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Original Article

Acute aerobic training and its impact on muscular dissatisfaction and body image perception in sedentary men

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Abstract:
Introduction: Body image disturbance, encompassing dissatisfaction, behaviors, and perceptions, is often associated with negative body image values. Scientific studies have aimed to identify strategies capable of modulating aspects of body image, with physical activity emerging as a viable intervention. Objective: This study aimed to assess the effects of aerobic exercise sessions at varying intensities on body image components in sedentary men. Twenty-six young adults (mean age 25.4 ± 3.3 years) were randomly assigned to either: a) 30 min at 60–70% of reserve heart rate (HRRes) or b) 70–80% of HRRes. Methods: Validated measures were used to assess body dissatisfaction, drive for muscularity, body checking behaviors, body-ideal internalization and body image perception in the five time-points: Pre-exercise, Post-exercise, 24, 48 and 72-hours post-exercise. Results: The main results indicated increases in muscularity dissatisfaction, with an isolated effect of the measurement time-points ($p \leq 0.001$) in which the 48h post-exercise had a higher average compared to the others [Pre ($p \leq 0.001$; 95%CI= 0.8–3.9), Post ($p=0.001$; 95%CI= 0.5–3.7), 24h ($p \leq 0.001$; 95%CI= 0.7–3.9) and 72h ($p \leq 0.001$; 95%CI= 1.1–4.4)]. For body image perception, an isolated effect of the measurement time ($p=0.032$) was found, in which the 72h post-exercise scores was significantly higher when compared to the pre-exercise moment ($p=0.022$; 95%CI= -1.66–-0.05). Conclusion: The analysis of the present results allows us to conclude that the acute aerobic exercise results in higher muscularity dissatisfaction, mainly 48 hours after the exercise. In addition, there was also a higher body image distortion 72 hours post-exercise.
Key Words*:* body image, muscularity concerns, body dysmorphia, body-ideal internalization, physical exercise, aerobic exercise

Introduction

Body image is a complex and multifaceted construct in which attention is given to how the body looks in terms of shape and weight. Because body shape and weight are considered to be under the control of the individual, they are generally seen as her or his responsibility (Cash & Smolak, 2011). Changes in body image perception are frequent, called body image disorders or distortions (Alcaraz-Ibáñez et al., 2021). Body image disturbances, on the other hand, are characterized by changes in affective, cognitive and behavioral components of body image (Gardner & Boice, 2004). For instance, body dissatisfaction, a derogatory feeling with one's own body, has been described with high frequency in elite athletes (Satterfield & Stutts, 2021), amateur (Zancu et al., 2021) and exercisers (Alcaraz-Ibáñez et al., 2021). Depreciation with one's physical appearance is a risk factor for the development of eating disorders and disordered eating (Stice et al., 2011), and is directly related to other disorders such as depression and mood disorders (Moccia et al., 2021), muscle dysmorphia (Kaszás et al., 2021) and body dysmorphic disorders (Carvalho et al., 2013; Kaszás et al., 2021; Moccia et al., 2021).

According to Stice et al. (2011), individuals dissatisfied with their own bodies, as well as those with body image distortion, may adopt unhealthy behaviors such as changing eating behavior, including disordered eating (i.e., vomiting, use of laxatives and diuretics, restrictive diet and not eating) and maladaptive and/or excessive exercise behavior, which may result in exercise dependence (Alcaraz-Ibáñez et al., 2021). Male physical exercise practitioners have a high frequency of body image disturbances that include dysfunctional beliefs about the body and appearance (e.g., body-ideal or muscular-ideal internalization), constant body checking behaviors (Carvalho et al., 2013; Shafran et al., 2004), and a heightened drive for muscularity (Edwards et al., 2014; McCreary & Sasse, 2000), showing a concern with acquiring a muscular physique, with emphasis on particular body parts, such as shoulders, chest and arms (Murray et al., 2017). Being this body, characterized by an ideal with a muscular upper body and low body fat index (Almeida et al., 2019). This high drive for muscularity and low body fat index can motivate a series of behaviors designed to achieve these goals, for example, restrictive diets, rigid and excessive exercise routines, use of anabolic steroids, among others

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(Lavender et al., 2017). Calzo et al. (2016) showed a distinct pattern of disordered eating driven by muscle concerns and an elevated risk for anabolic steroid use.

Physical exercise has been an important means to modulate body-related mental states, as well as body mass, making subjects feel more satisfied with their own image, decreasing states of depression and increasing psychological well-being (Hausenblas & Fallon, 2006). However, in some cases, physical exercise is used to change the appearance or control the body and diet, triggering changes in body image (Stice et al., 2011). For example, patients with eating disorders and muscle dysmorphia use physical exercise as a compensatory behavior. For instance, patients with bulimia nervosa use exercise as purging. Patients with muscle dysmorphia assume strict behaviors regarding social and professional activities, as well as strict diet regimes and show exercise dependence (Almeida et al., 2019; Pope et al., 2005). In these cases, physical exercise acts in the perpetuation of these disorders (Assunção et al., 2002; Hausenblas & Fallon, 2006).

Four meta-analyses relate physical exercise to body image. For Hausenblas and Fallon (2006), physical exercise practitioners showed a better relationship with body image when compared to those who did not. As for the type of exercise, subjects who practiced both aerobic and anaerobic exercises had better results compared to the practice of only one type of exercise. Exercises in moderate to strenuous intensity showed significantly greater results compared to light intensity. Reel et al. (2007), observed that physical exercise can reduce body image concerns, with the effects being more intense in anaerobic exercises when compared to aerobic exercises. Campbell and Hausenblas (2009), found a small effect size of physical exercise interventions on improvements in body image compared to the control group. However, the size of this effect did not differ for participants who improved their fitness level and body composition after the intervention. Finally, Bassett-Gunter et al. (2017), identified that physical activity is positively associated with body satisfaction among men. However, some aspects of body image may not be as modifiable as others, especially in studies that operationalized body image as the drive for thinness, thus there is a need to investigate the various body image components among men.

Previous studies that related physical exercise to body image investigated the effects of long-term training programs (chronic effect). The few studies that evaluated the acute effects of aerobic training on body image had important methodological limitations, such as a heterogeneous sample, inadequate questionnaire (i.e., non-validated measures) to measure changes during this period of time, and absence of objective measures to control exercise intensity (Béres et al., 2017). Another important limitation is the fact that previous studies assessed only some aspects of body image, generally related to its affective component, such as drive for thinness, weight and shape concerns, and body dissatisfaction. Accordingly to the systematic review conducted by Bassett-Gunter et al. (2017), there were no intervention studies that examined the effects of physical exercise interventions on body image operationalized regarding muscularity. This is critical given muscularity concerns are more prevalent among men than thinness concerns (Murray et al., 2017).

From the understanding that body image is a complex and multifaceted construct, we then realized that there is a need to assess different body image components, including the affective (i.e., muscularity dissatisfaction and drive for muscularity), behavioral (i.e., body checking behaviors), cognitive (i.e., body-ideal internalization), and perceptual components (i.e., body image distortions). Considering the limitations mentioned above, further studies are needed to assess the acute effects of physical exercise on body image in men. Therefore, the present study evaluated the effects of an aerobic exercise session at 60-70% and 70-80% HRRes, on body image components in insufficiently active men. We hypothesized that an aerobic training session is capable of altering at least some body image components, and that exercise intensity will be a modulating factor of the observed alterations.

Material & methods

Pre-experimental Procedures

This study protocol was approved by the Ethics and Research in Human Beings Committee of the institution where it was conducted (protocol number: 2,692,158). The invitation for research was made in the classrooms at the university where the study was conducted, as well as through social media (institutional website). All participants signed the Informed Consent Form. After consent, the following procedures were followed: a) application of a sociodemographic questionnaire; b) anthropometric assessment; c) application of pre-exercise body image instruments; d) exercise protocol; e) application of post-exercise body image instruments; 24 hours post-exercise; 48 hours post-exercise; and 72 hours post-exercise.

Anthropometric assessment

Body mass was measured with a precision of 100g (Balance CH-100, Welmy®, RS, Brazil). Height was measured with a precision of 1cm (Estadiometer ES2060, Sanny®, SP, Brazil). To estimate body density, the equation of 7 skinfolds of Jackson and Pollock (1978), the percentage of fat was estimated by the equation of Siri (1961).

Participants

About 70 subjects manifested interest. Of these, twenty-six men (25.4±3.3 years, BMI= 26.6±3.7 kg/m^2) met the inclusion criteria and participated in this study. We adopted as inclusion criteria; a) insufficiently active young adults classified by international physical active questionary (Franco et al., 2021); b) had not been

performing any physical exercise for at least three months; c) were available to answer the online questionnaires and; d) perform the trials and assessments.

Exercise protocols

The training intensity was performed by random sampling, containing the following submaximal HRRes intensities: a) 60-70% b) 70-80%. The intensities were determined based on studies from previous meta-analyses (Bassett-Gunter et al., 2017; Campbell & Hausenblas, 2009; Hausenblas & Fallon, 2006; Reel et al., 2007), and recommendations of *American College of Sports* Medicine (2013). Initially, the maximum heart rate (HRMax) was estimated by the equation of Tanaka et al. (2001) for healthy adults. Resting heart rate (RHR) was measured after 5 min of rest in the supine position (58009G0EVNP1 Heart rate monitor, Speedo®, SP, Brazil). The HRMax and RHR variables were used to estimate the HRRes. The training heart rate (HRTra) was estimated by the equation: HRTra = RHR + (% X HRRes). Each training had as protocol: 5 minutes of warm-up at low speed, 30 minutes within the prescribed zone, 5 minutes of final activity "return to calm" at low intensity.

Psychometric tests

Before and after the exercise protocol, the participants responded the questionnaires. Later, the participants responded the online questionnaires at home via Google Docs, 24-, 48- and 72-hours after. A researcher sent a text message via cellphone to each participant, containing a reminder to respond the questionnaires.

Brazilian Silhouettes Scale. The Brazilian Silhouettes Scale was used to assess body image perception. The scale was validated by Kakeshita et al. (2009). This instrument is composed by 15 different silhouette models for men and women, ranging from "very thin" to "very fat". Each figure has a specific BMI value ranging from 12.5 to 47.5 kg/m^2. The scale was presented digitally, using only the set of male images. The difference between the BMI that represents the figure chosen as the "current body" and the measured ("real" BMI) was calculated, thus calculating the body image distortion index. This scale showed strong correlation coefficients between test and retest ($r=0.84$; $p<0.01$) for real and perceived BMI.

Male Body Checking Questionnaire – MBCQ. This self-report instrument assesses the frequency of body checking behaviors in men. The MBCQ comprises 19 items answered on a five-point Likert scale (1 = *never* to 5 =*very often*), in which the higher the score, the higher the body checking behaviour. The MBCQ has been validated for Brazilian men (Carvalho et al., 2012; de Carvalho et al., 2014). The instrument's internal consistency was adequate at all time-point assessments (Cronbach's alpha [α] = 0.87 – 0.94).

Male Body Dissatisfaction Scale – MBDS. Instrument consisting of 12 items, answered on a five-point Likert scale (1 = *strongly agree* to 5 = *strongly disagree*), designed to assess muscularity dissatisfaction in men. Higher scores indicate higher muscularity dissatisfaction. For the present study, the short version (12 items) was used, proposed by da Silva et al. (2017). The total score was calculated using the proposed equation. This instrument showed adequate internal consistency in all time-point assessments (α= 0.66 – 0.85).

Drive for Muscularity Scale – DMS. Self-report instrument designed to assess attitudes and behaviors related to the pursuit of muscularity in men. We used the short version of 12 items, answered on a Likert-type scale (1 = *never* to 6 = *always*). Total scores derive by the sum of the items, with higher scores representing greater drive for muscularity. For this study we used the translated, adapted and validated scale for the Brazilian men proposed by Campana et al. (2013). This instrument showed adequate internal consistency in all time-point assessments (α = 0.73 – 0.84).

Sociocultural Attitudes Towards Appearance Questionnaire- 3 – SATAQ-3. It is a self-report instrument that assesses sociocultural factors that influence body image, such as media, sport and exercise. This questionnaire consists of 30 items answered on a five-point Likert-type scale, (1 = *strongly disagree* to 5 = *strongly agree*), and was translated and adapted for young Brazilian adults by Amaral et al. (2013). Higher scores suggest greater body-ideal internalization. This instrument showed adequate internal consistency in all time-point assessments (α = 0.85 - 0.88).

Statistical analysis

The sample was described by mean and standard deviation for each variable. Cronbach's alpha coefficient was used to assess the internal consistency of the instruments and was considered adequate >0.7 (Bland & Altman, 1997). For inferential analysis, generalized estimating equations were used, as described by Guimarães and Hirakata (2012). The adopted covariate was exercise intensity (60-70%HRRes and 70-80%HRRes). Each research instrument was analyzed at five time-points (pre-exercise, post-exercise, 24, 48 and 72 hours), pairing them alternately. When significant differences were detected, Bonferroni post-hoc was used. For all analyses, a value of $p\leq0.05$ was applied and all calculations were performed using the SPSS 20.0 software.

Results

Regarding the BMI, no men were underweight, 42% were classified as normal, 38% were overweight, and 19% were obese. No volunteer self-reported the use of dietary supplements or anabolic steroids. Regarding the drive for muscularity (DMS), there was an isolated effect of the measurement time-points (Wald=9.747; df=4; p=0.045), and an interaction between exercise protocol and measurement time-points (Wald=12.5; df=4; p=0.014). However, the differences were not found by the post-hoc test (Table 1). No significant difference was

found for the isolated effect of the protocol (Wald=0.330; df=1; p=0.566). As for the body checking behavior (MBCQ) there was no isolated effect of the measurement time-points (Wald=5.473; df=4; p=0.242) (Table 2), protocol (Wald=1.314; df=1; p=0.252), or in the interaction between exercise protocol and measurement time-points (Wald=5.017; df=4; p=0.286).

As for muscularity dissatisfaction (MBDS), the generalized linear model indicated an isolated effect of the measurement time-points (Wald=26.192; df=4; p≤0.001), in which there was an increase in muscularity dissatisfaction scores right after doing
the aerobic exercise. The 48-hour time-point had the highest mean scores compared to the others [Pre (p≤0.001; 95%CI= 0.8–3.9), Post (p=0.001; 95%CI= 0.5–3.7), 24h (p≤ 0.001; 95%CI= 0.7–3.9) and 72h (p≤0.001; 95%CI= 1.1–4.4)]. The 72-hour time-point had lower mean scores compared to the post-exercise (p=0.003; 95%CI= -1.0–-0.1). Protocol effects (Wald=0.15; df=1; p=0.903), or interaction between protocol and measurement time-points (Wald=4.893; df=4; p=0.298) were not identified (Table 1).

Table 1. Descriptive data from applied measures through time-points.

Pre-exercise	Post-exercise	24h	48h	72h	p-value
Muscularity dissatisfaction (MBDS)					
5.80 ±0.94	6.17 ±0.90	4.65 ±2.82	8.73 ±7.17	5.85 ±4.29	0.298
Drive for muscularity (DMS)					
36.15±9.51	36.65±9.33	35.20±10.06	31.81±9.26	38.06±11.65	0.014*#
Body checking behaviours (MBCQ)					
30.15±10.56	30.85±11.80	30.85±11.80	27.50±8.46	35.62±14.02	0.286
Body-ideal internalization (SATAQ-3)					
76.30±16.15	76.73±16.15	73.80±18.21	81.56±14.50	78.18±14.74	0.349

Note: *Statistically significant in relation to protocol and measurement moments. #There was an effect, but not found by Bonferroni's post-hoc test. MBDS - *Male Body Dissatisfaction Scale.* DMS - *Drive for Muscularity Scale.* MBCQ - *Male Body Checking Questionnaire.* SATAQ-3 - *Sociocultural Attitudes Towards Appearance Questionnaire*-3.

To assess the influence of the media on the body (Table 2), in terms of body-ideal internalization (SATAQ-3), no isolated effect of the measurement time-points (Wald=4,450; df=4; p=0.349), protocol (Wald=0.156; df=1; p=0.693), and interaction between protocol and measurement time-points (Wald=4.249; df=4; p=0.373) were found.

Finally, we found an isolated effect of the measurement time-points (Wald=10.573; df=4; p=0.032) on body image perception. The mean scores observed at 72-hour time-point were significantly higher when compared to the Pre-exercise (p=0.22; 95%CI= -1.66–-0.05), with an increase in body image distortion. Other significant effects were not found, either in the isolated protocol effect (Wald=1.098; df=1; p=0.295), or in the interaction between protocol and measurement time-points (Wald=2.770; df=4; p=0.597).

Table 2. **Descriptive of the effect of time-points.**

Measure	Pre-exercise	Post-exercise	24h	48h	72h
DMS#	29.19±1.40	29.90±1.51	29.19±1.60	27.05±1.60	31.06±2.28
MBCQ	30.70±2.12	32.23±2.38	32.40±2.52	29.05±1.79	35.79±3.27
MBDS	5.98±0.17 [a]	6.20±0.16 [ab]	6.02±0.20 [a]	8.35±0.57 [a]	5.60±0.18 [ab]
SATAQ-3	78.00±12.07	76.50±14.13	76.50±16.13	79.00±16.00	79.40±15.87
Body Distortion	-4.67±5.03[c]	-4.52±4.47	-4.52±5.18	-4.67±5.44	-4.67±5.50[c]

Note: [a] 48h vs. Pre-exercise; Post-exercise, 24h, 72h. [b]72h vs. Post-exercise. [c]72h vs. Pre-exercise. #There was an effect, but not found by Bonferroni's post-hoc test. DMS - *Drive for Muscularity Scale.* MBCQ - *Male Body Checking Questionnaire.* MBDS - *Male Body Dissatisfaction Scale.* SATAQ-3 - *Sociocultural Attitudes Towards Appearance Questionnaire*-3.

Dicussion

The present study evaluated the acute effects of aerobic exercise at two different intensities on body image components in insufficiently active young adult men. Among the main results, higher scores on muscularity dissatisfaction were observed at 48 hours after exercise. There was also greater body image distortion 72 hours after doing the aerobic exercise. Contrary to our hypothesis, we did not find acute effect of aerobic exercise on drive for muscularity, body-checking behaviors, and body-ideal internalization. We found no effects of exercise intensity on any body image components.

There is a growing recognition that body image disturbances and eating disorders symptoms from muscular nature are more common in men than previously thought. Although men show high muscularity concerns it is not uncommon to observe behaviors oriented to decrease the amount of body fat. Griffiths et al. (2013) state that, in the pursuit of muscularity, the desire to gain muscle mass and to decrease body fat percentage can, at least to some extent, be mutually exclusive and give rise to different forms of disordered behaviors. For example, muscularity-oriented disordered eating differs from "traditional" eating disorders, such

as anorexia nervosa, in that behaviors are typically oriented towards the development of larger muscles and the decrease in body fat percentage, since adiposity is thought to obscure the visibility of muscularity or both (Calzo et al., 2016; Lavender et al., 2017; Murray et al., 2018). The search for adiposity reduction can lead to a constant restriction of carbohydrates and fats, combined with the continuous consumption of lean protein. This alternation of behaviors (i.e., muscularity-oriented versus thinness-oriented behaviors) is known as the cycle of "expand and cut" (Griffiths et al., 2013). This cycle may explain why a single session of aerobic exercise may result in higher muscularity dissatisfaction among insufficiently active men.

Muscularity concerns are prevalent among men, and thinness-oriented behaviors are adopted as a specific strategy to increase body definition (Lavender et al., 2017). For men, the most effective exercise program for attaining the ideal body portrayed in the media includes aerobic exercise to control body fat, and resistance training to build muscle bulk. Of note, we evaluated insufficiently active men, who had not been performing any physical exercise for at least three months. That said doing an aerobic exercise session, without any associated resistance training can increase muscularity concerns with may result in acute muscularity dissatisfaction. In particular, we observed increases in muscularity dissatisfaction across time-points, with higher and significant differences between time-points observed at 48h post-exercise. Not surprisingly, through a systematic review Hausenblas and Fallon (2006) found that individuals who practiced both aerobic and anaerobic exercises had lower body dissatisfation compared to individuals who practice only one type of exercise (i.e., aerobic or resistance training). It is noteworthy that Bassett-Gunter et al. (2017) did not identify studies that examined the effects of physical exercise interventions on muscularity dissatisfaction. Our results suggest that muscularity concerns may increase days after a single session of aerobic exercise.

Despite that, we found no effects of a single aerobic session on drive for muscularity. Bassett-Gunter et al. (2017) found that muscularity-related body image is strongly associated with physical exercise in correlational studies. However, correlational studies are biased to indicate a cause-and-effect relationship. On one hand, drive for muscularity may increases exercise behaviors. On the other hand, exercise behaviors may result in higher drive for muscularity (Edwards et al., 2014; McCreary & Sasse, 2000). Our results suggest that a single session of aerobic exercise have no effects on attitudes and behaviors related to the pursuit of muscularity in men. In particular, the behavioral component of the drive for muscularity seems to be difficult to alter with a single session of aerobic exercise. It includes the use of protein or energy supplements, steroids, and consumption of large amount of calories in a day (Edwards et al., 2014; McCreary & Sasse, 2000).

As noted by Festinger (1957) strong beliefs are difficult to change. Meta-analytic review of dissonance-based eating disorder prevention programs that aimed to reduce body-ideal internalization found that multiple sessions produce larger effects (Stice et al., 2019). It may explain why we did not find effects of a single session of aerobic exercise on body-ideal internalization. Body-ideal internalization refers to the extent to which an individual cognitively “buys into” socially defined ideals of attractiveness and engages in behaviors designed to produce an approximation of these ideals (Stice et al., 2011). Again, efforts should be made to exercise if there is chronic effect of aerobic and anaerobic on body-ideal internalization.

Regarding body-checking behaviors we found no effects of time, protocol or interaction between time-point measurements and protocol. Body-checking behaviors are frequent among male physical exercise practitioners (Carvalho et al., 2013; Shafran et al., 2004), and include behaviors such as frequent weighing, examining specific body parts in the mirror, using the fit of clothes to judge shape or weight change, and body comparison (Shafran, Fairburn, Robinson, & Lask, 2004). This excessive body-monitoring behavior increases the selective attention to disliked body parts, and as a result, individuals become increasingly preoccupied and dissatisfied with their bodies. There is a scarce literature about the effects of exercise interventions on body-checking behaviours (Bassett-Gunter et al., 2017; Campbell & Hausenblas, 2009; Hausenblas & Fallon, 2006; Reel et al., 2007) which makes it difficult to compare our results with previous studies. Given that body-checking is a form of monitoring body changes arising from body change behaviors (i.e., dieting, using supplements and steroids, and doing exercise), it seems plausible to argue that a single aerobic exercise session would produce little or no effect on body-checking behaviors.

Finally, we found an isolated effect of the measurement time-points on body image perception. The mean scores observed at 72-hour time-point were significantly higher when compared to the Pre-exercise, with an increase in body image distortion. Bassett-Gunter et al. (2017) argued that few studies included any examination of mechanisms underlying the relationship between physical exercise and body image. Martin Ginis et al. (2012) found that there is evidence to support at least three categories of underlying mechanisms: (a) objective changes in physical fitness, (b) perceived changes in physical fitness, and (c) changes in self-efficacy. Although not evaluated some of the underlying mechanisms may explain the results, we observed regarding body image perception. As previously noticed, insufficiently active men may increase muscularity concerns after doing aerobic exercise by feeling that their body is smaller or less muscular than before doing exercise.

Conclusions

The present study provides important results regarding the effects of aerobic exercise and body image components among men. Higher scores on muscularity dissatisfaction were observed at 48 hours after exercise. There was also greater body image distortion 72 hours after doing the aerobic exercise. It is plausible argue that

muscularity dissatisfaction observed at 48h after doing exercise have impacted body image perception ate 72h after. There is a need for research using study designs that allow for the examination of mediating variables. We observed few differences between the two exercise intensities. The selected intensities are very close aerobic exercise prescription zones. It is also known that, HRRes is an important tool to estimate exercise intensity, as the method is based on the relationship between HR and reserve VO2. However, this method showed a limitation due to methodological differences associated with the estimation of VO2 at rest and its relationship with HRRes. Future researchers may investigate differences between aerobic exercise intensities as a factor in modulating body image. Efforts should also be employed to evaluate the effects of resistance training interventions on the drive for muscularity. In short, our results suggest that a single session of aerobic exercise can modulate affective and perceptual body image components regardless exercise intensity. Such research will allow for further understanding of how aerobic exercise can impact body image among men.

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References:

Alcaraz-Ibáñez, M., Paterna, A., Sicilia, Á., & Griffiths, M. D. (2021). A Systematic Review and Meta-Analysis on the Relationship between Body Dissatisfaction and Morbid Exercise Behaviour. *International Journal of Environmental Research and Public Health, 18*(2), 585.

Almeida, M., Campos, P. F., Gomes, V. M. G. M., Neves, C. M., Queiroz, A. C. C., Brito, C. J., . . . De Carvalho, P. H. B. (2019). Muscle dysmorphia, body image disturbances and commitment to exercise: A comparison between sedentary and physical active undergraduate men. *Journal of Physical Education and Sport, 19*(1), 507-513.

Amaral, A. C., Ribeiro, M. S., Conti, M. A., Ferreira, C. S., & Ferreira, M. E. (2013). Psychometric evaluation of the Sociocultural Attitudes Towards Appearance Questionnaire-3 among Brazilian young adults. *Span J Psychol, 16*(e94), 1-10.

Assunção, S. S. M., Cordás, T. A., & Araújo, L. (2002). Atividade física e transtornos alimentares. *Revista de Psiquiatria Clínica, 29*(1), 4-13.

Bassett-Gunter, R., McEwan, D., & Kamarhie, A. (2017). Physical activity and body image among men and boys: A meta-analysis. *Body Image, 22*, 114-128.

Béres, A., Czeglédi, E., & Babusa, B. (2017). Effects of a single aerobic exercise session on body image. *Mentálhigiéné és Pszichoszomatika, 18*(1), 84-104.

Bland, J. M., & Altman, D. G. (1997). Statistics notes: Cronbach's alpha. *Bmj, 314*(7080), 572.

Calzo, J. P., Horton, N. J., Sonneville, K. R., Swanson, S. A., Crosby, R. D., Micali, N., . . . Field, A. E. (2016). Male eating disorder symptom patterns and health correlates from 13 to 26 years of age. *Journal of the American Academy of Child & Adolescent Psychiatry, 55*(8), 693-700. e692.

Campana, A. N. N. B., Tavares, M. d. C. G. C. F., Swami, V., & da Silva, D. (2013). An examination of the psychometric properties of Brazilian Portuguese translations of the Drive for Muscularity Scale, the Swansea Muscularity Attitudes Questionnaire, and the Masculine Body Ideal Distress Scale. *Psychology of Men & Masculinity, 14*(4), 376.

Campbell, A., & Hausenblas, H. A. (2009). Effects of exercise interventions on body image: A meta-analysis. *Journal of Health Psychology, 14*(6), 780-793.

Carvalho, P. H. B. d., Conti, M. A., Cordás, T. A., & Ferreira, M. E. C. (2012). Tradução para o português (Brasil), equivalência semântica e consistência interna do Male Body Checking Questionnaire (MBCQ). *Archives of Clinical Psychiatry (São Paulo), 39*(2), 74-75.

Carvalho, P. H. B. d., Filgueiras, J. F., Neves, C. M., Coelho, F. D., & Ferreira, M. E. C. (2013). Body-checking, inappropriate eating attitudes and body image dissatisfaction among young students. *Jornal Brasileiro de Psiquiatria, 62*(2), 108-114.

Cash, T. F., & Smolak, L. (2011). *Body image: A handbook of science, practice, and prevention* (Vol. 2). New York: Guilford Press.

da Silva, W. R., Marôco, J., Ochner, C. N., & Campos, J. A. D. B. (2017). Male body dissatisfaction scale (MBDS): proposal for a reduced model. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 22*(3), 515-525.

de Carvalho, P. H. B., Conti, M. A., Ribeiro, M. S., Amaral, A. C. S., & Ferreira, M. E. C. (2014). Psychometric assessment of the Male Body Checking Questionnaire (MBCQ). *Psicologia, Reflexão e Crítica, 27*(4), 700.

Edwards, C., Tod, D., & Molnar, G. (2014). A systematic review of the drive for muscularity research area. *International Review of Sport and Exercise Psychology, 7*(1), 18-41.

Festinger, L. (1957). *A theory of cognitive dissonance* (Vol. 2): Stanford university press.

Franco, D. C., Farias, G. S., Pelegrini, A., Junior, J. S. V., & de Sousa, T. F. (2021). Validity of measure of sitting time of IPAQ Questionnaire short version in undergraduate from Brazil. *Revista Brasileira de Atividade Física & Saúde, 26*, 1-9.

Gardner, R. M., & Boice, R. (2004). A computer program for measuring body size distortion and body dissatisfaction. *Behavior Research Methods, Instruments, & Computers, 36*(1), 89-95.

Griffiths, S., Murray, S. B., & Touyz, S. (2013). Disordered eating and the muscular ideal. *Journal of eating disorders, 1*(1), 1-2.

Guimarães, L., & Hirakata, V. N. (2012). Use of the Generalized Estimating Equation Model in longitudinal data analysis. *Rev HCPA, 32*(4), 503-511.

Hausenblas, H. A., & Fallon, E. A. (2006). Exercise and body image: A meta-analysis. *Psychology and health, 21*(1), 33-47.

Jackson, A. S., & Pollock, M. L. (1978). Generalized equations for predicting body density of men. *British Journal of Nutrition, 40*(3), 497-504.

Kakeshita, I. S., Silva, A. I. P., Zanatta, D. P., & Almeida, S. S. (2009). A figure rating scales for Brazilian adults and children: development and test-retest reliability. *Psicologia: Teoria e Pesquisa, 25*(2), 263-270.

Kaszás, B., Oláh, B., & Kovács-Tóth, B. (2021). The relationship of muscle dysmorphia to the body image and early maladaptive schemata created by parental behaviours. *Psychiatria Hungarica: A Magyar Pszichiatriai Tarsasag Tudomanyos Folyoirata, 36*(2), 113-123.

Lavender, J. M., Brown, T. A., & Murray, S. B. (2017). Men, muscles, and eating disorders: An overview of traditional and muscularity-oriented disordered eating. *Current psychiatry reports, 19*(6), 1-7.

Martin Ginis, K., Bassett-Gunter, R. L., & Conlin, C. (2012). Body image and exercise. In E. O. Acevedo (Ed.), *The Oxford Handbook of Exercise Psychology* (Vol. 1, pp. 55). London: Oxford University Press.

McCreary, D. R., & Sasse, D. K. (2000). An exploration of the drive for muscularity in adolescent boys and girls. *Journal of American College Health, 48*(6), 297-304.

Medicine, A. C. o. S. (2013). *ACSM's guidelines for exercise testing and prescription* (Vol. 9). Baltimore: Lippincott Williams & Wilkins.

Moccia, L., Conte, E., Ambrosecchia, M., Janiri, D., Di Pietro, S., De Martin, V., . . . Gallese, V. (2021). Anomalous self-experience, body image disturbance, and eating disorder symptomatology in first-onset anorexia nervosa. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 1-8.

Murray, S. B., Accurso, E. C., Griffiths, S., & Nagata, J. M. (2018). Boys, biceps, and bradycardia: The hidden dangers of muscularity-oriented disordered eating. *Journal of Adolescent Health, 62*(3), 352-355.

Murray, S. B., Nagata, J. M., Griffiths, S., Calzo, J. P., Brown, T. A., Mitchison, D., . . . Mond, J. M. (2017). The enigma of male eating disorders: A critical review and synthesis. *Clinical psychology review, 57*, 1-11.

Pope, C. G., Pope, H. G., Menard, W., Fay, C., Olivardia, R., & Phillips, K. A. (2005). Clinical features of muscle dysmorphia among males with body dysmorphic disorder. *Body Image, 2*(4), 395-400.

Reel, J. J., Greenleaf, C., Baker, W. K., Aragon, S., Bishop, D., Cachaper, C., . . . Reid, W. K. (2007). Relations of body concerns and exercise behavior: A meta-analysis. *Psychological Reports, 101*(3), 927-942.

Satterfield, N. A., & Stutts, L. A. (2021). Pinning down the problems and influences: Disordered eating and body satisfaction in male wrestlers. *Psychology of Sport and Exercise, 54*, 101884.

Shafran, R., Fairburn, C. G., Robinson, P., & Lask, B. (2004). Body checking and its avoidance in eating disorders. *International Journal of Eating Disorders, 35*(1), 93-101.

Siri, W. E. (1961). Body composition from fluid spaces and density: analysis of methods. In J. Brozek & A. Heschel (Eds.), *Techniques for measuring body composition* (Vol. 1, pp. 223-244). Washington DC: National Academy of Science and Natural Resource Council.

Stice, E., Marti, C. N., & Durant, S. (2011). Risk factors for onset of eating disorders: Evidence of multiple risk pathways from an 8-year prospective study. *Behaviour Research and Therapy, 49*(10), 622-627.

Stice, E., Marti, C. N., Shaw, H., & Rohde, P. (2019). Meta-analytic review of dissonance-based eating disorder prevention programs: Intervention, participant, and facilitator features that predict larger effects. *Clinical psychology review, 70*, 91-107.

Tanaka, H., Monahan, K. D., & Seals, D. R. (2001). Age-predicted maximal heart rate revisited. *Journal of the American College of Cardiology, 37*(1), 153-156.

Zancu, S. A., Dafinoiu, I., & Enea, V. (2021). Alexithymia, body image and disordered eating in fashion models and student athletes. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity*, 1-8.