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2 **TITLE PAGE**

3 **Physical activity and body image among men and boys: A meta-analysis**

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Abstract

Three meta-analytic reviews have concluded that physical activity is positively related to body image. Historically, research regarding physical activity and body image has been disproportionately focused on female samples. For example, the most recent meta-analysis (2009) extracted 56 effect sizes for women and only 12 for men. The current paper provides an update to the literature regarding the relationship between physical activity and body image among men and boys across 84 individual effect sizes. The analysis also provides insight regarding moderator variables including participant age, and physical activity type and intensity. Overall, physical activity was positively related to body image among men and boys with various moderator variables warranting further investigation. Pragmatic implications are discussed as well as the limitations within existing research and need for additional research to further understand moderator and mediator variables.

Keywords: body image, physical activity, exercise, males, meta-analysis, quantitative synthesis,

Introduction

Body image is a multidimensional construct referring to the "psychological experience of embodiment, especially but not exclusively one's physical appearance" (Cash, 2004, p. 1). Body image reflects how individuals think, feel, see and act toward their bodies (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999). Multiple dimensions of body image have significant implications for one's physical and mental health (for a detailed review, see Martin Ginis, McEwan & Bassett, 2013). For example, body dissatisfaction is related to lower self-esteem (Miller, & Downey, 1999), as well as higher levels of depression and anxiety (Stice & Whitenton, 2002), eating disorders (Polivy & Herman, 2002) and muscle dysmorphia (Pope, Gruber, Choi, Olivardia, & Phillips, 1997). It has been suggested that body image concerns and body image dissatisfaction have increased over recent decades (for a review, see Cash, 2004) with research suggesting that rates of body dissatisfaction could be as high as 72% among women and 61% among men in North America (Kruger et al., 2008). Although there is great variability around the rates of body dissatisfaction reported based on sample characteristics, the operationalization of body dissatisfaction and study design (Fiske et al., 2014), there is clear evidence that body dissatisfaction is a prevalent issue with important implications.

Early research focused on body image as an issue relevant primarily to women and girls (hereafter 'women') (Thompson, Penner, & Altabe, 1990), with a mistaken belief that men and boys (hereafter 'men') were largely immune to the experience of body dissatisfaction (Cash & Brown, 1989). Subsequent research has demonstrated that body dissatisfaction is indeed present among men (McCabe & Ricciardelli, 2004). Several rationales have been offered to explain earlier findings which suggested that men were generally satisfied with their bodies (e.g., Rozin

& Fallon, 1988). For example, researchers have often operationalized body dissatisfaction in relation to a desire to be thinner (for a review see McCreary & Sasse, 2000), which is far too simplistic to capture body image ideals for men. That is, the (westernized) ideal of an ultra-thin physique is pervasive in women lending to a linear relationship between BMI and body dissatisfaction (Kostanski, Fisher, & Gullone, 2004). However, the relationship between BMI and body dissatisfaction is curvilinear among men such that underweight and overweight men experience body dissatisfaction (Frederick, Peplau, & Lever, 2006; Kostanski et al., 2004; McCabe & Ricciardelli, 2004; Muth & Cash, 1997).

Improved understanding of the complexity of body image in recent years has allowed for a better appreciation of the prevalence of body dissatisfaction among men. Relatedly, improved measures of various dimensions of body image relevant to men have been developed and psychometrically evaluated (for a review see, Cafri & Thompson, 2004). For example, the Drive for Muscularity scale (McCreary & Sasse, 2000) has shown validity and reliability in assessing men's thoughts (e.g., "I wish that I were more muscular") and behavior (e.g., "I lift weights to build up muscle") in relation to muscularity to allow for assessment of body image unrelated to desire for thinness. Similarly, the development and substantial psychometric evaluation of the Male Body Attitudes Scale has demonstrated its value for body image assessment among men (Tylka, Bergeron, & Schwartz, 2005).

Research has also advanced such that other nuances of body image among men have been exposed. For example, gender-role orientation (i.e., the extent to which a man identifies with stereotypically masculine traits) is likely to impact body image experiences with regard to pursuing muscular ideals (McCabe & Ricciardelli, 2004). Moreover, men may place greater value on the physical capabilities of their bodies whereas women may place more importance on

the physical appearance of their bodies (Martin Ginis et al., 2005). In addition, particular aspects of body dissatisfaction may be more or less pronounced among men compared to women. For example, the domain of discontent is likely to differ between men and women (see Cafri & Thompson, 2004; Hargreaves & Tiggemann, 2006) such that men may experience less dissatisfaction with certain domains of their bodies (e.g., dissatisfaction with hips/thighs; Fiske et al., 2014) and more dissatisfaction in other domains (e.g., dissatisfaction with muscularity/upper torso; Garner, 1997). Indeed, substantial research has accumulated over recent decades to demonstrate the complexity of body image among men (e.g., Frederick et al., 2006; McCabe & Ricciardelli, 2004). Men with body dissatisfaction are also at risk for previously discussed physical and mental health complications (for a review, see McCabe & Ricciardelli, 2004) including muscle dysmorphia (Pope et.al., 1997) and health compromising behaviours such as steroid use or unhealthy dieting (Olivardia, Pope, Borowiecki, & Cohane, 2004). Hence, there is great value in understanding interventions and strategies to support healthy body image among men.

One proposed intervention to improve body image is exercise or physical activity (PA). There has been a substantial amount of research focus on PA and body image. Three previous meta-analyses have concluded that PA is positively related to body image (Campbell & Hausenblas, 2009; Hausenblas & Fallon, 2006; Reel et al., 2007). The large majority of the studies included in these meta-analyses (e.g., >80%; Hausenblas & Fallon, 2009) operationalized body image within the subjective evaluation domain (e.g., body satisfaction or dissatisfaction). Correlational data have indeed demonstrated a positive relationship between PA and body image across a variety of samples. Experimental research has further demonstrated a positive relationship such that those who engage in PA experience healthier body image (e.g., more body

satisfaction or less body dissatisfaction) compared to those who do not engage in PA. Although the existing meta-analyses have been informative in understanding many aspects of the PA-body image relationship in general, there are several factors that limit our full understanding of the impact of PA on body image among men.

Research regarding PA and body image has been disproportionately focused on women. For example, the most recent meta-analysis (Campbell & Hausenblas, 2009) extracted 56 effect sizes for women and only 12 for men. Since the publication of the last meta-analysis in 2009, at least 20 studies have been published regarding the relationship between PA and body image among men. Thus, there is value in updating the meta-analytic evidence to include this relatively large number of studies that has focused on men.

Previous meta-analyses have also found equivocal evidence regarding the moderating role of sex or gender on the relationship between PA and body image. Although an earlier meta-analysis (Hausenblas & Fallon, 2006) found a larger effect size among women compared to men, the most recent meta-analysis (Campbell & Hausenblas, 2009) found no significant difference in the effect size for women and men. The moderating role of sex in the PA-body image relationship remains unclear. And although it is accepted that the relationship between PA and body image is positive for women *and* men (e.g., Campbell & Hausenblas, 2009), generalizing the overall findings of meta-analyses that are disproportionately focused on women should be cautioned. For instance, there is little known about the moderators of the PA-body image relationship among men as existing meta-analyses have failed to separate female and male samples for moderator analyses. Given the nuances of body image for men and women (e.g., different idealized bodies), there are possible differences in moderating variables that impact the relationship between PA and body image for women and men, respectively. Previous research

has considered various moderating variables (for a review see Martin Ginis & Bassett, 2011) such as individual characteristics (e.g., age), PA characteristics (e.g., type and intensity of PA), and body image operationalization characteristics (e.g., drive for thinness versus drive for muscularity). However, our existing knowledge regarding moderator variables is largely reflective of variables impacting the relationship between PA and body image among women given the disproportionate representation of women within the meta-analytic studies from where the conclusions about moderator variables have been drawn. Therefore, there is a need to examine potential moderating variables that are unique to male samples in order to inform future research and interventions.

An improved understanding of the mechanisms underlying the effects of PA on body image is also needed. Indeed, there has been a call to further understand the mechanisms such that optimally effective interventions can be designed (see Baranowski, Anderson, & Carmack, 1998; Martin Ginis, Bassett, & Conlin, 2012). A recent review of mechanisms driving the effects of PA on body image (Martin Ginis et al., 2012) found that while actual changes in body composition played a relatively small role in explaining changes in body image resulting from PA, *perceived* changes in body composition, and changes in self-efficacy seem to play a mechanistic role in the PA-body image relationship. Importantly, almost all of the studies included in that review were exclusively female samples. Although it is likely that many mechanisms are shared between women and men, it is plausible that there are unique mechanisms. For example, one study by Martin Ginis and colleagues (2005) specifically identified sex differences in the mechanisms underlying change in body image resulting from PA. Among the women in the sample, change in body image was related to objective *and* perceived changes in fitness and body composition, whereas among men, change in body image was related only to perceived changes in fitness and

body composition. There is a need to further understanding the mechanisms underlying the effects of PA on body image among men.

Unfortunately, there is no explicit theory or framework to guide PA and body image research so researchers have often drawn on theories developed for the study of body image *or* PA more generally (see Martin Ginis et al., 2012). The framework most frequently employed to guide research regarding PA and body image (Campbell & Hausenblas, 2009) is the exercise and self-esteem model (EXSEM; Sonstroem & Morgan, 1989). Although the EXSEM describes exercise effects on global self-esteem, the model has been operationalized such that it has been applied to understanding the effects of PA on body image within several studies (e.g., McAuley, Blissmer, Katula, Duncan, & Mihalko, 2000; Shaw, Ebbeck, & Snow, 2000; Martin Ginis, Strong, Arent, Bray, & Bassett-Gunter, 2014) . Accordingly, the EXSEM has been useful informing research to examine the relationship between PA and body image, and identifying possible moderating and mediating variables. In recognizing the need for an explicit theory to guide PA and body image research, Martin Ginis and colleagues (2012) developed a preliminary model. This preliminary model draws on the EXSEM and existing literature to identify three possible mechanisms to explain the effects of PA on body image: (a) objective changes in physical fitness, (b) perceived changes in physical fitness, and (c) changes in self-efficacy. The model also identifies two categories of moderator variables that should be considering in PA-body image research: (a) individual characteristics (e.g., age, sex, ethnicity) and (b) PA characteristics (e.g., PA type, PA intensity, PA frequency). These two theories have guided the current review in determining the mediator and moderator variables of interest.

In summary, research regarding PA and body image among men has advanced in recent years. Previous meta-analyses regarding PA and body image have been disproportionately

focused on women and have not included many of the recent studies of men. Our understanding of the moderators of the PA-body image relationship among men is poor and has not been fully advanced through previous meta-analyses. There is also a need for an improved understanding of the mechanisms underlying this relationship. The purpose of this study was to engage meta-analytic techniques to further our understanding of the relationship between PA and body image specifically among men. Several moderator and mediator variables were examined based on the EXSEM (Sonstroem & Morgan, 1989) and preliminary model for examining the effects of PA on body image (Martin Ginis et al., 2012), as well as previous meta-analyses (e.g., Hausenblas & Fallon, 2006). Specific moderator variables included age, type of body image measure, PA intensity, and PA mode. Additional moderators related to individual characteristics (e.g., BMI, ethnicity) and PA characteristics (e.g., PA frequency) were not included in the current analysis due to insufficient data available. A discussion regarding three potential mechanisms of the PA-body image relationship among men is also included: (a) objective changes in physical fitness, (b) perceived changes in physical fitness, and (c) changes in self-efficacy.

Method

Literature Search and Eligibility Criteria

Our literature search began by reviewing previous meta-analyses on body image and PA (Campbell & Hausenblas, 2009; Hausenblas & Fallon, 2006; Reel et al., 2007) for potential articles. Searches for additional possible studies were then carried out in the following databases: *PsycINFO*, *Medline*, *SportDiscus*, *Education Resources Information Center (ERIC*), and *ProQuest Dissertations and Theses*. Searches were conducted in January 2015. In each database search, we used the following combinations of search terms: ([dysmorph*] or [musc*] or [affect*] or [bigorex*] or [body] or [eating] or [physique] or [self] or [social physique]) AND

([physical activity] or [exercise] or [fitness]). Search terms were generated based on the search terms used in previous meta-analyses regarding body image and PA with the addition of body image related terms that are specific to research regarding men (e.g., muscularity, bigorexia).

Potential articles were then reviewed for eligibility by two of the co-authors. Each article was subjected to title elimination, followed by abstract elimination, and finally full-text elimination. We also searched the reference sections of the articles that met our inclusion criteria to determine if any additional articles could be retrieved (see Figure 1). An article needed to meet the following criteria to be included in the meta-analysis: (1) included a measure of PA or experimental condition that engaged in PA (e.g., leisure time physical activity, exercise, weight training), (2) include a measure of body image that was consistent with any dimension of body image (e.g., affective, cognitive, subjective evaluation, perceptual), (3) report data such that an effect size could be calculated specifically for men; (4) available in English; (5) examine participants from non-clinical populations; and (6) provide appropriate statistics to compute effect sizes. If the requisite statistical information was missing from a given manuscript, we contacted the corresponding authors for this information. Of the eleven authors that were contacted, one provided the necessary data to incorporate into the analyses.

Data Analysis

Articles that met eligibility criteria were extracted and subsequently reviewed independently by two co-authors with respect to study design and the four moderator variables described below. The rate of agreement between reviewers was 80%. When discrepancies in coding occurred, the authors met to resolve these differences by referring back to the article in question until unanimity was reached. Data were then analyzed as a random-effects model using the software *Comprehensive Meta-Analysis*, *Version 2* (Borenstein, Hedges, Higgins, & Rothstein, 2005). A

random-effects model assumes variability in the effect sizes across the included studies, and is the appropriate model to use in social science research (as opposed to a fixed-effects model which assumes that the average effect size does not vary across studies; Borenstein et al., 2009; Field & Gillett, 2010).

Where possible, effect sizes for each study were calculated via means, standard deviations, and sample sizes at baseline and post-intervention of experimental and control conditions in intervention studies (Borenstein et al., 2009; Decoster & Claypool, 2004). For correlational studies, effect sizes were calculated. If such statistics were missing, we used *F*-statistics, *t*-scores, and *p*-values. Each study was given a relative weight based on its precision, which is determined by the study's sample size, standard error, and confidence interval (i.e., more precise data is given a larger relative weight compared to less precise data; Borenstein et al., 2009). Hedges' *g* was used as the effect size metric, as it accounts for differences in sample size and variance across studies (Hedges & Olkin, 1985). Standard errors and 95% confidence intervals were computed to test for the accuracy of the standardized effects obtained.

If articles provided more than one effect size (e.g., when studies tested body image at multiple time points), these effect sizes were combined into one overall effect size statistic for that study, so as to not give greater relative weight to these studies (Borenstein et al., 2009). Exceptions to this approach were taken when articles reported the effects of multiple interventions (i.e., multiple subgroups), each of which was subject to a unique physical activity protocol (e.g., a strength-building intervention versus a cardiovascular training intervention versus a non-training control condition). In these cases, an effect size from each intervention was computed; thus, the article would provide multiple effect sizes to the total number of comparisons within the meta-analysis. Potential unit-of-analysis errors in these studies were corrected by dividing the sample

size of the control condition by the number of within-study comparisons. For example, if a study reported data from 20 participants assigned to a strength-building intervention, 20 assigned to a cardiovascular training intervention, and 20 assigned to a no-training control condition, the *n* of the control condition was entered as 10 (i.e., 20 [control group participants] divided by 2 [conditions]; Higgins & Green, 2011).

Tests of heterogeneity within the meta-analysis were also performed by assessing the variability in the observed effect sizes across studies (*Q* value), as well as the ratio of the true heterogeneity to the total observed variation (I^2). Potential publication bias was examined in three ways. First, the fail-safe *N* statistic was calculated as an estimate of the number of unpublished studies with null findings that would be necessary to reduce the effect size to zero (Rosenthal, 1979). If this value is greater than 5*N*+10, then the probability of such a number of studies existing (in the file drawer) is low (Rosenberg, 2005). Second, funnel plots were obtained to provide a visual representation of potential publication bias. Third, sensitivity analyses were conducted by noting the effect size that emerged when a study was removed.

Moderator Analyses

In total, four potential moderator variables were examined: age, type of body image measure, PA intensity and PA mode. For correlational studies, we coded participants' *age* into three categories (i.e., adolescents, adults, or older adults) and the *body image measure* utilized into five categories: (a) body satisfaction, (b) muscularity-related, (c) thinness-related, (d) social physique anxiety, or (e) general (i.e., any measure that did not fit within one of the other four categories). For intervention studies, we coded participants' *age*, *body image measure* utilized, prescribed PA *intensity* into three categories (i.e., low, moderate, or vigorous), and PA *mode* utilized into two categories (i.e., aerobic training or resistance training). For each moderator

variable, we calculate an effect size, standard error, 95% confidence interval, *Z*-value, and *p*-value to test for the effects of each category on PA, as well as a *Q* statistic and corresponding *p*-value to estimate the heterogeneity across these effects (Borenstein et al., 2009).

Results

Literature Search

The literature searches returned 34,758 potentially relevant articles. After removing duplicates, 33,250 articles were subject to title and abstract review. Based on these reviews, 33,180 articles were eliminated, while 70 were full-text reviewed. Ultimately, 36 articles met eligibility criteria—see Figure 1 for the PRISMA (Moher, Liberati, Tetzlaff, & Altman, 2009) flow diagram. Of these studies, 9 included multiple subgroups, which resulted in 52 total comparisons (*k*), a total sample size (*n*) of 12,519 participants, and 84 individual effect sizes. Overviews of each study with regard to design, sample, and measurement characteristics as well as descriptions of the effect sizes calculated are provided in Table 1.

Summary Statistics

There was a medium overall effect size for all studies included in the meta-analysis, Hedges *g* (*SE*) = 0.567 (0.08), $Z = 7.39$, $p < .001$. However, the heterogeneity across studies was very high, Q (*df*) = 482.0(51), $p < .001$, $I^2 = 89.4$. We therefore separated studies according to experimental design. This resulted in a medium-to-large effect size for controlled trials ($k = 13$, *g* (*SE*) = 0.645 (0.19), $Z = 3.44$, $p = .001$), a small effect size for single-group (i.e., uncontrolled) interventions ($k = 8$, *g* (*SE*) = 0.281 (0.10), Z = 2.91, $p = .004$), and a medium effect size for correlational studies ($k = 34$, *g* (*SE*) = 0.660 (0.10), Z = 5.99, $p < .001$). This also resulted in much smaller heterogeneity within intervention studies; Q (*df*) = 58.45 (12), $p < .001$, $I^2 = 79.47$ for controlled

and $Q(df) = 21.40(7)$, $p = .003$, $I^2 = 67.28$ for uncontrolled interventions. However, heterogeneity remained very high within correlational studies—Q (df) = 384.5(30), $p < .001$, $I^2 = 92.20$.

To further reduce heterogeneity, we excluded outlier studies; that is, those that had abnormally high effect sizes and standardized residuals (outside an absolute value of 3.0), especially when these values were accompanied by very narrow confidence intervals. No experimental studies were excluded on this basis. With regard to correlational studies, this process resulted in a small-to-medium sized effect in the remaining studies, $k = 28$, g (SE) = 0.468 (0.07), $Z = 6.34$, $p < .001$, with heterogeneity being greatly reduced, Q (df) = 151.8 (27), $p < .001$, $I^2 = 82.21$. The fail-safe n was 114 for controlled trials and 1268 for correlational studies, both of which are sufficiently large (Rosenberg, 2005). However, the fail-safe n was 41 for uncontrolled interventions which is not sufficiently large. Summary statistics and forest plots for controlled interventions, uncontrolled interventions, and correlational studies are provided in Tables 2, 3, and 4, respectively.

Moderator Analyses

There were too few studies within the pool of controlled and uncontrolled studies to carry out moderator analyses separately. We, therefore, combined these studies together into one pool in order to assess potential moderators. This resulted in a small-to-medium effect size ($k = 21$, g (SE) = 0.391 (0.09), $Z = 4.17$, $p < .001$) with heterogeneity remaining acceptable (Q (df) = 80.51(20), $p < .001$, $I^2 = 75.16$). In addition, the fail-safe n was 311, which—unlike the results for uncontrolled interventions alone—is sufficiently large. For these reasons, we proceeded with the combination of controlled and uncontrolled interventions for the moderator analyses for variables where there was sufficient data. These results are provided in Table 5 for intervention studies and Table 6 for correlational studies.

Age of Participants. With regard to age, the moderator analyses suggest that there is a significant relationship between exercise and body image for adult males (g = 0.34, k = 12 for intervention studies and g = 0.46, k = 16 for correlational studies). The results were less conclusive for adolescent and older adult populations. With regard to adolescent males, there were significant relationships between PA and body image in correlational studies (g = 0.47, k = 9), but null effects in intervention studies (g = 0.04, k = 3). However, caution should be exercised in interpreting the latter results, as there were relatively few intervention studies. Likewise, the small number of correlational (g = 0.16, k = 2) and intervention (g = 0.27, k = 1) studies limit conclusions about the PA-body image relationship for older adults. It is worth noting, however, that significant effects were shown for both intervention (g = 1.37, k = 5) and correlational (g = 0.94, k = 1) studies when adult and older adult samples were combined in the analyses.

Body Image Measure. In terms of the type of body image measure employed, significant effect sizes were evident for general measures of body image (i.e., measures that did not fit within another category such as muscularity or thinness-related body image; g = 0.35, k = 12) in both intervention studies and (g = 0.53, k = 15) in correlational studies. Significant effects were also shown for measures of body satisfaction (g = 0.62, k = 7) in intervention studies and (g = 0.37, k = 17) in correlational studies. Muscularity-related body image was strongly associated with PA in correlational studies (g = 0.90, k = 6); there were no intervention studies that examined the effects of PA interventions on body image operationalized regarding muscularity. Intervention studies did not enhance body image in terms of drive for thinness (g = -0.31, k = 2); however, it is difficult to draw conclusions with few intervention studies that measured this construct. Finally, although PA was significantly related to social physique anxiety in

correlational studies (g = 0.30, k = 9), these effects were not evident in intervention studies (g = 0.29, k = 5).

Physical Activity Intensity. Regarding PA intensity prescribed in PA interventions, there were significant effect sizes of low- (g = 2.58, k = 3) and moderate- (g = 0.38, k = 6) intensity PA on body image. Interestingly, as this PA intensity reached vigorous levels, the effects became non-significant. However, because there was only one intervention study that examined the effect of vigorous intensity PA on body image (g = 0.31) and three studies that examined the effect of moderate-and-vigorous intensity PA on body image (g = 0.38), caution must be exercised when interpreting these findings.

Mode of Physical Activity. Finally, body image improved as a result of interventions that prescribed aerobic PA (g = 0.61, k = 12) as well as those that prescribed resistance training (g = 0.45, k = 4). Only two studies looked at the *combination* of aerobic and resistance PA on body image, with non-significant effects emerging (g = 0.11, k = 2). Hence, although there appears to be promise in using either mode of PA to enhance body image, at present, our understanding of the combined effects of these two modes on body image is limited.

Discussion

Overall Findings Regarding Physical Activity and Body Image among Men

The results of this meta-analysis support the notion that physical activity (PA) is positively associated with body image among men. The relationship seems robust among men and the overall effect size was medium which is somewhat consistent with previous meta-analyses, which have found small to medium sized relationships between PA and body image for men (Campbell & Hausenblas, 2009; Hausenblas & Fallon, 2006; Reel et al., 2007). The review provides an update to the meta-analytic literature which was formerly disproportionately focused

on women. Within the current analysis, the effect size for controlled interventions was medium to large, which was higher than that of correlational or single group designs. Earlier meta-analyses included few intervention studies conducted among male samples. Although our analysis included relatively few controlled studies (k = 13), this is more than the total number of effect sizes across all study types included in the former most recent meta-analysis (see Campbell & Hausenblas, 2009). Our meta-analytic findings provide an important update to the existing literature regarding the relationship between PA and body image among men. The medium-large sized effect observed within controlled studies supports the pragmatic implications for using PA as an intervention strategy to improve body image among men.

In order to understand and optimally design PA interventions for improving body image, it is necessary to have a sound understanding of possible moderator and mediator variables. The current meta-analysis aimed to update knowledge regarding moderators of the relationship between PA and body image among men. Potential mediator variables are also discussed.

Moderator Analyses

The moderator analyses regarding age were somewhat informative. Overall, the largest effects were seen among adult male samples, which is consistent with earlier meta-analytic data suggesting the relationship between PA and body image was largest for adults (Hausenblas & Fallon, 2006). The limited number of studies examining adolescent and older men preclude any conclusive understanding of the PA-body image relationship among these groups. However, earlier work suggesting PA may have the greatest impact on body image among young people (e.g., adolescents and university students; Hausenblas & Fallon, 2006; Reel et al., 2007) should be cautiously interpreted. Overall, our findings support the positive association between PA and body image among adult men but suggest there is a need for further research among younger and

older samples of men.

The moderator analyses suggest that PA is positively related to body image as operationalized in various ways including body satisfaction, social physique anxiety, drive for muscularity, and general body image. Only one previous meta-analysis has examined "type of body image measure" as a moderator and found that PA had the largest impact on body satisfaction (Reel et al., 2007). Our findings suggest that PA is positively related to various aspects of body image. However, it is possible that certain aspects of body image may not be as amenable to change as others through PA interventions. Studies that operationalized body image as Drive for Thinness did not find a significant relationship between PA and body image. This finding could align with the notion that thinness is not a meaningful indicator of body image for many men (e.g., Olivardia et al., 2004). However, our interpretation is limited by the small sample of studies examining drive for thinness. Future research could consider operationalizing body image in various forms within single studies such as to better understand the relationship between PA and various dimensions of body image among men.

PA intensity is another variable that may impact the relationship between PA and body image among men. Two previous meta-analyses found that strenuous or vigorous intensity PA had a larger impact on body image compared to mild PA, which had virtually no effect on body image (Hausenblas & Fallon, 2006; Reel et al., 2007). However, the current meta-analytic data suggest that low to moderate PA was positively related to body image among men. Contrary to earlier findings, no significant relationship was found between vigorous PA and body image. However, these null findings may reflect the small sample of studies that included vigorous PA. Nonetheless, as various PA agencies recommend moderate to vigorous intensity PA for physical

and mental health benefits, future research should be conducted to determine whether these recommendations align with improvements in body image among men.

Previous meta-analytic data (among men and women) have presented mixed findings regarding mode of PA as a moderator of the PA-body image relationship. While anaerobic PA had the largest effect in one analysis (Reel et al., 2007), combined aerobic and anaerobic PA had the largest effect in another analysis (Hausenblas & Fallon, 2006). Researchers have concluded that the mode of PA does not generally moderate the relationship between PA and body image (e.g., Martin Ginis & Bassett, 2011). Our results corroborate this statement as both aerobic and anaerobic PA were positively related to body image. Based on the current evidence (i.e., previous reviews and current meta-analysis), it would appear suitable to prescribe anaerobic or aerobic PA. However, further research with regard to mode of PA is necessary given the limited number of studies upon which this conclusion is based.

Mechanisms of Physical Activity Effects on Body Image among Men

Few studies included *any* examination of mechanisms underlying the relationship between PA and body image. A recent review of mechanisms driving the effects of PA on body image (Martin Ginis et al., 2012) found that there is evidence to support three categories of mechanisms: (a) objective changes in physical fitness, (b) perceived changes in physical fitness, and (c) changes in self-efficacy. Although there was limited consideration for mechanisms across the studies included in the meta-analysis, there was evidence from at least one study to support each of the three proposed mechanisms, respectively. Specifically, evidence was found to support objective change in fitness including body composition (McAuley, Bane, Rudolph, & Cox, 1995) and aerobic capacity (McAuley, Marquez, Jerome, Blissmer, & Katula, 2002) as a mechanism underlying improved body image resulting from PA. Evidence was also found to

support perceived changes in physical fitness including perceived loss of body fat and perceived gains in strength and muscularity as a mechanism (Martin Ginis et al., 2005). Finally, there was evidence to support changes in self-efficacy as an underlying mechanism as well (McAuley et al., 2002). It seems plausible that there are multiple mechanisms at play in the PA-body image relationship. Unfortunately, we could not perform a statistical examination of mechanisms underlying the PA- body image relationship due to limited data within the studies. Further research is, therefore, needed to better understand mechanisms and other possible moderators of the underlying mechanisms (e.g., individual goals for PA). There is a need for research using study designs that allow for the examination of mediating variables; namely, designs that establish causation (see Frazier, Tix, & Barron, 2004). Such research will allow for further understanding of *how* PA can improve body image (Martin Ginis et al., 2012) among men.

Limitations and Future Directions

The results of this meta-analysis provide an updated review of the literature regarding PA and body image among men. There are several important limitations to consider, many of which reflect limitations within the studies included in the analyses. This discussion highlights important considerations for future research regarding PA and body image among men. Many papers included cross-sectional and correlational designs, or did not include a control group. Future research must employ stronger study designs in order to advance our understanding of the causal relationship between PA and body image, as well as further understand moderating and mediating variables. Relatedly, an additional limitation of the meta-analysis was the high heterogeneity across studies. As a result, outliers were removed and studies were divided by design type in order to conduct the analyses. This left a small number of studies to be included in each analysis, which limits the interpretation of the findings.

The results of the moderator analyses provide some insight regarding nuances and pragmatic considerations of the relationship between PA and body image among men. However, it is important to highlight the lack of data, or insufficient data, available to examine certain moderator variables. For example, we were unable to examine characteristics of the participants (e.g., body composition, ethnicity) and PA program (e.g., frequency of PA, intervention length). In many cases, although we were able to conduct analyses to examine a possible moderator variable, our interpretation of the results was limited by the number of studies available. There is a need for further research to examine moderator variables and most importantly, researchers must report on meaningful characteristics of their sample and PA. Specifically, the operationalization of PA and/or description of PA interventions were very poor in many studies. This is a common limitation of PA research (Williams & French, 2011). Relatedly, most studies relied on self-report measures of PA, many of which were not considered to be valid or reliable. Unfortunately, the variability in quality of measurement of PA is a limitation of the current and previous meta-analyses. In order to overcome this limitation and advance research on the effects of PA in relation to body image, it is critical that researchers to develop and utilize measures that are valid and reliable.

Generally, the operationalization and measurement of body image was better than that of PA. However, some studies did not clearly operationalize body image which leads to challenges with regard to the synthesis of knowledge across studies. Some studies relied on body image measurement tools with weak or unknown psychometric value. The variability in psychometric properties across measures may have confounded the observed findings in the current review. Indeed, the psychometric properties of the body image measures themselves may play a moderating role. As the literature regarding body image among men has advanced so too have

the options for appropriate psychometrically sound measurement tools; these tools should be employed in future work and this paper serves as a call for improved measurement of PA and body image within future research. .

Conclusion

There has been an increase in research focused on PA and body image among men. We provide an update to the meta-analytic literature specifically focusing on PA and body image among men and provide some insight regarding possible moderator variables. It is disappointing to note that the limitations of the PA and body image research existing today are virtually identical to those reported in meta-analyses conducted almost 10 years ago. To advance this area of research and inform the development of effective PA interventions, there is a need for further research regarding moderators and mechanisms of the PA-body image relationship.

References

Note: **Articles included in meta-analytic calculations.

**Altintas, A., & Asci, F. H. (2008). Physical self-esteem of adolescents with regard to physical activity and pubertal status. *Pediatric Exercise Science*, *20*, 142-156. doi: 10.1123/pes.20.2.142

Anderson, M., Foster, C., McGuigan, M., Seebach, E., & Porcari, J. (2004). Training vs. body image: Does training improve subjective appearance ratings? *Journal of Strength Conditioning Research*, *18*, 255- 259. doi: 10.1519/r-13203.1

**Asci, H. (2009). Sex differences in psychological effects of exercise. *International Journal of Psychology*, *44*, 313-320. doi:10.1080/00207590802325903

**Asci, H. (2002). The effects of step dance on physical self-perception of female and male university students. *International Journal of Sports Psychology*, *33*, 431-442.

Baranowski, T., Anderson, C., & Carmack, C. (1998). Mediating variable framework in physical activity interventions. How are we doing? How might we do better? *American Journal of Preventive Medicine*, *15*, 266-297. doi:10.1016/s0749-3797(99)00065-3

**Bobbio, A. (2009). Relation of physical activity and self-esteem. *Perceptual and Motor Skills*, *108*, 549-557. doi: 10.2466/pms.108.2.549-557

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2005). *Comprehensive meta-analysis, version 2* [Computer software]. Englewood, NJ: Biostat.

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2009). *Introduction to meta-analysis.* Chichester, England: Wiley.

**Bratland-Sanda, S., & Sundgot-Borgen, J. (2011). Symptoms of eating disorders, drive for muscularity and physical activity among Norwegian adolescents. *European Eating Disorders Review*, *20*, 287-293. doi:10.1002/erv.1156

**Brown, D., Wang, Y., Ward, A., Ebbeling, C., Fortlage, L., … & ~~Puleo, E...~~Rippe, J. M. (1995). Chronic psychological effects of exercise and exercise plus cognitive strategies. *Medicine & Science In Sports and~~&~~ Exercise*, *27*, 765-775. doi: 10.1249/00005768-199505000-00021

Cafri, G., & Thompson, J. K. (2004). Measuring male body image: a review of the current methodology. *Psychology of Men and Muscularity*, *5*, 18-29.

Campbell, A., & Hausenblas, H. A. (2009). Effects of exercise interventions on body image a meta-analysis. *Journal of Health Psychology*, *14*, 780-793. doi:10.1177/1359105309338977

Cash, T. F., Fleming, E. C., Alindogan, J., Steadman, L., & Whitehead, A. (2002). Beyond body image as a trait: The development and validation of the Body Image States Scale. *Eating Disorders: The Journal of Treatment and Prevention*, *10*, 103–113. doi: 10.1080/10640260290081678

Cash, T. F. (2004). Body image: past, present, and future. *Body Image*, *1*, 1-5. doi: 10.1016/s1740-1445(03)00011-1

Cash, T. F., & Brown, T. A. (1989). Gender and body images: Stereotypes and realities. *Sex Roles*, *21*, 361-373. doi:10.1007/bf00289597

**Cok, F. (1990). Body image satisfaction in Turkish adolescents. *Adolescence*, *25*, 409-412.

**Davis, C., Elliott, S., Dionne, M., & Mitchell, I. (1991). The relationship of personality factors and physical activity to body satisfaction in men. *Personality aAnd Individual Differences*, *12*, 689-694. doi:10.1016/0191-8869(91)90224-y

Decoster, J., & Claypool, H. M. (2004). A meta-analysis of priming effects on impression formation supporting a general model of informational biases. *Personality and Social Psychology Review*, *8*, 2-27. doi:10.1207/s15327957pspr0801_1

**Duncan, M. (2004). Body image and physical activity in British secondary school children. *European Physical Education Review*, *10*, 243-260. doi: 10.1177/1356336x04047125

**Duncan, M., Al-Nakeeb, Y., & Nevill, A. (2009). Effects of a 6-week circuit training intervention on body esteem and body mass index in British primary school children. *Body Image*, *6*, 216-220. doi: 10.1016/j.bodyim.2009.04.003

Field, A. P., & Gillett, R. (2010). How to do a meta-analysis. *The British Journal of Mathematical and Statistical Psychology*, *63*, 665-694. doi:10.1348/000711010X502733.

Fiske, L., Fallon, E. A., Blissmer, B., & Redding, C. A. (2014). Prevalence of body dissatisfaction among United States adults: Review and recommendations for future research. *Eating Behaviors*, *15*, 357-365. doi:10.1016/j.eatbeh.2014.04.010

**Ford, H. (1991). Effects of selected physical activities on global self-concept and body-cathexis scores. *Psychological Reports*, *68*, 1339-1343. doi: 10.2466/pr0.68.4.1339-1343

Frazier, P. A, Tix, A. P., & Barron, K. E. (2004). Testing moderator and mediator effects in counseling psychology. *Journal of Counseling Psychology*, *51*, ~~51:~~ 115-134.

Frederick, D. A., Peplau, L. A., & Lever, J. (2006). The swimsuit issue: Correlates of body image in a sample of 52,677 heterosexual adults. *Body Image*, *3*, 413-419. doi:10.1016/j.bodyim.2006.08.002

Garner, D. M. (1997). The 1997 body image survey results. *Psychology Today*, *30*, 30-44.

**Gehrman, C., Hovell, M., Sallis, J., & Keating, K. (2006). The effects of a physical activity and nutrition intervention on body dissatisfaction, drive for thinness, and weight concerns in pre-adolescents. *Body Image, 3*, 345-351. doi:10.1016/j.bodyim.2006.07.006

Hargreaves, D. A., & Tiggemann, M. (2006). 'Body image is for girls': a qualitative study of boys' body image. *Journal of Health Psychology, 11*, 567-576. doi: 10.1177/1359105306065017

**Haugen, T., Ommundsen, Y., & Seiler, S. (2013). The relationship between physical activity and physical self-esteem in adolescents: The role of physical fitness indices. *Pediatric Exercise Science, 25*, 138-153. doi: 10.1123/pes.25.1.138

**Hausenblas, H., & Fallon, E. (2002). Relationship among body image, exercise behavior, and exercise dependence symptoms. *International Journal of Eating, 32*, 179-185. doi:10.1002/eat.10071

Hausenblas, H. A., & Fallon, E. A. (2006). Exercise and body image: A meta-analysis. *Psychology and Health, 21*, 33-47. doi:10.1080/14768320500105270

**Hayes, S., Crocker, P., & Kowalski, K. (1999). Gender differences in physical self-perceptions, global self-esteem and physical activity: Evaluation of the physical self-perception profile model. *Journal of Sport Behavior, 22*, 1-14.

Hedges, L. V., & Olkin, I. (1985). *Statistical methods for meta-analysis*. Orlando: Academic Press.

Higgins, J. P. T., & Thompson, S. G. (2002). Quantifying heterogeneity in a meta-analysis. *Statistics in Medicine, 21*, 1539–1558. doi:10.1002/sim.1186.

Higgins, J., Thompson, S. G., Deeks, J. J., & Altman, D. G. (2003). Measuring inconsistency in meta-analyses. *BMJ, 327*, 557-560. doi:10.1136/bmj.3277414.557.

Higgins, J. P., & Green, S. (Ed.). (2008). Cochrane handbook for systematic reviews of interventions. *The Cochrane Collaboration*. (Vol. 5.1.0). Retrieved from htttp://www.cochrane-handbook.org doi:10.1002/9780470712184.index

Higgins, J. P., Altman, D. G., Gøtzsche, P. C., Jüni, P., Moher, D., Oxman, A. D., ... & Sterne, J. A. (2011). The Cochrane collaboration's tool for assessing risk of bias in randomised trials. *BMJ, 343*, d5928. doi: 10.1136/bmj.d5928

**Holmes, T., Chamberlin, P., & Young, M. (1994). Relations of exercise to body image and sexual desirability among a sample of university students. *Psychological Reports, 74*, 920-922. doi:10.2466/pr0.1994.74.3.920

**Huang, J., Norman, G., Zabinski, M., Calfas, K., & Patrick, K. (2007). Body image and self-esteem among adolescents undergoing an intervention targeting dietary and physical activity behaviors. *Journal of Adolescent Health, 40*, 245-251. doi:10.1016/j.jadohealth.2006.09.026

Formatted: Font: Italic

**Kołoło, H., Guszkowska, M., Mazur, J., & Dzielska, A. (2012). Self-efficacy, self-esteem and body image as psychological determinants of 15-year-old adolescents' physical activity levels. *Human Movement, 13,* 264-270. doi:10.2478/v10038-012-0031-4

**Korn, L., Gonen, E., Shaked, Y., & Golan, M. (2013). Health perceptions, self and body image, physical activity and nutrition among undergraduate students in Israel. *Plos ONE, 8,* e58543. doi:10.1371/journal.pone.0058543

Kostanski, M., Fisher, A., & Cullone, E. (2004). Current conceptualisation of body image dissatisfaction: have we got it wrong? *Journal of Child Psychology and Psychiatry, 45,* 1317-1325. doi: 10.1111/j.1469-7610.2004.00315.x

Kruger, J., Lee, C., Ainsworth, B. E., & Macera, C. A. (2008). Body size satisfaction and physical activity levels among men and women. *Obesity, 16,* 1976-1979. doi:10.1038/oby.2008.311.

**Lantz, C. D., Hardy, C. J., & Ainsworth, B. E. (1997). Social physique anxiety and perceived exercise behavior. *Journal of Sport Behavior, 20,* 83-93.

**Laus, M., Costa, T., & Almeida, S. (2011). Body image dissatisfaction and its relationship with physical activity and body mass index in Brazilian adolescents. *Jornal Brasileiro De Psiquiatria, 60,* 315-320. doi:10.1590/s0047-20852011000400013

**Loland, N. W. (1998). Body image and physical activity. A survey among Norwegian men and women. *International Journal of Sport Psychology, 29,* 339-365.

**Luszczynska, A., & Abraham, C. (2012). Reciprocal relationships between three aspects of physical self-concept, vigorous physical activity, and lung function: A longitudinal study among late adolescents. *Psychology of Sport and Exercise, 13,* 640-648. doi:10.1016/j.psychsport.2012.04.003

Martin Ginis, K. A., Eng, J. J., Arbour, K. P., Hartman, J. W., Phillips, S. M. (2005) Mind over muscle? Sex differences in the relationship between body image change and subjective and objective physical changes following a 12-week strength-training program. *Body Image, 2,* 363–372. doi:10.1016/j.bodyim.2005.08.003

Martin Ginis, K. A., & Bassett, R. L. (2011). Exercise and changes in body image. In T. F. Cash & Smolak, L. (Eds.), *Body image: A handbook of theory, research, and clinical practice* (pp. 414-421). New York: Guilford Press.

Martin Ginis, K. A., Bassett-Gunter, R. L., & Conlin, C. (2012). Body image and exercise. In E. Acevedo (Ed.), *Oxford handbook of exercise psychology* (pp. 55-75). Oxford, United Kingdom: Oxford. University Press. doi:10.1093/oxfordhb/9780195394313.013.0004

Martin Ginis, K. A., McEwan, D., & Bassett, R. L. (2013). Physical activity and body image. In Ekkekakis, P. (Ed), *Routledge handbook of physical activity & mental health*. New York: Routledge. doi:10.4324/9780203132678.ch15

Martin Ginis, K. A., Strong, H. A., Arent, S. A., Bray, S. R., & Bassett-Gunter, R. L. (2014). The effects of aerobic- versus strength-training on body image among young women with pre-existing body image concerns. *Body Image*, *11*, 219-227. DOI: 10.1016/j.bodyim.2014.02.004.

**McAuley, E., Bane, S., Rudolph, D., & Lox, C. (1995). Physique anxiety and exercise in middle-aged adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *50*, 229-235. doi:10.1093/geronb/50b.5.p229

McAuley, E., Blissmer, B., Katula, J., Duncan, T.E., & Mihalko, S.L. (2000). Physical activity, self-esteem, and self-efficacy relationships in older adults: A randomized controlled trial. *Annals of Behavioral Medicine, 22*, 131-139.

**McAuley, E., Marquez, D., Jerome, G., Blissmer, B., & Katula, J. (2002). Physical activity and physique anxiety in older adults: Fitness, and efficacy influences. *Aging & Mental Health*, *6*, 222-230. doi:10.1080/13607860220142459

McCabe, M. P., & Ricciardelli, L. A. (2004). Body image dissatisfaction among males across the lifespan: A review of past literature. *Journal of Psychosomatic Research, 56*, 675-685.

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*, 297-304. doi:10.1080/07448480009596271

Miller, C. T., & Downey, K. T. (1999). A meta-analysis of heavyweight and self-esteem. *Personality and Social Psychology Review*, *3*, 68-84. doi:10.1207/s15327957pspr0301_4

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *Annals of Internal Medicine, 151*, 264-269. doi:10.1136/bmj.b2535

**Moore, J., Mitchell, N., Bibeau, W., & Bartholomew, J. (2011). Effects of a 12-week resistance exercise program on physical self-perceptions in college students. *Research Quarterly for Exercise and Sport, 82*, 291-301. doi:10.1080/02701367.2011.10599757

Muth, J. L., & Cash, T. F. (1997). Body-image attitudes: What difference does gender make? *Journal of Applied Social Psychology, 27*, 1438-1452. doi:10.1111/j.1559-1816.1997.tb01607.x

Olivardia, R., Pope, H. G. Jr., Borowiecki III, J. J., & Cohane, G. H. (2004). Biceps and body image: The relationship between muscularity and self-esteem, depression, and eating disorder symptoms. *Psychology of Men and Masculinity*, *5*, 112-120.

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Polivy, J., & Herman, C. P. (2002). Causes of eating disorders. *Annual Review of Psychology*, *53*, 187-213. doi:10.1146/annurev.psych.53.100901.135103

Pope, H. G., Gruber, A. J., Choi, P., Olivardia, R., & Phillips, K. A. (1997). Muscle dysmorphia: An underrecognized form of body dysmorphic disorder. *Psychosomatics*, *38*, 548-557. doi:10.1016/s0033-3182(97)71400-2

Reel, J. J., Greenleaf, C., Baker, W. K., Aragon, S., Bishop, D., Cachaper, C., ... & Hattie, J. (2007). Relations of body concerns and exercise behavior: A meta-analysis. *Psychological Reports*, *101*, 927-942. doi:10.2466/pr0.101.3.927-942

Rosenberg, M. S. (2005). The file-drawer problem revisited: A general weighted method for calculating fail-safe numbers in meta-analysis. *Evolution: International Journal of Organic Evolution*, *59*, 464-468. doi: 10.1554/04-602.

Rosenthal, R. (1979). The file drawer problem and tolerance for null results. *Psychological Bulletin*, *86*, 638-641. doi:10.1037/0033-2909.86.3.638.

Rozin, P., & Fallon, A. (1988). Body image, attitudes to weight, and misperceptions of figure preferences of the opposite sex: A comparison of men and women in two generations. *Journal of Abnormal Psychology*, *97*, 342-345. doi:10.1037/0021-843x.97.3.342

**Santarnecchi, E. & Dèttore, D. (2012). Muscle dysmorphia in different degrees of bodybuilding activities: Validation of the Italian version of Muscle Dysmorphia Disorder Inventory and Bodybuilder Image Grid. *Body Image*, *9*, 396-403. doi:10.1016/j.bodyim.2012.03.006

**Schwerin, M., Corcorn, K., Fisher, L., Patterson, D., Askew, W., Olrich, T., & Shanks, S. (1996). Social physique anxiety, body esteem, and social anxiety in bodybuilders and self-reported anabolic steroid users. *Addictive Behaviors*, *21*, 1-8. doi:10.1016/0306-4603(95)00031-3

Shaw, J.M., Ebbeck, V., & Snow, C.M. (2000). Body composition and physical self concept in older women. *Journal of Women and Aging*, *12*, 59-75.

Sonstroem, R. J., & Morgan, W. P. (1989). Exercise and self-esteem: Rationale and model. *Medicine and Science in Sports and Exercise*, *21*, 329–337. doi:10.1249/00005768-198906000-00018

Stice, E., & Whitenton, K. (2002). Risk factors for body dissatisfaction in adolescent girls: A longitudinal investigation. *Developmental Psychology*, *38*, 669-678. doi:10.1037/0012-1649.38.5.669

Thompson, J. K., Penner, L. A., & Altabe, M. (1990). Procedures, problems, and progress in the assessment of body images. In T. F. Cash & T. Pruzinsky (Eds.), *Body images; Development, deviance, and change* (pp. 21-48). New York: Guilford.

Formatted: Font: Italic

Thompson, J. K., Heinberg, L., Altabe, M., & Tantleff-Dunn, S. (1999). *Exacting Beauty.* Washington, DC: American Psychological Association.

**Tiggemann, M., & Williamson, S. (2000). The effect of exercise on body satisfaction and self-esteem as a function of gender and age. *Sex Roles*, *43*, 119-127.

**Tucker, L. (1983). Effect of weight training on self-concept: A profile of those influenced most. *Research Quarterly For Exercise and Sport*, *54*, 389-397. doi:10.1080/02701367.1983.10605324

Tylka, T. L., Bergeron, D., & Schwartz, J.P (2005). Development and psychometric evaluation of the Male Body Attitudes Scale (MBAS). *Body Image*, *2*, 161-175.

**Umstattd, M., Wilcox, S., & Dowda, M. (2010). Predictors of change in satisfaction with body appearance and body function in mid-life and older adults: Active for Life®. *Annals of Behavioral Medicine*, *41*, 342-352. doi:10.1007/s12160-010-9247-8

**Varnado-Sullivan, P., Horton, R., & Savoy, S. (2006). Differences for gender, weight and exercise in body image disturbance and eating disorder symptoms. *Eating and Weight Disorders*, *11*, 118-125. doi:10.1007/bf03327556

Williams, S. L., and French, D. P. (2011). What are the most effective intervention techniques for physical activity self-efficacy and physical activity behaviour - and are they the same? *Health Education Research*, *25*, 308-322. doi:10.1093/her/cyr005

**Zabinski, M., Calfas, K., Gehrman, C., Wilfley, D., & Sallis, J. (2001). Effects of a physical activity intervention on body image in university seniors: Project GRAD. *Annals of Behavioral Medicine*, *23*, 247-252. doi:10.1207/s15324796abm2304_3

**Zaccagni, L., Masotti, S., Donati, R., Mazzoni, G., & Gualdi-Russo, E. (2014). Body image and weight perceptions in relation to actual measurements by means of a new index and level of physical activity in Italian university students. *Journal of Translational Medicine*, *12*, 42-50.

**Zach, S., Zeev, A., Dunsky, A., Goldbourt, U., Shimony, T., Goldsmith, R., & Netz, Y. (2013). Perceived body size versus healthy body size and physical activity among adolescents – Results of a national survey. *European Journal of Sport Science*, *13*, 723-731. doi:10.1080/17461391.2013.771382

**Zach, S. & Netz, Y. (2014). Self-presentation concerns and physical activity in three-generation families. *Social Behavior and Personality: An International Journal*, *42*, 259-267. doi:10.2224/sbp.2014.42.2.259

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