Archives of Assessment Psychology, Vol. 5, No. 1, (11-22)

Development and Validation of the Muscle Pictorial Measure

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Abstract

Most pictorial measures of body perceptions vary by adiposity rather than muscularity. Measures examining muscularity have typically been created for men. We created pictorial measures that vary by muscularity and can be used by both genders in order to assess body perceptions. Two samples of racially/ethnically diverse undergraduates (N = 279 total) completed a survey including the new pictorial measure, weight-lifting behavior, and drive for muscularity. Weight and height were measured for one sample while self-reported for the second sample. Two weeks later, participants completed the pictorial measure online. Results indicate that this measure has satisfactory test-retest reliability, convergent validity, and cultural validity, and can be used to collect data quickly in large samples. Health implications of muscularity dissatisfaction as well as future research directions on this topic are discussed.

Introduction

Pictorial measures that include a series of male and female figure drawings ranging from thin to obese are a popular means of assessing body perceptions. They can easily be incorporated into surveys and administered to large samples (Gardner & Brown, 2010) and are versatile in terms of the variables they can assess. However, as some have recently noted (Cafri, van den Berg, & Brannick, 2010; Gardner & Brown, 2010), extant pictorial measures are limited in some ways. One of the limitations of these measures is that many assess incremental changes in body fat, failing to capture changes in muscularity, which may be important to body perceptions (McCreary, 2011). In the current study, our goal is to test the reliability and validity of a new pictorial measure that features changes in muscularity: the Muscle Pictorial Measure (MPM).

Muscularity is a central feature of the male body ideal, and can be observed in many male figures in the media such as action figures, models, and actors (McCreary, 2011; Murnen, 2011). Not surprisingly, research shows that men have a higher drive for muscularity (McCreary, 2011), engage in more weight-lifting behaviors (Salvatore & Marecek, 2010), and have higher rates of steroid use (Berning, Adams, DeBeliso, Stamford, & Newman, 2008) than women. Because muscularity is important to men, measures of men's body image should account for this feature.

Although there are some well-designed pictorial measures (e.g., the Contour Drawing Rating Scale; Thompson & Gray, 1995), these measures typically do not assess muscularity but instead change incrementally in terms of body fat. When used with men, these measures often produce inconclusive findings regarding body dissatisfaction (operationally defined as the difference between the figure participants see as ideal for themselves and the figure they think best represents their current body size). For example, in some studies a similar percentage of men desire to be either smaller or larger (Gillen & Lefkowitz, 2011; Stanford & McCabe, 2002). Men who want to be larger may be wishing for more muscles, whereas men who want to be smaller may desire to lose body fat. In any case, it is impossible to draw firm conclusions from this measure about the source of men's body dissatisfaction—lack of muscles or excess body fat.

To gain a better understanding of the role of muscularity in men's body image, researchers have developed two types of pictorial measures. One type is a paper-based assessment that consists of a series of male figure drawings that increase incrementally by muscle (Buchanan, Frederick, & Friedman, 2005; Lynch & Zellner, 1999). These measures generally have good psychometric properties (Frederick, Fessler, & Haselton, 2005; Frederick et al., 2007; Lynch & Zellner, 1999). To our knowledge, there is only one pictorial measure for women where figures increase incrementally by muscle (Furnham, Titman, & Sleeman, 1994), although psychometric properties for this scale have not been reported. The second type of measure is designed primarily for men and assesses their perceptions of both muscularity and body fat. Examples include the somatomorphic matrix (Gruber, Pope, Borowiecki, & Cohane, 1999) and bodybuilder image grid (Hildebrandt, Langenbucher, & Schlundt, 2004). The validity of both instruments is good (Cafri & Thompson, 2004; Gruber et al., 1999; Hildebrandt et al., 2004), although the somatomorphic matrix has demonstrated unsatisfactory 7 – 10 day test-retest reliability in a sample of male and female college students (Cafri, Roehrig, & Thompson, 2004).

Building on this previous research, we created the MPM. The MPM has two important features. One is that it includes both male and female pictorial drawings that increase incrementally by muscle. Extant pictorial measures include drawings of only one gender (Buchanan et al., 2005; Furnham et al., 1994; Lynch & Zellner, 1999), and the somatomorphic matrix and bodybuilder image grid were designed to be used by men. Thus, research on muscularity concerns seems to be focused on men. Although men have a higher drive for muscularity than women, some research suggests that muscularity is still important to women (McCreary, 2011). Considering that the female ideal body includes being both lean and "toned" (Petrie & Greenleaf, 2012), some women may strive to gain more muscle to achieve this look. Female athletes in particular may seek to increase muscle in order to improve performance (McCreary, 2011; Petrie & Greenleaf, 2012). Including both male and female pictorial drawings has the potential to not only increase our understanding of muscle-related perceptions among women, but will also allow for testing gender differences in these perceptions.

Another important feature of the MPM is its applicability to various racial/ethnic groups. Some figure drawings, such as the CDRS (Thompson & Gray, 1995), have been criticized for having European American facial features (see Gillen & Lefkowitz, 2011; Patel & Gray, 2001), which suggests that participants in other racial/ethnic groups may not be able to identify with them to the same extent as European Americans. In the present study, the MPM was designed with neutral facial features in order to enhance its applicability to multiple racial/ethnic groups.

In sum, the goal of the present study is to explore reliability and validity of a new pictorial measure, the MPM, which includes male and female figure drawings that increase incrementally by muscle. The specific study goals are as follows:

1. To assess the test-retest reliability of the MPM.
2. To assess the convergent validity of the MPM by examining relations with body mass index (BMI), weight-lifting behaviors, and drive for muscularity.
3. To assess the cultural validity of the MPM by examining perceived race/ethnicity of the figures and personal identification with the figures.

Method

Two samples of undergraduate students enrolled in colleges located near a large city in the northeastern United States participated in this study (one sample was drawn from each college). Students received course credit toward their psychology class in exchange for participating. At Time 1, participants completed an in-person survey in a research lab or classroom, and for Sample 1 only, were measured for their height and weight (Sample 2 self-reported their height and weight). At Time 2, participants completed an online survey approximately 2 weeks later (Sample 1, M = 14.93 days, SD = 4.42; Sample 2, M = 15.13 days, SD = 3.95). How were the samples chosen in terms of who/criteria for ending up in each sample?

In Sample 1 (N = 116; M = 21.10 years, SD = 4.08, range 18 – 44 years), 53% were female, and 57% identified as European American/White, 18% as African American/Black, 11% as Asian/Asian American/Pacific Islander, 10% as Latino American/Hispanic, 2% as American Indian/Native American/Aleutian or Eskimo, and 2% as other. In Sample 2 (N = 163; M = 20.43 years, SD = 3.63, range 18 – 44 years), 56% were female, and 55% identified as European American/White, 21% as Asian/Asian American/Pacific Islander, 15% as African American/Black, 6% as Latino American/Hispanic, and 4% as other.

The MPM was created to assess perceptions of body muscularity. We commissioned a student artist to draw the MPM. The final MPM includes a set of 9 male and 9 female figure drawings that increase incrementally by muscularity (see Appendix A). We presented participants with same-gender figure drawings and asked them to identify: (1) the drawing that looks most like their own figure (*perceived body*) and (2) the drawing they would most want to look like (*ideal body*). Following the recommendation of Gardner and Brown (2010), each question was placed on a separate page, with the same figure drawing set repeated on each page for reference. From the scores on these variables, we calculated one discrepancy score: *ideal body – perceived body* (*muscularity dissatisfaction*). Participants were then asked two questions pertaining to the race/ethnicity of the figures (modified from Pulvers et al., 2004): (1) Which race/ethnicity best describes the figures (1 = African American/Black, 2 = European American/White, 3 = Asian American/Asian/Pacific Islander, 4 = Latino American/Hispanic, 5 = American Indian/Native American/Aleutian or Eskimo, 6 = no specific race/ethnicity) and (2) Do the figures look like you and other people of your race/ethnicity (yes, no). These questions appeared on the same page with one figural drawing set as a reference for both questions.

Also as recommended by Gardner and Brown (2010), we varied the order of presentation of figures in each sample. In Sample 1, figures were presented in ascending size order (figures 1 – 9). In Sample 2, figures were presented in random order (figures 4, 7, 2, 9, 6, 3, 1, 8, 5) so as to reduce the possibility of inflated test-retest reliability (Gardner & Brown, 2010; Gardner, Friedman, & Jackson, 1998), and because prior work demonstrates that findings may differ depending on the order of figures presented (Doll, Ball, & Willows, 2004). We conducted a pilot test (N = 25) to determine average completion time on this measure. On average, participants took 97.64 seconds to complete the measure, suggesting that the MPM is a quick assessment of body size perceptions.

In Sample 1, trained research assistants measured participants’ height in centimeters and weight in kilograms. Measurements were taken three times (Lohman, Roche, & Martorell, 1988), and the average of these measures was used in data analyses. In Sample 2, participants reported their height and weight. Previous research indicates that self-report measures of height and weight are highly correlated with actual measures of these variables (rs = .85 - .92 for self-reported and actual BMI; Goodman, Hinden, & Khandelwal, 2000; Himes, Hannan, Wall, & Neumark-Sztainer, 2004), but may slightly underestimate weight and overestimate height (Himes et al., 2004). For both samples, BMI was calculated from height and weight using the formula provided by the Centers for Disease Control and Prevention (CDC, 2015).

Participants were asked two questions about weight-lifting: during the typical week, do you use (1) free weights and (2) weight machines (yes/no)? Responses to each question were summed to create a total score, with higher scores indicating more weight-lifting behavior.

The Drive for Muscularity Scale (McCreary & Sasse, 2000) has 15 items that assess the desire to be muscular. These items include cognitions about muscularity as well as behaviors for increasing muscle mass (e.g., “I wish that I were more muscular”). Participants rate their responses on a scale of 1 = always, to 6 = never. All items are reverse scored so that higher scores indicate a greater drive for muscularity. Internal consistency reliability was satisfactory in both samples (Sample 1, $\alpha = .92$; Sample 2, $\alpha = .93$).

Results

Mean scores on perceived and ideal body sizes for the MPM at Times 1 and 2 are presented in Table 1 separately by gender. Gender differences cannot be calculated on raw scores on the MPM because men and women respond to different sets of figures; however, gender differences can be calculated on discrepancy scores (i.e., muscle dissatisfaction; Tantleff-Dunn & Thompson, 1995). In Sample 1, men had a significantly higher BMI than women, and significantly higher muscle dissatisfaction at Time 1 (but not at Time 2). In Sample 2, there were no gender differences in BMI although men had higher muscle dissatisfaction than women at both time points (see Table 1). In both samples, weight-lifting behavior and drive for muscularity were significantly higher among men than women (see Table 1).

Table 1

Mean scores and gender differences on all study variables

	Sample 1 *M* (*SD*)			Sample 2 *M* (*SD*)		
	Men	Women	*t*	Men	Women	*t*
Time 1: MPM						
Perceived body size	5.95 (1.48)	5.21 (1.21)	N/A	6.00 (1.79)	5.33 (1.59)	N/A
Ideal body size	7.45 (1.60)	5.00 (1.44)	N/A	7.88 (1.57)	5.61 (1.44)	N/A
Muscle dissatisfaction	2.05 (1.35)	1.13 (0.94)	4.30***	2.15 (1.58)	1.25 (1.10)	4.12***
Time 2: MPM						
Perceived body size	6.11 (1.37)	5.41 (1.37)	N/A	6.30 (1.54)	5.53 (1.51)	N/A
Ideal body size	7.20 (1.45)	4.70 (1.27)	N/A	8.00 (1.08)	5.86 (1.13)	N/A
Muscle dissatisfaction	1.52 (1.28)	1.20 (0.98)	1.50	1.96 (1.40)	1.27 (1.13)	3.47***
BMI	25.42 (4.67)	23.60 (4.23)	2.19*	24.22 (3.66)	23.36 (4.89)	1.23
Weight-lifting	1.33 (0.86)	0.45 (0.72)	5.89***	1.13 (0.86)	0.46 (0.78)	5.01***
Drive for Muscularity	46.87 (12.79)	26.31 (9.00)	9.92***	45.88 (14.84)	26.25 (10.19)	9.49***

Note. MPM = Muscle Pictorial Measure. BMI, weight-lifting, and drive for muscularity were assessed at Time 1. N/A= gender differences cannot be calculated. Muscle dissatisfaction represents absolute value scores. *$p \leq .05$; **$p \leq .01$, ***$p \leq .001$.

Reliability

Because the MPM presents single items to assess current and ideal body perceptions, internal reliability cannot be computed and instead test-retest reliability must be established. We assessed two-week test-retest reliability on the MPM by performing correlations among MPM variables separately by gender. First, we examined correlations between perceived body size at Times 1 and 2, and ideal body size at Times 1 and 2 (see Table 2). Second, we examined correlations between the discrepancy scores (i.e., muscle dissatisfaction) at Times 1 and 2 (see Table 2). Although reliability of scores on muscle dissatisfaction and on perceived and ideal body sizes are certainly related, we also tested reliability of the discrepancy score because it is often used to represent dissatisfaction (see Cafri & Thompson, 2004; Cafri et al., 2004). We performed Fisher's r-to-z transformations on all reported average correlations. Perceived body size at Time 1 was significantly positively correlated with perceived body size at Time 2 (average r = .72). Similarly, ideal body size at Time 1 was significantly positively correlated with ideal body size at Time 2 (average r = .56), and muscle dissatisfaction at Time 1 was significantly positively correlated with muscle dissatisfaction at Time 2 (average r = .57).

Table 2

Test-retest reliability for the MPM, separately by gender

Sample 1	1	2	3	4	5	6
1. Perceived body size (T1)	--	.40***	.30*	.69***	.28*	.34**
2. Ideal body size (T1)	.20	--	.10	.38**	.75***	-.01
3. Muscle dissatisfaction (T1)	-.55***	.26*	--	.35**	.09	.62***
4. Perceived body size (T2)	.81***	.23	-.44***	--	.45***	.58***
5. Ideal body size (T2)	.23	.72***	.04	.29*	--	-.01
6. Muscle dissatisfaction (T2)	-.30*	.06	.62***	-.46***	.26	--
Sample 2	**1**	**2**	**3**	**4**	**5**	**6**
1. Perceived body size (T1)	--	.41***	-.08	.60***	.21*	-.10
2. Ideal body size (T1)	.37**	--	.03	.25*	.42***	-.13
3. Muscle dissatisfaction (T1)	-.60***	.09	--	-.09	-.05	.47***
4. Perceived body size (T2)	.74***	.24*	-.46***	--	.22*	-.15
5. Ideal body size (T2)	.21	.23*	.08	.20	--	.02
6. Muscle dissatisfaction (T2)	-.54***	-.02	.55***	-.67***	.35**	--

Note. MPM = Muscle Pictorial Measure. T1 = Time 1, T2 = Time 2. Women's correlations (rs) are above the diagonal; men's are below. *$p \leq .05$; **$p \leq .01$, ***$p \leq .001$. Muscle dissatisfaction represents absolute value scores.

Validity

We assessed two aspects of the MPM's validity. All correlation analyses to test validity were performed separately by gender. First, we examined convergent validity, or the extent to which a measure is associated with another measure to which it should be theoretically similar. Given that individuals who are more muscular should have higher BMIs, we expected that scores on perceived body size on the MPM would be correlated with BMI. Three of four correlations were positive and significant (average $r = .39$; see Table 3); the non-significant correlation was for women in Sample 2.

Also, we expected that individuals who have larger ideal body sizes and higher muscle dissatisfaction should show a stronger drive for muscularity and engage in more weight-lifting behavior. To that end, we performed correlations between ideal body size and muscle dissatisfaction at Time 1, and weight-lifting behavior and drive for muscularity. Three of four correlations between ideal body size and weight-lifting behavior were positive and significant (average $r = .23$; see Table 3). All correlations between ideal body size and drive for muscularity were positive, although only three were significant (average $r = .33$; see Table 3). None of the correlations between muscle dissatisfaction, weight-lifting behavior, and drive for muscularity were significant, although most were positive (see Table 3).

Table 3

Validity for the MPM, separately by gender

Sample 1	1	2	3	4	5	6
1. Perceived body size (T1)	--	.40***	.30*	.55***	-.07	-.01
2. Ideal body size (T1)	.20	--	.10	.31*	.02	.17
3. Muscle dissatisfaction (T1)	-.55***	.26*	--	.52***	-.00	.22
4. BMI	.54***	-.03	-.25	--	-.01	.10
5. Weightlifting	.29*	.28*	-.17	.18	--	.59***
6. Drive for muscularity	.03	.47***	.13	-.25	.53***	--
Sample 2	**1**	**2**	**3**	**4**	**5**	**6**
1. Perceived body size (T1)	--	.41***	-.08	-.05	.13	.02
2. Ideal body size (T1)	.37**	--	.03	.00	.23*	.21*
3. Muscle dissatisfaction (T1)	-.60***	.09	--	.11	.18	.18
4. BMI	.37**	.11	-.30**	--	-.03	-.11
5. Weightlifting	.29*	.39***	.02	.14	--	.46***
6. Drive for muscularity	.22	.43***	.08	-.06	.22	--

Note. MPM = Muscle Pictorial Measure. T1 = Time 1. Women's correlations (*r*s) are above the diagonal; men's are below. $*p \leq .05$; $**p \leq .01$, $***p \leq .001$. Muscle dissatisfaction represents absolute value scores.

Second, we tested the cultural validity of the MPM, or the extent to which a measure is valid across different racial/ethnic groups. Among men in Samples 1 and 2, most thought that the figures resembled no specific race/ethnicity (61.1%, 56.3%), with many other male participants reporting that the figures resembled European Americans/Whites (27.8%, 12.7%), and African Americans/Blacks (9.3%, 25.4%), respectively. Among women in Samples 1 and 2, results were similar, with many participants in both samples choosing no specific race/ethnicity (36.1%, 55.7%), European American/White (54.1%, 36.4%), or African American/Black (6.6%, 3.4%), respectively. When asked whether the figures resembled themselves and members of their own racial/ethnic group, nearly 2/3 of participants in Samples 1 and 2 reported that they did (63.6%, 57.1% of men; 64.4%, 67.8% of women, respectively).

Discussion

In this study, our goal was to introduce a new measure of perceptions of muscularity and provide preliminary reliability and validity information for this measure, the Muscle Pictorial Measure (MPM). We created this measure to facilitate body image research aiming to investigate perceptions of muscularity and extend research that has focused on perceptions of adiposity. Although researchers have established the importance of understanding men's muscularity dissatisfaction, and consequences associated with this dissatisfaction such as steroid use, extant research has devoted little attention to women's muscularity (McCreary, 2011). The MPM provides a comparable pictorial measure for men and women. Further, it is a cost-efficient and time-efficient measure that can easily be administered to large samples.

Across two samples of participants, we conducted test-retest reliability analyses on the MPM across a two-week time period. We found that assessment of women's (r range = .42 - .75) and men's (r range = .23 - .81) perceived body size, ideal body size, and muscularity dissatisfaction were significantly correlated across Time 1 and Time 2. Test-retest reliability scores for men on these three variables are similar to those found for men in prior studies of paper-based muscularity pictorial measures (rs = .71 - .89; Frederick et al., 2007; Lynch & Zellner, 1999). In the current study, reliability scores were similar for Samples 1 and 2, although slightly higher for Sample 1 where figures were presented in ascending rather than random order. When presented incrementally, participants may more easily remember the position of their previously selected figures, and then choose these same figures at a later time point for ease of completion, contributing to inflated test-retest reliability (Gardner & Brown, 2010; Gardner et al., 1998). Our findings suggest that this may not be a significant problem for this measure, although future studies including ascending and random order figures would be useful.

Next, both convergent and cultural validity of the MPM were assessed. To examine convergent validity, we first examined correlations between the MPM and BMI. We expected that participants who reported perceiving themselves as more muscular would also have higher BMIs. Three of the four correlations examined were significant; in Sample 2 women's BMIs were not significantly related to their perceptions of their muscularity. It is likely that women who have higher BMIs are not particularly muscular, but have higher levels of adiposity. For example, among men and women with the same BMI, women typically have more body fat than their male counterparts (CDC, 2015). Thus, BMI may not be as highly associated with muscularity among women as among men.

Perhaps a better means of assessing convergent validity of the MPM is to examine correlations between participants' ratings of their ideal muscularity and their weight lifting behaviors and drive for muscularity. Our results indicate that individuals who preferred figures with greater muscularity were generally more likely to engage in weight lifting behaviors, although the correlation for women in Sample 1 was not significant. Also, individuals who preferred figures with more muscle had a higher drive for muscularity. Again, the correlation for women in Sample 1 was not significant, although it was positive and thus still indicative of greater drive for muscularity among women with larger body ideals. These findings suggest that the MPM is a valid measure of muscle ideals, particularly among men. It is interesting that only body ideals, but not muscle dissatisfaction, was significantly associated with weight-lifting behavior and drive for muscularity. It could be that muscle dissatisfaction has no relation with weight-lifting behavior and drive for muscularity because muscle-building behaviors may not necessarily represent dissatisfaction. That is, individuals who engage in muscle-building behaviors may be dissatisfied with their perceived lack of progress toward a larger size, whereas those who do not engage in these same behaviors may also be dissatisfied but may not be actively trying to resolve these feelings.

In order to estimate the cultural validity of the MPM, we asked participants to indicate the extent to which the pictorial measure resembled someone of their own racial/ethnic group and what racial/ethnic group they believed the figures to represent. The majority of the sample believed that the figures resembled themselves and members of their own racial/ethnic group, regardless of the racial/ethnic group that they belonged to. Thus, it appears that this measure is valid for use with individuals of diverse racial and ethnic groups.

Limitations, Implications, and Future Directions

This study presents preliminary reliability and validity information for a new measure designed to assess perceptions of muscularity. One limitation of this study is that participants completed Time 1 measures in person and Time 2 measures online, which may have impacted findings but also may have increased retention. Also, findings cannot be generalized to groups other than college students. Findings indicate that the MPM is valid for use among men and women of diverse ethnic backgrounds. However, this measure will be most effectively used with other assessments of body size, body perceptions, and related behaviors. Although we believe that this specific assessment of muscularity has the potential to make a significant contribution to body image research, researchers should also continue to assess BMI, adiposity, and eating behaviors in studies designed to understand individuals' health.

Ultimately, we hope that public health messages will be devised to encourage healthy approaches to achieving both fitness and muscularity. Rates of obesity are high in the US population; strategies that include environmental changes may be effective for reducing obesity rates (Flegal, Carroll, Ogden, & Curtin, 2010). For example, increasing physical activity (i.e., as opposed to supplement and steroid use) has many advantages for increasing muscularity among individuals who desire it and will also result in significant improvements in population health. A better understanding of muscularity dissatisfaction among both men and women has the potential to help researchers and clinicians identify its correlates and design educational and intervention programs aimed at improving body image.

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Acknowledgements

We are grateful to artist Andrew O. McManus for creating the Muscle Pictorial Measure (MPM), and to Julie Wasko for her thoughtful comments on previous versions of this manuscript. We also thank Becky Ayeh, Gianna Bowler, Sofia Dahlgren, Johanna Del Valle, Kaitlin Galambos, Naveeta George, Rochelle Grant, Jennifer Kelley, Samantha Kelly, Meera Khan, Amanda Loverdi, Joshua Paris-Santana, Grace Park, Shannon Thompson, and Kristin Weissberg for their help with study design and data collection, scoring, entering, cleaning, and analyses.

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Appendix A