</td>
<td>1</td>
<td>164</td>
<td>26.899</td>
<td>&lt; .001</td>
<td>-.405</td>
</tr>
<tr>
<td>MD &amp; BDD</td>
<td>1</td>
<td>164</td>
<td>19.754</td>
<td>&lt; .001</td>
<td>-.347</td>
</tr>
<tr>
<td>MD &amp; BDD &amp; EAT</td>
<td>1</td>
<td>164</td>
<td>11.725</td>
<td>.001</td>
<td>-.267</td>
</tr>
</tbody>
</table>

*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Fisher's Exact Tests Revealed Significant Association Between the Amount of Time Spend Thinking About how you Look and Whether Participants Were at Risk of Symptoms of Muscle Dysmorphia, Body Dysmorphic Disorder, and Eating Disorders or not

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>n</th>
<th>$\chi^2$</th>
<th>$p$</th>
<th>$\phi_c$</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD only</td>
<td>2</td>
<td>162</td>
<td>24.902</td>
<td>.001</td>
<td>.391</td>
</tr>
<tr>
<td>BDD only</td>
<td>2</td>
<td>162</td>
<td>188.356</td>
<td>&lt; .001</td>
<td>.964</td>
</tr>
<tr>
<td>MD &amp; BDD</td>
<td>2</td>
<td>162</td>
<td>69.623</td>
<td>&lt; .001</td>
<td>.610</td>
</tr>
<tr>
<td>MD &amp; EAT</td>
<td>2</td>
<td>162</td>
<td>19.692</td>
<td>&lt; .001</td>
<td>.347</td>
</tr>
<tr>
<td>MD &amp; BDD &amp; EAT</td>
<td>2</td>
<td>162</td>
<td>40.725</td>
<td>&lt; .001</td>
<td>.474</td>
</tr>
</tbody>
</table>

*Note.* MD = muscle dysmorphia; EAT = eating disorder; BDD = body dysmorphic disorder.
Table E45

**Spearman Rank Order Correlation and Point-Biserial Correlations Between the Muscle Appearance Satisfaction Scale, Body Dysmorphic Disorder Questionnaire, and the 26-Item Eating Attitudes Test**

<table>
<thead>
<tr>
<th></th>
<th>MASS</th>
<th>BD</th>
<th>MC</th>
<th>SU</th>
<th>IR</th>
<th>MS</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAT-26 total score</td>
<td>.411*</td>
<td>.274*</td>
<td>.146</td>
<td>.170</td>
<td>.216*</td>
<td>.192*</td>
</tr>
<tr>
<td>Binge</td>
<td>-.019</td>
<td>.033</td>
<td>-.078</td>
<td>-.053</td>
<td>-.034</td>
<td>.184*</td>
</tr>
<tr>
<td>Vomit</td>
<td>.091</td>
<td>.106</td>
<td>.050</td>
<td>.031</td>
<td>.196*</td>
<td>.026</td>
</tr>
<tr>
<td>Laxatives, diuretics</td>
<td>.133</td>
<td>.156</td>
<td>.096</td>
<td>.177*</td>
<td>.113</td>
<td>-.042</td>
</tr>
<tr>
<td>Exercise</td>
<td>.127</td>
<td>.117</td>
<td>.082</td>
<td>-.056</td>
<td>.226*</td>
<td>.041</td>
</tr>
<tr>
<td>Lost ≥ 9 kg</td>
<td>.042</td>
<td>-.028</td>
<td>.144</td>
<td>.124</td>
<td>-.040</td>
<td>-.184*</td>
</tr>
<tr>
<td>EAT</td>
<td>.092</td>
<td>.016</td>
<td>.123</td>
<td>-.013</td>
<td>.094</td>
<td>.120</td>
</tr>
<tr>
<td>BDD</td>
<td>.324*</td>
<td>.315*</td>
<td>.299*</td>
<td>.218*</td>
<td>.178*</td>
<td>.041</td>
</tr>
</tbody>
</table>

Worried about how you look

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you think about it a lot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has it upset you a lot</td>
<td>-.211*</td>
<td>-.152</td>
<td>-.168</td>
<td>-.084</td>
<td>-.156</td>
<td>-.186*</td>
</tr>
<tr>
<td>Has it gotten in the way</td>
<td>-.173</td>
<td>-.219*</td>
<td>-.038</td>
<td>-.127</td>
<td>-.088</td>
<td>-.111</td>
</tr>
<tr>
<td>Has it caused any problems</td>
<td>-.022</td>
<td>-.081</td>
<td>-.075</td>
<td>.059</td>
<td>.038</td>
<td>-.013</td>
</tr>
<tr>
<td>Are there things you avoid</td>
<td>-.02</td>
<td>.071</td>
<td>-.081</td>
<td>.11</td>
<td>-.002</td>
<td>-.247**</td>
</tr>
<tr>
<td>How much time do you think about it</td>
<td>.383*</td>
<td>.385*</td>
<td>.372*</td>
<td>.255*</td>
<td>.151</td>
<td>.069</td>
</tr>
</tbody>
</table>

*Note.* MASS = Muscle Appearance Satisfaction Scale total score; BD = Bodybuilding Dependence subscale; MC = Muscle Checking subscale; SU = Substance Use subscale; IR = Injury Risk subscale; MS = Muscle Satisfaction subscale; EAT-26 = 26-item Eating Attitudes Test; EAT = at risk of eating disorder; BDD = at risk of body dysmorphic disorder.

* *p < .05, ** *p < .01.