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Body image, muscle dysmorphia, and muscularity concerns: a comparison of crossfit athletes, weight-trainers, and non-athletes

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ABSTRACT

CrossFit is a strength-and-conditioning physical activity programme that some studies have shown results in healthier body image outcomes. However, prior studies have typically examined CrossFit in isolation, without adequate group comparison. This study aimed to investigate body image experiences in CrossFit athletes in comparison to weight-trainers and non-athletes. The study used a cross-sectional design in which CrossFit athletes, weight-trainers, and non-athletes from Brazil were asked to complete a measure of positive body image (i.e., body appreciation), negative body image (i.e., body dissatisfaction), and gender-specific muscle-oriented body image (i.e., muscularity concerns in women and muscle dysmorphia symptomatology in men). Between-group comparisons showed that CrossFit athletes and weight-trainers had healthier body image than non-athletes, but differences between the two groups were small. There were no significant between-group differences in muscularity concerns in women, whereas weight-training men had a significantly higher drive for size compared to both CrossFit athletes and non-athletes. Male CrossFit athletes and weight-trainers also showed significantly higher functional impairment as a result of exercise compared to non-athletes. These results suggest that participation in CrossFit may be a route to promoting a healthier body image while mitigating unhealthy muscularity-related attitudes and behaviours. More broadly, our results support the suggestion that physical activity is associated with a healthier body image.

KEYWORDS: body appreciation; body dissatisfaction; sport; physical activity; muscle concerns; crossfit.

INTRODUCTION

Body image refers to a multidimensional and multifaceted construct consisting of affective, cognitive, perceptual, and behavioural components (Cash, 2012). While decades of research on body image have focused on its negative aspects, such as weight and appearance dissatisfaction, body image disturbance, and body dysmorphia (Cash, 2012), scholars have more recently turned their attention to positive experiences that include body appreciation and functionality appreciation (Tylka, 2018; Andersen & Swami, 2021). There is now increasing recognition that both negative and positive body images are uniquely associated with a wide range of downstream outcomes, including eating behaviours, weight management, and psychosocial functioning (Tylka, 2018). Given such associations, body image researchers have sought to identify factors and activities that confer protection against negative body image and/or promote more positive body experiences.

One factor that may be particularly important in terms of body image is sport and physical activity behaviour. Meta-analyses have consistently reported that participation in physical activity and sport is associated with lower body image concerns in both genders (e.g., Campbell & Hausenblas, 2009; Bassett-Gunter, McEwan, & Kamarhie, 2017) and that athletes have lower body image concerns compared to non-athletes (Varnes et al., 2013). These findings were further supported in a recent scoping review (Sabiston, Pila,

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Vani, & Thogersen-Ntoumani, 2019), which found that participation in physical activity and sport was associated with a more positive body image. Although theoretical explanations of these effects remain fragmented (Sabiston et al., 2019), sport and physical activity likely affect body image directly by allowing individuals to close the gap with idealised appearance ideals and/or by promoting embodying experiences that generate a more connected relationship with one's body (Piran, 2016). Indirect pathways have also been postulated, with lower self-objectification and greater self-esteem having been suggested as mediating factors of positive body image (e.g., Piran, 2017).

Beyond these broad-stroke findings, however, researchers have also suggested that the specific type of sport is important when considering body image outcomes (Varnes et al., 2013). For instance, some researchers have noted that participation in sports types that are "judged" (i.e., where physical appearance has an influence on performance evaluation, such as gymnastics and figure skating) and sports that promote stringent appearance ideals (e.g., synchronised swimming and aerobics) are associated with higher levels of negative body image (e.g., Kong & Harris, 2015). For instance, Swami, Steadman and Tovée (2009) reported that female track athletes in the United Kingdom had significantly greater body dissatisfaction than martial artists and non-athletes. However, not all studies have supported this conclusion, with some recent research indicating that athletes in aesthetic sports have significantly lower negative body image compared to those in non-aesthetic sports (e.g., Jankauskienė & Bacevičienė, 2019) or reporting no significant differences as a function of sport type (Prnjak, Jukiv, & Tufano, 2019).

The equivocal nature of extant findings might, in part, reflect differences in methodology (e.g., the way in which body image is operationalised), researcher-defined criteria for categorising aesthetic versus non-aesthetic sports, and a focus on a limited range of sport types. Importantly, one sport that has been touted as having the potential to promote healthier body image is CrossFit. According to Glassman (2002), CrossFit is a type of strength-and-conditioning programme that aims to develop broad, general, and inclusive fitness and physical power. To achieve these goals, the CrossFit programme has athletes performing constantly varied, high-intensity, functional movements that fall into the modalities of gymnastics, Olympic weightlifting, and metabolic conditioning (or "cardio"). In a typical CrossFit workout, athletes participate in a warm-up, a skill or strength development segment, and a variable "workout of the day" (WOD) conducted at high intensity and in a group environment. The focus on functional training for everyday activities and its supportive and tight-knit community have both contributed to the global popularity of CrossFit among both amateur and elite athletes (Dawson, 2017; Lautner, Patterson, Spadine, Boswell, & Heinrich, 2021).

A notable feature of the CrossFit programme is its attention to both health- and skill-related fitness over body aesthetics; that is, CrossFit explicitly de-emphasises a focus on appearance and frames its focus instead on performance (Dominski, Serafim, Siqueira, & Andrade, 2021). Emerging evidence has suggested that involvement in CrossFit may benefit the body image of athletes. For example, in a prospective study with novice CrossFit athletes (N= 63) in the United Kingdom, Swami (2019) reported significant and large (η_p^2= 0.22-0.36) improvements in positive body image (body appreciation, functionality appreciation) and body acceptance by others after 3 months. Similarly, a study of female CrossFit athletes from Canada (N= 149) reported that self-identified CrossFit skill and frequency were associated with lower body dissatisfaction (Coyne & Woodruff, 2020). Conversely, however, a cross-sectional study with a Norwegian sample of adult CrossFitters (N= 186) reported that CrossFit experience (operationalised as duration x weekly frequency) was not significantly associated with body awareness, body dissatisfaction, and body competence (Köteles, Kollsete, & Kollsete, 2016).

There is also some evidence of the gendered impact of CrossFit participation on body image. For example, content analyses of CrossFit online content (Washington & Economides, 2016) and *CrossFit Journal* (Knapp, 2015a) have suggested that CrossFit simultaneously affords the space to actively resist heteronormative appearance ideals for women (e.g., through the development of body musculature to symbolise feminine strength) while reproducing hegemonic feminine expectations (e.g., to be attractive for others and a focus on body aesthetics). Likewise, interviews with female athletes have suggested that CrossFit challenges and subverts traditional expectations of feminine appearance, promoting body confidence (Knapp, 2015b; Podmore & Paff Ogle, 2018). Athletes spoke of how their CrossFit community promoted inclusive appearance ideals (e.g., cultivating strength and muscularity) that disrupted normative expectations and de-emphasised appearance while focusing on performance and body functionality (Podmore & Paff Ogle, 2018). At the same time, however, women athletes also described difficulties managing expectations of conforming to an athletic ideal of female muscularity while staying thin, particularly regarding the coaches' and members' gaze over their bodies (Podmore & Paff Ogle, 2018; Malcom, Edmonds, Gipson, Haudd, & Bennett, 2021; Schrijnder, van Amsterdam, & McLachlan, 2021).

Although these studies suggest that CrossFit may have the potential to promote healthier body image, it is important to note that quantitative studies to date (Köteles et al., 2016; Swami, 2019; Coyne & Woodruff, 2020) have typically relied on relatively small samples, have not considered gendered differences, and have not included adequate comparison groups. The latter is important because it limits the extent to which reported findings are the result of CrossFit specifically or engagement with specific elements of the CrossFit programme; that is, it may be possible that outcomes reported in previous studies are not the outcome of participation in CrossFit *per se*, but rather engagement with specific elements of the CrossFit programme, such as weight-training. Indeed some evidence indicates that functional workouts in isolation (i.e., the training aimed at improving performance in daily neuromuscular activities) are associated with reduced negative body image (Aukštuolytė, Mauricienė, Daunoravičienė, Knispelytė, & Berškienė, 2018). Likewise, weight training (i.e., strength training for developing the strength and size of muscles) in isolation has been found to result in reductions in negative body image (SantaBarbara, Whitworth, & Ciccolo, 2017; Waldorf, Erkens, Vocks, McCreary, & Cordes, 2017).

The present study

Much more can be done to fully understand the CrossFit programme's impact on body image outcomes. In the present study, therefore, we conducted a study examining aspects of body image in a sample of CrossFit athletes and, for comparative purposes, weight-trainers and non-athletes. While non-athletes provide an appropriate "baseline" comparison insofar as they are not involved in any organised physical activity (Swami et al., 2009; Jankauskienė & Bacevičienė, 2019), we also included a sample of weight-trainers given that strength development is an important component of the CrossFit programme (Glassman, 2002). Worth noting that some work has suggested that weight-training athletes report greater appearance-related motives than CrossFit athletes suggesting that the former may represent a useful comparison group in terms of being a more aesthetic-focused sport (Popp Marin, Polito, Foschini, Urtado, & Otton, 2018). Here, we operationalised body image in terms of an index of positive body image (i.e., body appreciation) and two indices of negative body image, namely body dissatisfaction and gender-specific muscle-oriented body image (i.e., muscularity concerns in women and muscle dysmorphia in men). Based on previous work (Swami, 2019; Coyne & Woodruff, 2020), we hypothesised that CrossFit athletes would have significantly greater positive body image and lower body dissatisfaction and muscularity concerns and/or muscle dysmorphia than both weight-trainers and non-athletes.

METHODS

Participants

In this cross-sectional study, the initial participant group consisted of 1,074 individuals; however, data from 458 individuals were omitted because they did not return a signed informed consent form (n= 13), did not meet inclusion or exclusion criteria (n= 234), or were missing substantial (i.e., > 80%) item-level data (n= 207). The final sample, therefore, consisted of 620 adults (319 women, 301 men) who were recruited in-person and online. A total of 32 CrossFit athletes (14 women, 18 men), 107 weight-trainers (42 women, 65 men), and 105 non-athletes (71 women, 34 men) were recruited in-person at university campuses (non-athletes), CrossFit boxes, and weight-training gyms. All remaining participants were recruited online: 105 CrossFit athletes (56 women, 49 men), 130 weight-trainers (62 women, 68 men), and 141 non-athletes (74 women, 67 men).

Participants ranged in age from 18 to 40 years (M= 27.07, SD= 5.63) and in self-reported body mass index (BMI) from 15.35 to 46.17 kg/m^2 (M= 24.51, SD= 4.05). Regarding race, 81.1% of the sample were White, 14.4% were Brown, and the remaining 4.6% were Black, Asian, or Indian, in accordance with official race/ethnicity categories in the Brazilian census (Brazilian Institute of Geography and Statistics, 2020). Regarding marital status, 80.3% of the sample were single, 18.9% were married/living together, and the remainder 0.8% were divorced. In terms of educational attainment, 1.0% had completed middle school, 10.5% had completed high school, 50.5% had an undergraduate degree, and 38.1% were attending college. Regarding the frequency of sport, 5.9% were engaged 1-2 times per week, 45.9% were engaged 3-4 times per week, and 48.3% were engaged 5 or more times per week. The sociodemographic characteristics of each group are reported in Table 1.

Measures

Sociodemographic questionnaire

Participants were asked to report their gender identity, age, race, highest educational qualification, and marital status. They were also asked to self-report their height and weight, which we used to compute BMI as kg/m^2. In addition, participants who engaged in CrossFit or weight-training were asked to report how long (in months) they had been active in the sport (duration) and how many times per week (frequency) they engaged in the sport (1= 1-2 times per week, 2= 3-4 times per week, 3= 5 or more times per week).

Body appreciation

To measure a facet of positive body image, we used the 10-item Body Appreciation Scale (BAS-2; Tylka & Wood-Barcalow, 2015; Brazilian Portuguese translation, Junqueira et al., 2019). The BAS-2 measures acceptance of one's body, respect and care for one's body, and protection of one's body from unrealistic beauty standards. All items were rated on a 5-point scale, ranging from 1 (never) to 5 (always), and an overall score was computed as the mean of all items. Higher scores on this measure reflect greater body appreciation. Scores on the Brazilian Portuguese version of the BAS-2 have been shown to have a 1-dimensional factor structure and have been judged as adequate in terms of internal consistency estimates, test-retest reliability after 3 weeks, and indices of convergent validity (Junqueira et al., 2019). In this study, McDonald's ω for scores on this scale was 0.93 (95%CI 0.92–0.93).

Body satisfaction

To measure a facet of negative body image, we asked participants to complete the 9-item Body Areas Satisfaction Scale (BASS) of the Multidimensional Body-Self Relations Questionnaire (MBSRQ; Cash, 2000; Brazilian Portuguese translation, Laus, Vales, Oliveira, Braga Costa, & Almeida, 2020), which measures the degree of (dis)satisfaction with various body parts. Items were rated on a 5-point scale, ranging from 1 (strongly disagree) to 5 (strongly agree), and an

Table 1. Demographic Characteristics of Participants as a Function of Sport Type and Gender.

	CrossFit athletes		Weight-trainers		Non-athletes	
	Men (*n*= 67)	Women (*n*= 70)	Men (*n*= 133)	Women (*n*= 104)	Men (*n*= 101)	Women (*n*= 145)
Age (years)						
M (SD)	28.73 (6.10)	26.54 (6.02)	24.35 (4.81)	24.82 (5.58)	26.37 (6.17)	22.59 (4.12)
Range	18-40	18-40	18-38	18-39	18-40	18-40
BMI (kg/m^2)						
M (SD)	26.36 (1.93)	23.84 (3.05)	25.23 (3.13)	22.59 (3.47)	26.71 (4.91)	23.16 (4.31)
Range	20.52-29.94	19.13-41.41	17.92-37.86	15.67-35.64	17.92-38.74	15.78-36.20
Duration (months)*						
M (SD)	28.96 (23.22)	26.5 (17.91)	53.68 (54.79)	40.32 (41.23)	-	-
Range	6.00 – 120.00	6.00 – 75.00	6.00 – 312.00	6.00 – 240.00	-	-
Education level	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Middle school	0 (0.0%)	1 (1.4%)	2 (1.5%)	3 (2.9%)	0 (0.0%)	0 (0.0%)
High school	10 (14.9%)	7 (10.0%)	14 (10.5%)	10 (9.6%)	16 (15.8%)	8 (5.5%)
Attending college	43 (64.2%)	37 (52.9%)	43 (32.3%)	42 (40.4%)	40 (39.6%)	31 (21.4%)
Bachelor's degree	14 (20.9%)	25 (35.7%)	74 (55.6%)	49 (47.1%)	45 (44.6%)	106 (73.1%)
Race	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
White	52 (77.6%)	66 (94.3%)	111 (83.5%)	80 (76.9%)	81 (80.2%)	113 (77.9%)
Black	0 (0.0%)	0 (0.0%)	5 (3.8%)	3 (2.9%)	3 (3.0%)	5 (3.4%)
Brown	12 (3.0%)	3 (4.3%)	15 (11.3%)	19 (18.3%)	16 (15.8%)	24 (16.6%)
Asian	2 (3.0%)	1 (1.4%)	2 (1.5%)	2 (1.9%)	1 (1.0%)	3 (2.1%)
Indian	1 (1.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Marital status	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Single	49 (73.1%)	51 (72.9%)	120 (90.2%)	77 (74.0%)	71 (70.7%)	130 (89.7%)
Married	16 (23.9%)	18 (25.7%)	12 (9.0%)	27 (26.0%)	30 (29.7%)	14 (9.7%)
Divorced	2 (3.0%)	1 (1.4%)	1 (0.8%)	0 (0.0%)	0 (0.0%)	1 (0.7%)
Frequency of sport**	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
1-2 times	3 (4.5%)	2 (2.9%)	6 (4.5%)	11 (10.6%)	-	-
3-4 times	17 (25.4%)	36 (51.4%)	60 (45.1%)	59 (56.7%)	-	-
5+ times	47 (70.1%)	32 (45.7%)	67 (50.4%)	34 (32.7%)	-	-

BMI: Body Mass Index; *Training duration; **Frequency per week.

overall score was computed as the mean of all nine items. Scores were reverse-coded for analyses so that higher scores reflect greater body dissatisfaction. Laus et al. (2020) reported that scores on the Brazilian Portuguese version of the BASS are 1-dimensional and have adequate psychometric properties. In the present study, McDonald's ω for scores on the BASS was 0.82 (95%CI 0.80–0.84).

Muscle dysmorphia

Men in the present study were asked to complete the Muscle Dysmorphic Disorder Inventory (MDDI; Hildebrandt, Langenbucher, & Schlundt, 2004; Brazilian Portuguese translation, Gomes et al., 2020). The MDDI is a 13-item measure assessing a pathological fear of being too small and a pursuit of muscularity. All items were rated on a 5-point scale ranging from 1 (never) to 5 (always). Like the original version, scores on the Brazilian Portuguese version of the MDDI have been found to reduce to three dimensions measuring drive for size (DS; 5 items), appearance intolerance (AI; 4 items), and functional impairment (4 items) (FI; Gomes et al., 2020). Subscale scores were computed as the mean of the items, such that higher scores reflect greater muscle dysmorphia. Scores on the Brazilian Portuguese version have been shown to have adequate internal consistency coefficients and construct validity, as well as good test-retest reliability up to two weeks in men (Gomes et al., 2020). In the present study, McDonald's ω was 0.78 (95%CI 0.75–0.80) for MDDI-DS, 0.76 (95%CI 0.72–0.78) for MDDI-AI, and 0.85 (95%CI 0.81–0.85) for MDDI-FI.

Female muscularity

Women in the present study were asked to complete the Female Muscularity Scale (FMS; Rodgers et al., 2018; Brazilian Portuguese translation: Campos et al., 2021). The FMS is a 10-item measure assessing muscularity concerns in women along two dimensions indexing attitudinal dispositions (5 items) and behavioural aspects (5 items). All items were rated on a 5-item scale ranging from 1 (never) to 5 (always). Scores on the Brazilian Portuguese version of the FMS have been shown to reduce to two dimensions mirroring the original scale (Campos et al., 2021). In the present study, therefore, we computed subscale scores as the mean of the items, with higher scores reflective of greater muscularity concerns. Scores on the Brazilian Portuguese version have been shown to have adequate internal consistency coefficients and construct validity, as well as good test-retest reliability up to two weeks in men (Campos et al., 2021). In the present study, McDonald's ω was 0.87 (95%CI 0.84–0.87) for the Attitudes subscale and 0.90 (95%CI 0.88–0.90) for the Behaviours subscale.

Procedure

The project was approved by the relevant Institutional Review Board (approval code: CAAE 21607019.0.0000.5498). Potential participants were invited to complete a survey that was advertised as being on sports participation and well-being. Inclusion criteria included being between the ages of 18 and 40 years (as most of our instruments were validated for use in populations of this age range), being sedentary for the non-athletes, and, for the sports groups, having engaged in CrossFit or weight-training for at least six months prior to the point of the survey. The latter criterion was included to ensure a minimum period in which participants would begin to exhibit the psychological and physical transformations required to meet the challenges of CrossFit or weight-training (Swami, 2019). Exclusion criteria included practising any type of sport other than CrossFit or weight training, being pregnant at the time of recruitment, having given birth within twelve months of recruitment, and having any medical condition that may directly or indirectly influence one's physical appearance (e.g., cancer, amputation).

Beginning in January 2020, participants were recruited in places of congregate activity on university campuses (non-athletes), CrossFit boxes, and weight-training gyms in São Paulo state, Brazil. Six trained research assistants approached the potential participants directly and, following a brief explanation of the project, those who agreed to participate were invited to take home a sealed envelope (which contained a written informed consent sheet, the survey materials with the order of presentation of scales counter-balanced, and debriefing information). The sealed envelopes were returned to researchers within 7 days. However, due to the novel coronavirus (COVID-19) pandemic and attendant measures to limit virus transmission, we paused recruitment in March 2020 due to the closure of all gyms and training facilities. Although these re-opened in mid-2020, we elected to continue online recruitment to facilitate participation. The online collection was performed via advertisements placed on social media between August 2020 and February 2021. Inclusion and exclusion criteria were identical to those used for face-to-face recruitment. Potential participants were provided with brief information about the project, and those who agreed to participate provided digital informed consent and completed an online survey. The survey was hosted on SurveyMonkey, and the order of presentation of scales was counter-balanced, using the "block randomisation" option. IP addresses were checked to ensure that no participant completed the survey more than once. The survey was entirely anonymous for both online and offline recruitment, and data were treated confidentially. All participants took part voluntarily and were not reimbursed for participation.

Statistical analysis

All study variables were analysed using descriptive statistics (mean, standard deviation, and frequencies). Between-group differences were analysed using chi-square tests and univariate analyses of variance (ANOVAs). A series of analyses of covariance (ANCOVAs) or multivariate analyses of covariance (MANCOVAs) were conducted to test the study hypothesis, and multiple linear regressions were conducted for exploratory purposes. All statistical analyses were performed using the Software Statistical Package for Social Sciences (SPSS) v. 23.0. A significance level of $p \leq .05$ was adopted for all analyses.

RESULTS

Preliminary analysis

Descriptive statistics for all sociodemographic and study variables are reported in Tables 1 and 2.

We first examined between-group differences in the distribution of gender, race, highest educational qualifications, and marital status to verify if the groups were similar in terms of sociodemographic characteristics. There were significant differences in the distribution of gender, $\chi^2(1)= 10.97$, $p= .004$, and highest educational qualification, $\chi^2(2)= 45.98$, $p< 0.001$, but not of race, $\chi^2(2)= 10.56$, $p= 0.228$, and marital status, $\chi^2(2)= 8.81$, $p= 0.066$. There were also significant between-group differences in mean age, $F(2, 617)= 19.36$, $p < 0.001$, $\eta_p^2= 0.06$, but not BMI, $F(2, 617)= 2.81$, $p= 0.061$, $\eta_p^2= 0.01$. Finally, weight-trainers had been training for significantly longer than CrossFit athletes, $t(371)= 4.52$, $p< 0.001$, $d= 0.47$, and were also more likely to train more frequently per week, $\chi^2(2)= 8.42$, $p= 0.015$.

Main analyses

To test the study hypotheses, we conducted a series of ANCOVAs or MANCOVAs. When gender, educational qualifications, training duration, and training frequency were

Table 2. Means and standard deviations of the study variables as a function of sport type and gender.

	CrossFit athletes		Weight-trainers		Non-athletes	
	Men (*n*= 67)	Women (*n*= 70)	Men (*n*= 133)	Women (*n*= 104)	Men (*n*= 67)	Women (*n*= 70)
BAS-2						
M (SD)	4.06 (0.56)	3.75 (0.70)	3.91 (0.60)	3.75 (0.74)	3.57 (0.79)	3.33 (0.87)
Range	2.40-5.00	1.50-5.00	2.10-5.00	1.60-5.00	1.10-4.90	1.00-5.00
MBSRQ-BASS						
M (SD)	2.10 (0.65)	2.41 (0.58)	2.41 (0.59)	2.50 (0.68)	2.60 (0.63)	2.80 (0.71)
Range	1.00 – 4.00	1.22 – 3.67	1.00 – 3.78	1.22 – 4.56	1.44 – 4.11	1.00 – 4.67
FMS-AS						
M (SD)	-	4.01 (0.81)	-	4.13 (0.79)	-	3.89 (0.96)
Range	-	2.40 – 5.00	-	2.00 – 5.00	-	1.00 – 5.00
FMS-BS						
M (SD)	-	3.29 (0.91)	-	3.47 (0.96)	-	1.89 (0.99)
Range	-	1.40 – 5.00	-	1.20 – 5.00	-	1.00 – 5.00
MDDI - DS						
M (SD)	2.24 (0.78)	-	2.88 (0.78)	-	2.20 (0.84)	-
Range	1.00 – 4.20	-	1.20 – 5.00	-	1.00 – 4.20	-
MDDI - AI						
M (SD)	1.91 (0.85)	-	1.99 (0.71)	-	2.20 (0.95)	-
Range	1.00 – 4.50	-	1.00 – 4.00	-	1.00 – 4.75	-
MDDI - FI						
M (SD)	2.50 (0.93)	-	2.32 (0.91)	-	1.30 (0.53)	-
Range	1.00 – 4.74	-	1.00 – 5.00	-	1.00 – 3.50	-

BAS-2: Body appreciation scale-2; BASS: Body areas satisfaction scale of Multidimensional body-self relations questionnaire – appearance scales; FMS: Female muscularity scale; FMS – AS: attitudes subscale of FMS; FMS – BS: behavior subscale of FMS; MDDI: muscle dysmorphic disorder inventory; MDDI – DS: drive for size subscale of MDDI; MDDI – AI: appearance intolerance subscale of the MDDI; MDDI – FI: functional impairment.

entered as covariates in these analyses, none of these variables had significant covariate or interaction effects (all $\eta_p^2 \leq 0.01$). For this reason, we have omitted the reporting of covariate results below for the sake of brevity.

In the first set of analyses, we conducted a ANCOVA with gender (women *vs*. men) and sport type (CrossFit athletes *vs*. weight-trainers *vs*. non-athletes) as independent variables and participant age and education as covariates. When body appreciation was entered as the dependent variable, there was a significant main effect of sport type, $F_{(2, 612)} = 22.28$, $p < 0.001$, $\eta_p^2 = 0.07$. CrossFit athletes and weight-trainers were not significantly different from each other in mean body appreciation, $t(372) = 0.82$, $p = 0.412$, $d = 0.09$, but both groups had significantly higher body appreciation than non-athletes (ts= 5.68-5.97, ps< 0.001, ds= 0.54–0.58). There was also a significant effect of gender, $F_{(1, 612)} = 12.09$, $p < 0.001$, $\eta_p^2 = 0.02$ (men had significantly higher body appreciation than women), but the interaction was not significant, $F_{(2, 612)} = 0.381$, $p = 0.684$, $\eta_p^2 < 0.01$.

When body dissatisfaction was entered as the dependent variable, we found a significant main effect of sport type, $F_{(2, 612)} = 21.64$, $p < 0.001$, $\eta_p^2 = 0.07$. CrossFit athletes had significantly lower body dissatisfaction compared with weight trainers, $t(372) = 2.82$, $p = 0.005$, $d = 0.30$, and non-athletes, $t(381) = 6.53$, $p < 0.001$, $d = 0.67$, whereas weight-trainers had significantly lower body dissatisfaction compared with non-athletes, $t(481) = 4.55$, $p < 0.001$, $d = 0.42$. There was a significant main effect of gender, $F_{(1, 612)} = 11.67$, $p < 0.001$, $\eta_p^2 = 0.02$ (men had significantly lower body dissatisfaction than women), but the interaction between sport type and gender did not reach significance, $F_{(2, 612)} = 1.14$, $p = 0.320$, $\eta_p^2 < 0.01$.

Next, we ran a MANCOVA with symptoms of muscle dysmorphia (i.e., the three MDDI subscales) in men as the dependent variables, sport type as the independent variable, and age and education entered as covariates. There was a significant omnibus effect of sport type, $\lambda = .63$, $F_{(6, 558)} = 24.16$, $p < 0.001$, $\eta_p^2 = 0.21$. Examination of the univariate results indicated a significant effect of sport type on drive for size, $F_{(2, 281)} = 19.05$, $p < 0.001$, $\eta_p^2 = 0.12$, with weight-trainers having significantly higher scores than both CrossFit athletes and non-athletes (ts= 5.44-6.07, ps< 0.001, ds= 0.77-0.82), whereas CrossFit athletes and non-athletes did not differ significantly, $t(151) = 0.31$, $p = 0.758$, $d = 0.05$. There was also a significant effect of sport type on functional impairment, $F_{(2, 281)} = 52.66$, $p < 0.001$, $\eta_p^2 = 0.27$. CrossFit athletes and weight-trainers were not significantly different in functional impairment, $t(198) = 1.28$, $p = 0.201$, $d = 0.18$, but both groups had significantly higher scores than non-athletes (ts= 9.43-10.07, ps< 0.001, d= 1.28-1.64). There effect of sport type on appearance intolerance did not reach significance, $F_{(2, 281)} = 2.98$, $p = 0.053$, $\eta_p^2 = 0.02$.

Finally, we ran a MANCOVA with muscularity concerns (i.e., the two FMS subscales) in women as the dependent variables, sport type as the independent variable, and age and education as covariates. The results indicated a significant omnibus effect of sport type, $\lambda = 0.60$, $F_{(4, 494)} = 35.37$, $p < 0.001$, $\eta_p^2 = 0.22$. Analysis of the univariate results indicated a significant effect of sport type on the behaviours dimension, $F_{(2, 248)} = 64.85$, $p < 0.001$, $\eta_p^2 = 0.34$. However, tests of simple effects indicated that none of the between-group comparisons reached significance (ts= 0.83-1.87, ps= 0.063– 0.404, ds= 0.14-0.28). There was no significant effect of sport type on the attitudes dimension, $F_{(2, 248)} = 1.76$, $p = 0.174$, $\eta_p^2 = 0.01$.

Exploratory analyses

For exploratory purposes, we examined whether sport type (dummy coded using CrossFit athletes as the reference group and coded as 0), training duration, and training frequency predicted body image outcomes (non-athletes were not included in these analyses). To do so, we conducted a series of multiple linear regressions with body appreciation, body dissatisfaction, muscle dysmorphia (using total MDDI scores in men), and muscularity concerns (using total FMS scores in women) as criterion variables, respectively. Neither the regression with body appreciation nor body dissatisfaction were significant (Fs< 2.22, Adj. $R^2 \leq 0.02$). In women, the regression with total FMS scores as the criterion variable was also non-significant, $F_{(3, 169)} = 1.55$, $p = 0.205$, Adj. $R^2 = 0.03$. In men, the regression was significant, $F_{(3, 196)} = 4.22$, $p = 0.006$, Adj. $R^2 = 0.06$. Weight-trainers were more likely to display symptoms of muscle dysmorphia than CrossFit athletes (B= 0.27, SE= 0.09, β= 0.23, t= 3.16, p= 0.002) and greater weekly frequency of training was associated with greater symptoms of muscle dysmorphia (B= 0.15, SE= 0.07, β= 0.16, t= 2.21, p= 0.028). Duration of training was not significantly associated with symptoms of muscle dysmorphia (B= -0.01, SE= 0.01, β= -0.08, t= -1.14, p= 0.256.

DISCUSSION

The present study examined body image outcomes in a sample of CrossFit athletes, weight-trainers, and non-athletes from Brazil. We hypothesised that CrossFit athletes would have significantly greater body appreciation and lower body dissatisfaction and muscularity concerns/muscle dysmorphia than weight-trainers and non-athletes. Our results support these hypotheses: CrossFit athletes had lower body dissatisfaction than weight-trainers and non-athletes, but

there was no significant difference between CrossFit athletes and weight-trainers in terms of body appreciation (though both groups had significantly higher body appreciation than non-athletes). Among men, there was some evidence that CrossFit athletes differed from weight-trainers in terms of drive for size, although both groups had significantly greater functional impairment than non-athletes. Among women, there were no significant differences in muscularity concerns between all three groups.

In broad outline, our results are consistent with the results of meta-analyses and scoping reviews indicating that athletes have fewer body image concerns than non-athletes (Varnes et al., 2013) and that sports participation is associated with lower body image concerns (Campbell & Hausenblas, 2009; Bassett-Gunter et al., 2017) and more positive body image (Sabiston et al., 2019). It seems likely that sport and physical activity bring real changes to the physical self, such as changes in weight, body shape, and appearance, that contribute to improvements in body image (Martin Ginis & Bassett, 2012). In addition, it is also possible that sports participation helps to build feelings of self-efficacy, mastery of new skills, and development of confidence that either directly or indirectly result in improvements in body image (Swami, 2019). In this sense, it is reasonable to suppose that sports such as CrossFit and weight-training may also provide individuals with opportunities to form close and appreciative relationships with their bodies (e.g., by developing improved awareness of what their bodies are capable of achieving physically and by mastering new skills); that is, both CrossFit and weight-training may be viewed as embodying activities (Piran, 2017) that contribute to a closer and more connected relationship with one's body.

Beyond the focus on athletes versus non-athletes, however, the results of the present study were more equivocal. On the one hand, there was no significant difference in body appreciation between CrossFit athletes and weight-trainers. On the other hand, CrossFit athletes had significantly lower body dissatisfaction compared with weight-trainers (although the effect size of this difference was small-to-moderate). Although CrossFit has been touted as a useful mechanism for promoting healthier body image outcomes due to its focus on both health- and skill-related fitness over body aesthetics (Swami, 2019; Coyne & Woodruff, 2020), our results suggest that CrossFit may not be overly superior in achieving healthier body image compared to weight-training alone. Indeed, our results are particularly important given that previous studies examining the impact of CrossFit on body image have not included appropriate comparison groups. One possible explanation for the present findings is that weight-training, like CrossFit, produces substantive changes to muscular strength and mass. These changes likely mean that these athletes not only close the gap between current and idealised appearance ideals but also receive immediate feedback on their functional capabilities, which in turn de-emphasises a focus on body aesthetics (SantaBarbara et al., 2017).

A more critical reading of our results would suggest that CrossFit may not contribute much more to developing a healthier body image than weight-training alone. Of course, this does not suggest that CrossFit does not convey other benefits beyond weight-training that contribute to body image outcomes, such as skills-related improvements. However, based on the present results alone, it seems likely that any benefit to body image conveyed by participation in CrossFit is not substantially greater than that conveyed by weight training alone. Importantly, our results also indicated a lack of gendered effects in this regard. That is, although men had significantly higher body appreciation and significantly lower body dissatisfaction than women, which is consistent with previous work (He, Sun, Zickgraf, Lin, & Fan, 2020), our results indicated no significant sport type by gender interaction. Put differently, both CrossFit and weight-training appear to be associated with real benefits in terms of body image outcomes, irrespective of an athlete's gender, compared to non-athleticism.

Our findings on muscularity concerns in women and muscle dysmorphia were also noteworthy. In terms of women, we found no significant differences in either muscularity-related behaviours or attitudes across all three groups. That is, although both CrossFit and weight-training can be expected to promote the development of body musculature, our results suggest that involvement in these sports is not necessarily associated with unhealthy muscularity-related attitudes and behaviours in female athletes compared to non-athletes. This may be a particularly important finding for female athletes, particularly given discussions about the way that female musculature can help women to resist heteronormative appearance ideals actively, subvert traditional feminine expectations of feminine appearance, and promote greater body confidence (Knapp, 2015b; Podmore & Paff Ogle, 2018). It may be that immersion in supportive weight-training or CrossFit communities helps to disrupt normative expectations around appearance while helping female athletes to manage their muscularity concerns (Podmore & Paff Ogle, 2018).

However, our results about muscle dysmorphic symptomatology among men were less clear-cut. First, we found no significant between-group differences in appearance intolerance (i.e., the extent of avoidance behaviours related to displaying one's body) across the three groups. Second, we found

that weight-trainers had a significantly greater drive for size (i.e., a perception of not being sufficient muscular or looking small and a desire to increase body size) than CrossFit athletes, who were not significantly different from non-athletes. Finally, our results indicated that both weight-trainers and CrossFit athletes had significantly greater functional impairment (i.e., the extent to which individuals maintain a routine of excessive exercise, discomfort as a result of altering this behaviour, and the avoidance of social situations) than non-athletes. Overall, these results may be interpreted as showing that, while participation in both weight-training and CrossFit may be associated with a compulsion to exercise, CrossFit is not necessarily associated with the greater drive for greater size or muscularity compared with non-athletes.

These results are notable for two reasons. First, the finding that weight-trainers experience a deficit in appearance (i.e., a lack of perceived muscularity) has been noted previously (Hildebrandt, Schlundt, Langenbucher, & Chung, 2006), and our work is consistent in showing that weight-trainers experience relatively high levels of driving for size. Interestingly, the finding that CrossFit athletes did not differ significantly from non-athletes in terms of drive for size may be seen as evidence supporting the claim that the CrossFit programme de-emphasises a focus on appearance. Conversely, both CrossFit athletes and weight-trainers had significantly higher levels of functional impairment compared with non-athletes, which suggests that these groups experience a compulsion to exercise or maintain routines of physical activity that may interfere with other aspects of their lives. Indeed, the finding of higher scores among athletes on functional impairment is particularly notable given that scores on this subscale of the MDDI fit with criteria in the 5th edition of the *Diagnostic and Statistical Manual of Mental Disorders* concerning the negative impact of muscular dysmorphic disorder (American Psychiatric Association, 2013). These findings were also consistent with our exploratory analyses with male athletes, which indicated that weekly training frequency was significantly associated with greater muscle dysmorphia symptomatology.

Compared to previous work (Köteles et al., 2016; Swami, 2019; Coyne & Woodruff, 2020), a strength of the present study is the recruitment of a relatively large sample of CrossFit athletes, as well as the inclusion of two comparative groups that differed in their degree of physical activity. Nevertheless, several limitations of the present study should also be acknowledged. First, the cross-sectional design of our study limits the causational conclusions that can be drawn. For instance, while we have interpreted our findings in line with theorising and earlier results (Swami, 2019) showing that participation in CrossFit is associated with longitudinal improvements in body image, alternative explanations are also possible. Thus, it could be that individuals with higher levels of body appreciation and/or lower body dissatisfaction are more likely to gravitate toward physical activity programmes, such as weight training and CrossFit. Participation in these programmes may reflect a repertoire of behaviours associated with healthier body image (Tylka, 2018).

A second limitation was that our samples were not ideally matched; there were significant differences in the distribution of educational qualifications and mean age across the three groups, as well as differences in training duration and weekly frequency across the CrossFit and weight-training groups. Although these variables were included as covariates in our analyses, and although we see no evidence that these factors impacted our findings, we cannot entirely rule out the possibility that some of our results are accounted for by sociodemographic or training differences across groups. Similarly, we note that our recruitment strategy was impacted by the social distancing measures implemented to manage the transmission of COVID-19. It is difficult to know how this may have affected our results, although we acknowledge that the stress and anxiety caused by the pandemic may have had adverse effects on body image outcomes (Swami, Horne, & Furnham, 2021).

A second limitation of our study design is that we did not assess our participants' athleticism levels. Although we do not have any reason to believe that our sample included a disproportionately high number of elite athletes (i.e., most, if not all, CrossFit athletes and weight-trainers were recreational athletes), we acknowledge that the level of participation may have been important. For instance, compared to recreational athletes and non-athletes, elite or professional athletes likely experience unique pressures that have a detrimental effect on their body image, including heightened pressure to maintain a lean and muscular physique for optimum physical performance. In future work, it will be important to assess body image outcomes as a function of both sport type and sport level. Likewise, it may also be useful to examine constructs associated with body image outcomes, such as body acceptance by others and perceived pressure to internalise appearance ideals, as well as sport-related factors, such as sport-confidence and subjective appraisals of performance.

CONCLUSION

The present results suggest that CrossFit athletes and weight-trainers may be more similar than different in terms of body appreciation and body dissatisfaction. In

contrast, differences in muscle dysmorphia/muscularity concerns are more equivocal and gendered. However, our findings are consistent with a large body of existing literature showing that sports participation is associated with lower body image concerns (Campbell & Hausenblas, 2009; Bassett-Gunter et al., 2017) and more positive body image (Sabiston et al., 2019). Findings such as ours are particularly important given the high levels of physical inactivity worldwide and the relationship between physical inactivity and premature mortality (Lee et al., 2012). As such, encouraging physically inactive individuals to participate in weight-training or CrossFit programmes — carefully managed to emphasise health- and functional-related fitness, rather than body aesthetics (e.g., through improved coach awareness of these body image issues) — may bring benefits not just in terms of physical health, but also in terms of body image outcomes.

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