

MUSCLE DYSMORPHIA AND MEDIATING VARIABLES IN PHYSICALLY ACTIVE BRAZILIAN MEN

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Highlights: (1) The appearance ideal internalization is associated with muscle dysmorphia symptoms. (2) Muscularity dissatisfaction is associated with muscle dysmorphia symptoms. (3) Muscularity dissatisfaction partially mediated the relationship between the appearance ideal internalization and muscle dysmorphia symptoms.

PRE-PROOF

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ABSTRACT

To assess whether muscularity dissatisfaction is a significant mediator between appearance ideal internalization and muscle dysmorphia symptoms in physically active Brazilian men. This is a cross-sectional study, which included 915 physically active Brazilian men aged 18 to 35, of any color, race, or ethnicity. Through an online survey, participants responded to a sociodemographic questionnaire, as well as measures to assess symptoms of muscle dysmorphia (*Muscle Dysmorphic Disorder Inventory*), appearance ideal internalization (*Sociocultural Attitudes Toward Appearance Questionnaire-4*), and muscularity dissatisfaction (*Male Body Attitudes Scale - Revised*). The correlation between variables was evaluated using Spearman's correlation coefficient (ρ), and a simple mediation analysis with bootstrapping of 5,000 resamples was conducted. Muscle dysmorphia symptoms showed a significant, positive correlation of moderate magnitude with appearance ideal internalization and a large magnitude with muscularity dissatisfaction. Muscularity dissatisfaction partially mediated (~50%) the relationship between appearance ideal internalization and muscle dysmorphia symptoms. Therefore, muscularity dissatisfaction represents an important mediator between appearance ideal internalization and muscle dysmorphia symptoms in physically active Brazilian men. These findings underscore the importance of interventions aimed at both reducing the appearance ideal internalization and addressing body dissatisfaction, thereby contributing to the prevention and treatment of muscle dysmorphia in this population.

Keywords: Body image; body dysmorphic disorders; men; mediation analysis.

**DISMORFIA MUSCULAR E VARIÁVEIS MEDIADORAS EM HOMENS
BRASILEIROS FISICAMENTE ATIVOS****RESUMO**

Avaliar se a insatisfação com a muscularidade é um mediador significativo entre a internalização da aparência ideal e os sintomas de dismorfia muscular em homens brasileiros fisicamente ativos. Trata-se de um estudo transversal, no qual foram incluídos 915 homens, brasileiros e fisicamente ativos, com idade entre 18 e 35 anos, de qualquer cor, raça ou etnia. Por meio de uma pesquisa *on-line*, os participantes responderam a um questionário sociodemográfico, assim como medidas de avaliação dos sintomas de dismorfia muscular (*Muscle Dysmorphic Disorder*

Inventory), internalização da aparência ideal (*Sociocultural Attitudes Toward Appearance Questionnaire-4*) e insatisfação com a muscularidade (*Male Body Attitudes Scale - Revised*). A correlação entre as variáveis foi avaliada pelo coeficiente de correlação de Spearman (ρ) e uma análise de mediação simples, com *bootstrapping* de 5.000 reamostragens, foi conduzida. Os sintomas de dismorfia muscular apresentaram uma correlação significativa, positiva, de magnitude moderada com a internalização da aparência ideal e de grande magnitude com a insatisfação com a muscularidade. A insatisfação com a muscularidade mediou parcialmente (~50%) a relação entre a internalização da aparência ideal e os sintomas de dismorfia muscular. Portanto, a insatisfação com a muscularidade representa um mediador importante entre a internalização da aparência ideal e os sintomas de dismorfia muscular em homens brasileiros fisicamente ativos. Esses achados reforçam a importância de intervenções que visem tanto a redução da internalização dos ideais de aparência quanto o enfrentamento da insatisfação corporal, contribuindo para a prevenção e o tratamento da dismorfia muscular nessa população. **Palavras-chave:** Imagem corporal; transtornos dismórficos corporais; homens; análise de mediação.

INTRODUCTION

Currently, men have been experiencing sociocultural pressures to achieve a muscular and defined body, mainly from parents, friends, and the media^{1, 2}. These sociocultural influences are associated with greater internalization of the mesomorphic ideal, characterized by a body with high muscle mass and low body fat, aiming to enhance muscular visibility³. Consequently, the internalization of appearance ideals is directly associated with body dissatisfaction, which, in turn, may lead individuals to adopt pathological attitudes and behaviors similar to those observed in individuals with muscle dysmorphia (MD)^{4, 5}.

MD is a mental disorder characterized by a specific and excessive concern that one's own body is too small or insufficiently muscular⁶. Notably, individuals with this psychopathology typically present a normal body appearance or may even be more muscular than they perceive⁶. Initially, MD was observed among bodybuilders and referred to as “reverse anorexia,” as individuals exhibited beliefs, attitudes, and behaviors similar to—but opposite of—those seen in anorexia nervosa⁷. Whereas individuals with anorexia nervosa pursue pathological weight loss, those with MD focus on weight gain, particularly muscle mass⁸.

Subsequently, Pope et al.⁹ identified additional cases and proposed renaming the syndrome “muscle dysmorphia.”

Currently, this condition is classified in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) as a subtype of Body Dysmorphic Disorder, within the category of Obsessive-Compulsive and Related Disorders⁶. Within this diagnostic framework, muscle dysmorphia is characterized by a persistent preoccupation with the belief that one’s body is too small or insufficiently muscular, even when this perception does not correspond to the individual’s actual appearance. These concerns are accompanied by repetitive behaviors, such as body checking and comparisons with others, and result in clinically significant distress or impairment in social, occupational, or other important areas of functioning⁶. Beyond diagnostic features, individuals with MD often experience elevated psychological distress, including anxiety, depressive symptoms, and social withdrawal, which can interfere with daily functioning⁶.

Among the core symptoms of MD, appearance intolerance, drive for size (e.g., muscularity), and functional impairment are particularly prominent⁶. Specifically, appearance intolerance involves intrusive and unwanted concerns that consume time and are often difficult to resist or control⁶. In parallel, drive for size encompasses excessive physical exercise—even in the presence of pain, injury, or fatigue—as well as rigid behaviors related to diet and the use or abuse of dietary supplements and anabolic-androgenic steroids (AAS)⁶. Collectively, these persistent beliefs and behaviors impair social, occupational, recreational, and other important areas of functioning⁶.

To better understand the psychosocial factors associated with MD symptoms, Bégin, Turcotte, and Rodrigues⁵ proposed an etiological model in a sample of university men. Their findings indicated that appearance ideal internalization significantly mediated the relationship between sociocultural appearance pressures (i.e., peers, family, and media) and drive for muscularity⁵. Additionally, body change behaviors significantly mediated the association between drive for muscularity and MD symptoms⁵. Corroborating these results, Klimek et al.⁴ found that higher levels of appearance ideal internalization were associated with increased MD symptom scores. Moreover, previous studies consistently report positive and significant associations among appearance ideal internalization, muscularity dissatisfaction, and MD symptoms^{5, 10}.

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In the Brazilian context, it remains unclear whether muscularity dissatisfaction mediates the relationship between appearance ideal internalization and MD symptoms, as mediation models have not yet been tested. This gap is particularly relevant given the strong cultural emphasis on physical appearance in Brazil, where the body is often framed as a marker of social status¹¹. Additionally, a sociocultural environment that highly values bodily aesthetics, physical performance, and public visibility may intensify muscularity-related pressures among men. Within this context, muscularity is commonly linked to masculinity, potentially contributing to the emergence and persistence of core MD symptoms¹². Such cultural dynamics may reinforce the internalization of muscular ideals and heighten vulnerability to muscularity dissatisfaction, thereby shaping the expression of MD symptoms. Supporting this notion, systematic reviews have documented high prevalence rates of anabolic-androgenic steroid use (up to 33%) and performance-enhancing substance use (up to 94%) among exercise practitioners in Brazil^{13, 14}. In line with these findings, Brazilian men report higher engagement in excessive exercise than their American counterparts¹⁵, and physically active men exhibit significantly higher MD symptom scores than insufficiently active men^{16, 17}.

Given this scenario, understanding the mechanisms that underlie MD symptoms in Brazilian men is essential for developing or adapting effective preventive interventions. However, the limited number of studies on MD in Brazilian populations may hinder advances in prevention, diagnosis, and treatment. Therefore, the present study aimed to examine whether muscularity dissatisfaction significantly mediates the relationship between appearance ideal internalization and MD symptoms in physically active Brazilian men. Based on previous evidence, we hypothesized that muscularity dissatisfaction would function as a mediator in this association^{4, 5, 18}. By adopting this approach, the study highlights the importance of considering culturally specific factors that shape body image and muscularity ideals among Brazilian men, with potential implications for targeted interventions addressing muscle dysmorphia in this population.

METHOD

Sample

This study employed a quantitative approach with a cross-sectional design, involving young adult Brazilian men aged 18 to 35 years, of any race or ethnicity. Only physically active Brazilian nationals were included. Participants who left more than 80% of the research protocol unanswered or explicitly requested non-use of their data were excluded. The sample size was determined *a posteriori*, ensuring that, for the mediation analysis, the smallest β value found was 0.23, indicating a need for a minimum of 558 participants¹⁹.

Procedures

Participants were invited to join the research through various social media platforms, including Instagram®, Facebook®, and WhatsApp®. Additionally, a snowball sampling method was employed to reach potential participants. They were directed to a Google Forms link where they could review the research objectives, procedures, and the Informed Consent Form. After agreeing to the Informed Consent Form, participants accessed a new page containing all study instruments (described below), which were randomized to control for potential order effects. Ethical approval was obtained from the Ethics Committee for Research Involving Human Subjects at Centro Universitário FAMINAS on November 4, 2021, under protocol number 5,079,900. All procedures adhered to the guidelines of Resolution N° 466/12 of the Brazilian National Health Council and the principles of the Declaration of Helsinki.

Instruments

Sociodemographic Questionnaire

To describe the sample, a sociodemographic questionnaire was administered, which included questions regarding age (in years), race/ethnicity, weight (in kg), and height (in meters). The latter two measurements were used to calculate Body Mass Index (BMI) by dividing weight by height squared (kg/m^2)²⁰. Additionally, participants reported the amount of weekly physical activity performed, with those engaging in 150 minutes or more of light or moderate physical activity, or 75 minutes or more of vigorous physical activity, considered physically active and included in the study²¹.

Muscle Dysmorphic Disorder Inventory (MDDI)

The Muscle Dysmorphic Disorder Inventory (MDDI) is a self-report scale consisting of 13 items designed to assess cognitive, affective, and behavioral symptoms of MD²². Items on the instrument are rated on a Likert-type scale (1 = never to 5 = always), with the final score obtained by summing all items. Total scores can range from 13 to 65, where higher scores indicate greater MD symptoms. The MDDI was cross-culturally adapted for the Brazilian population²³ and subsequently evaluated for psychometric properties among physically active Brazilian men, showing adequate factorial validity (confirmatory factor analysis), convergent validity, as well as adequate internal consistency and test-retest reliability¹⁰. In the current sample, the MDDI total score demonstrated adequate internal consistency (Cronbach's alpha [α] = 0.75).

Male Body Attitudes Scale - Revised (MBAS-R)

The Male Body Attitudes Scale - Revised (MBAS-R) is a self-report instrument consisting of 15 items designed to assess male body dissatisfaction with muscularity, body fat, and height²⁴. Items on the MBAS-R are rated on a Likert-type scale (1 = never to 5 = always), and the total score is obtained by summing all items on the scale. Scores range from 15 to 75, with higher values indicating greater body dissatisfaction. The MBAS-R comprises three subscales: Muscularity (MUS; items 1-7), Body Fat (BF; items 8-12), and Height (HT; items 13-15). The MBAS-R was translated and adapted for the Brazilian population by Almeida, Gomes, and Carvalho²³. Subsequently, its psychometric properties were investigated among Brazilian men, demonstrating adequate factorial validity (exploratory and confirmatory factor analysis), convergent validity, as well as adequate internal consistency and test-retest reliability²⁵. In the current study, only the MUS subscale of the MBAS-R was used and showed adequate internal consistency (α = 0.87).

Sociocultural Attitudes Toward Appearance Questionnaire-4 (SATAQ-4)

The Sociocultural Attitudes Toward Appearance Questionnaire-4 (SATAQ-4) is a self-report questionnaire consisting of 22 items designed to assess the sociocultural influence of family, friends, and media regarding appearance, as well as to evaluate the appearance ideal internalization experienced by individuals²⁶. Items on the SATAQ-4 are rated on a Likert-type

scale (1 = strongly disagree to 5 = strongly agree), and the total score is obtained by summing all items on the questionnaire. Total scores range from 22 to 110 points, with higher values indicating greater sociocultural influence regarding appearance and appearance ideal internalization. The SATAQ-4 comprises five subscales: Internalization: thin/low body fat (items 3, 4, 5, 8, and 9), Internalization: muscular/athletic (items 1, 2, 6, 7, and 10), Pressures: family (items 11, 12, 13, and 14), Pressures: peers (items 15, 16, 17, and 18), and Pressures: media (items 19, 20, 21, and 22). The SATAQ-4 was translated for use among Brazilian university students and demonstrated adequate psychometric properties, including factorial validity, convergent and discriminant validity, as well as adequate internal consistency and composite reliability²⁷. The internalization subscales (specifically, Internalization: thin/low body fat and Internalization: muscular/athletic) together form a single latent factor, namely appearance ideal internalization (SATAQ-4 INT). In the current study, the SATAQ-4 INT was utilized and showed good internal consistency ($\alpha = 0.87$).

Statistical Analysis

Initially, the data were inspected to identify missing values²⁸. Little's test²⁹ was used to assess whether the missing values were *Missing Completely At Random* (MCAR). A $p > 0.05$ indicates that the missing values are completely randomly distributed. In such cases, the data will be imputed using the expectation-maximization algorithm²⁸.

In the case of descriptive statistics, continuous variables were described using mean, standard deviation, minimum, and maximum values, while categorical variables were described by absolute and relative frequencies. The Shapiro-Wilk normality test showed that the data followed a parametric distribution ($p > 0.05$). Despite the data exhibiting a normal distribution, given the ordinal nature of the instruments used in this study, Spearman's rank correlation coefficient (ρ) was used to assess the association between the dependent variable (MD symptoms) and the independent variables (appearance ideal internalization and muscularity dissatisfaction). Correlations ≤ 0.10 were considered small, correlations ~ 0.30 were considered moderate, and correlations ~ 0.50 were considered large³⁰.

To understand if muscularity dissatisfaction mediates significantly between the appearance ideal internalization and MD symptoms, a simple mediation analysis was conducted³¹. Following Hayes's recommendation³¹, a bootstrapping procedure with 5,000

resamples was used to identify the indirect effect ($a*b$). A significant indirect effect exists if the 95% confidence interval between the lower and upper limits does not include zero³¹.

The internal consistency of the instruments used in the study was assessed using Cronbach's alpha, with values ≥ 0.70 considered adequate³². All analyses were performed using SPSS software (IBM, Version 22.0). Additionally, the Macro PROCESS (Version 3.4) was utilized for conducting the mediation analysis. A significance level of 5% ($p < 0.05$) was adopted for all tests.

RESULTS

A total of eight participants left more than 80% of the research protocol unanswered and were excluded listwise²⁴. Additionally, 11, ten, and eight participants were identified as MCAR for the variables of appearance ideal internalization ($\chi^2 (35) = 37.06, p = 0.37$), muscularity dissatisfaction ($\chi^2 (41) = 32.77, p = 0.81$), and MD symptoms ($\chi^2 (83) = 85.45, p = 0.40$), respectively. Therefore, these values were imputed using the expectation-maximization algorithm²⁸. Thus, a total of 915 physically active men participated in the study. Participants' ages ranged from 18 to 35 years ($M = 24.99$; $SD = 4.54$ years). Regarding race/ethnicity, participants self-identified as White ($n = 460$; 50.30%), Brown/Mixed ($n = 298$; 32.60%), Black ($n = 129$; 14.10%), Yellow ($n = 23$; 2.50%), and Indigenous ($n = 5$; 0.50%). The participants' BMI ranged from 16.82 to 41.00 kg/m² ($M = 24.91$; $SD = 3.46$).

Table 1 presents the descriptive analysis and bivariate correlation among the study variables. It is noted that the MDDI showed a significant positive correlation, of moderate to large magnitude, with the SATAQ-4 INT and MBAS-R MUS, respectively. Additionally, the SATAQ-4 INT showed a significant positive association, of small magnitude, with the MBAS-R MUS.

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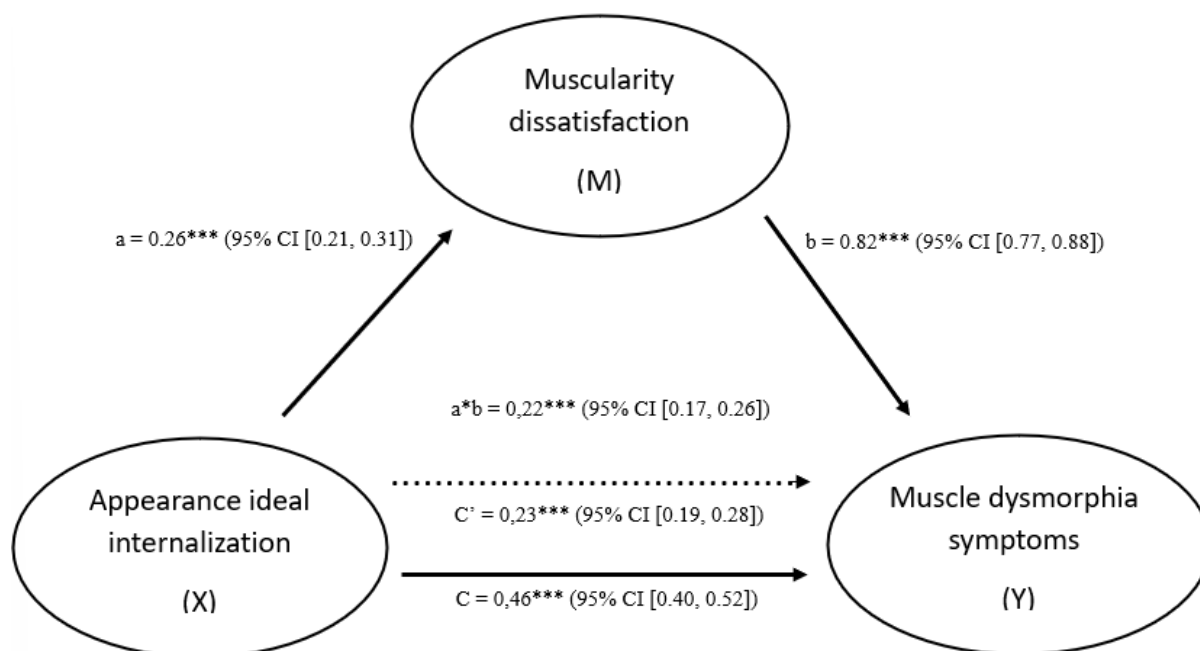
Table 1 – Descriptive analysis and bivariate correlation among study variables.

Variable	Mean (SD)	Minimum	Maximum	1.	2.	3.
1. MDDI	31.08 (7.64)	13	62	-	0.42***	0.73***
2. SATAQ-4 – INT	30.59 (7.41)	10	50		-	0.30***
3. MBAS-R – MUS	19.69 (6.10)	7	35			-

Notes: SD = Standard Deviation; MDDI = Muscle Dysmorphic Disorder Inventory; SATAQ-4 INT = Sociocultural Attitudes Towards Appearance Scale-4 Appearance Ideal Internalization Latent Factor; MBAS-R MUS = Male Body Attitudes Scale – Revised Muscularity subscale. *** $p < 0.001$

The proposed mediation model and the corresponding beta (β) values for the regression coefficients are illustrated in Figure 1. The regression coefficient between the independent variable (appearance ideal internalization) and the mediator variable (muscularity dissatisfaction) was significant ($\beta = 0.26$; 95% CI [0.21 - 0.31], $t = 10.45$, $p < 0.001$). Additionally, the regression coefficient between the mediator variable (muscularity dissatisfaction) and the dependent variable (MD symptoms) was also significant ($\beta = 0.82$; 95% CI [0.77 - 0.88], $t = 29.37$, $p < 0.001$). The total effect of appearance ideal internalization on MD symptoms was significant ($\beta = 0.46$; 95% CI [0.40 - 0.52], $t = 15.11$, $p < 0.001$, $R^2 = 0.20$). Furthermore, a significant direct effect was observed in the model ($\beta = 0.23$; 95% CI [0.19 - 0.28], $t = 10.30$, $p = 0.001$, $R^2 = 0.58$), indicating that appearance ideal internalization influences MD symptoms, while controlling for muscularity dissatisfaction. Importantly, there was no change in sign within the 95% confidence interval for the model's indirect effect ($\beta = 0.22$; $SE = 0.02$; 95% CI [0.17 - 0.26]). As shown in Figure 1, muscularity dissatisfaction mediated approximately 50% of the relationship between appearance ideal internalization and MD symptoms.

Figure 1 – Mediation model between study variables.



Notes: X = independent variable; M = mediator variable; Y = dependent variable; a = regression coefficient between independent variable and mediator variable; b = regression coefficient between mediator variable and dependent variable; CI = Confidence Interval; $a*b$ = indirect effect; c = total effect; c' = direct effect. $***p < 0.001$

DISCUSSION

Studies concerning MD in Brazilian populations are scarce, which may hinder the prevention, diagnosis, and treatment of this psychopathology. Therefore, the present study aimed to evaluate whether muscularity dissatisfaction serves as a significant mediator between appearance ideal internalization and MD symptoms in physically active Brazilian men. Confirming the initial hypothesis of the study, muscularity dissatisfactions partially mediated the relationship between appearance ideal internalization and MD symptoms in physically active Brazilian men.

In terms of the association analysis, an essential prerequisite for mediation analysis, it was found that MD symptoms exhibited a significant, positive association of moderate to large magnitude with the variables of appearance ideal internalization and muscularity dissatisfaction, respectively. These findings align with those from previous studies, highlighting that appearance ideal internalization and muscularity dissatisfaction are positively and significantly associated with MD symptoms^{4,10,25}. Indeed, a study conducted with men in the

United States (US) by Klimek *et al.*⁴ identified that higher scores in muscularity internalization were associated with greater MD symptoms. This relationship was similarly observed in Brazilian men, where MD symptoms showed a significant, positive, and large-magnitude association with muscularity dissatisfaction^{25,33}.

To the best of our knowledge, the present study is the first to propose a mediation model for the development of MD symptoms in physically active Brazilian men. Our results underscore that appearance ideal internalization and muscularity dissatisfaction are risk factors for MD, aligning with findings similar to those of Bégin, Turcotte, and Rodrigues⁵. In their study, the authors identified that appearance ideal internalization was a significant mediator between sociocultural pressures related to appearance (i.e., pressures from peers, family, and media) and the drive for muscularity⁵. Furthermore, body change behaviors were significant mediators between the drive for muscularity and MD symptoms⁵.

The mediation found in the present study is of a cross-sectional nature, making causal inferences not possible; however, it provides essential insights for the field's development. Understanding the mediating factors for the development of MD symptoms is crucial for developing prevention strategies with proven efficacy and effectiveness. Particularly for men, these strategies are even more critical because they are less likely to seek treatment due to self-stigma that men are "strong" and should not suffer from a mental disorder³⁴. Additionally, many men believe that masculinity and muscularity are synonymous, viewing achieving a muscular body as a way to become more attractive and "masculine"¹². Indeed, in Brazilian culture, the body has been posited as a symbol of social status¹¹. Together, these factors may contribute to a high incidence and/or prevalence of MD symptoms in Brazilian men, such as excessive exercise¹⁵ and the use and/or abuse of dietary supplements and AAS¹³⁻¹⁴.

Building on these considerations, from a practical perspective, the present findings identify relevant targets for prevention and intervention strategies aimed at reducing muscle dysmorphia symptoms among physically active men. Interventions implemented in fitness and sports settings should prioritize reducing appearance ideal internalization and muscularity dissatisfaction by promoting healthier and more flexible body image attitudes. In this context, fitness centers and sports programs may benefit from implementing screening procedures, psychoeducational initiatives, and training protocols for exercise professionals to identify and address early signs of MD-related behaviors.

Such approaches may be particularly important in contexts where masculinity is strongly tied to physical appearance, reinforcing maladaptive beliefs about muscularity. In addition, professionals working with this population should be trained to recognize early signs of maladaptive body-related concerns, including excessive exercise behaviors and rigid appearance-focused practices. At the public health level, campaigns that challenge sociocultural norms linking masculinity to muscularity and promote diverse and healthy body ideals may be especially relevant in the Brazilian context. From a clinical perspective, these findings support the inclusion of muscularity dissatisfaction and appearance ideal internalization as key targets in assessment and intervention protocols for MD.

Although the present study makes several contributions to the field, it has some limitations. First, the sample was non-probabilistic and recruited via online dissemination and snowball sampling, which may introduce selection bias and limit the generalizability of the findings. Moreover, the exclusive inclusion of physically active, predominantly young men may further restrict the applicability of the results to other populations, despite the sample size exceeding recommendations from the specialized literature¹⁹. Second, the use of self-report instruments may have introduced response and social desirability biases, which are inherent to this type of assessment³⁵. However, anonymity and confidentiality were ensured to minimize these biases, and all instruments demonstrated adequate internal consistency. Future studies should incorporate multimethod approaches, including clinical interviews, objective indicators, and measures of social desirability, to further reduce response bias. Additionally, the study did not control for potential confounding variables, such as use of performance-enhancing substances, duration and intensity of physical activity practice, or history of mental health disorders, which may influence MD symptoms. Finally, the present study employed a simple mediation analysis, which limits causal inferences. Future studies should adopt more robust analytical approaches, such as structural equation modeling, and consider longitudinal designs to better elucidate the mechanisms underlying the development of MD symptoms in physically active Brazilian men.

CONCLUSION

It is concluded that muscularity dissatisfaction was a significant mediator between appearance ideal internalization and MD symptoms in physically active Brazilian men. These

results directly contribute to the understanding of MD in Brazilian men, aiding in its prevention, diagnosis, and treatment. Specifically, understanding the mediating aspects of MD symptoms in Brazilian men is crucial for developing and/or adapting preventive interventions with proven efficacy and effectiveness.

Future studies should expand this model by incorporating longitudinal designs, controlling for relevant behavioral and psychological variables, and examining how sociocultural factors specific to the Brazilian context shape the development and maintenance of MD symptoms. Such efforts may further strengthen culturally sensitive strategies for prevention and intervention in this population.

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