Why is Low Waist-to-Chest Ratio Attractive in Males? The Mediating Roles of Perceived

Dominance, Fitness, and Protection Ability

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WAIST-TO-CHEST RATIO   1

Abstract

Past research suggests that a lower waist-to-chest ratio (WCR) in men (i.e., narrower waist and broader chest) is viewed as attractive by women. However, little work has directly examined why low WCRs are preferred. The current work merged insights from theory and past research to develop a model examining perceived dominance, fitness, and protection ability as mediators of to WCR-attractiveness relationship. These mediators and their link to both short-term (sexual) and long-term (relational) attractiveness were simultaneously tested by having 151 women rate one of 15 avatars, created from 3D body scans. Men with lower WCR were perceived as more physically dominant, physically fit, and better able to protect loved ones; these characteristics differentially mediated the effect of WCR on short-term, long-term, and general attractiveness ratings. Greater understanding of the judgments women form regarding WCR may yield insights into motivations by men to manipulate their body image.

Keywords: physical attractiveness; waist-to-chest ratio; attraction; body mass index; dominance

Word count: 146

Physical attractiveness is a primary determinant of the extent to which one is perceived as a desirable mate (Buss et al., 1990; Fletcher, Kerr, Li, & Valentine, 2014; Schwarz & Hassebrauck, 2012), and one of the most important aspects of male physical attractiveness is upper body "V-shapedness." Several studies have shown that men with more V-shaped upper bodies are perceived as more attractive (Braun & Bryan, 2006; Brown et al, 2008; Horvath, 1979; Maisey, Vale, Cornelissen & Tovée, 1999; Price, Pound, Dunn, Hopkins, & Kang, 2013; Swami & Tovée, 2005; Swami et al., 2007). In many of these studies, V-shapedness is measured in terms of waist-chest ratio (WCR), with lower WCR being more attractive. The goal of this research is to address the issue of *why* females find males with low WCRs attractive. Understanding why low WCR males are seen as attractive is an important component of more broadly understanding why and under what conditions some men strive to attain a very low WCR, as well as the mental and physical health consequences of this goal.

Some previous research has explored this question. Approached primarily from an evolutionary perspective, fitness (e.g., Frederick & Haselton, 2007; Gangestad & Simpson, 2000) has been conceptualized in a variety of ways and supported as one potential mediator of the link from WCR to attractiveness. However, a second potential mediator stemming from this same perspective, the ability to protect oneself and one's family, has largely gone untested and is likely to be strongly related to WCR, as more muscular men are likely better able to fight off or intimidate a potential aggressor. A third potential mediator, dominance, has been conceptualized from both evolutionary (Braun & Bryan, 2006; Frederick & Haselton, 2007) and sociocultural (Bryan, Webster, & Mahaffey, 2011) perspectives, but has received mixed support as a mediator of the WCR-attractiveness link. We now turn to more fully discussing the three hypothesized mediators, and their evolutionary and sociocultural theoretical underpinnings.

Fitness, Protection Ability, and Evolutionary Perspectives

Much of the work that has been done on the perception of male physical attractiveness has taken an evolutionary approach. In general, evolutionary theory predicts that individuals should prefer mates with traits that indicate health, developmental stability, and physical fitness (in both sexes), fertility in women, and formidability (e.g., strength, fighting ability) in men (Grammer, Fink, Møller & Thornhill, 2003; Roney, 2009; Sugiyama, 2005). In men, such traits may indicate physical ability to contribute high-quality parental investment, and/or possession of "good genes," either of which could make a man a more adaptive choice as a reproductive partner (Gangestad & Simpson, 2000). A related reason why attractive men could make more promising mates is because they tend to attain high social status (Langlois et al., 2000; Lukaszewski, 2013), which could further enhance their access to resources and ability to provide parental investment.

Because men with more muscular upper bodies and lower body fat have a lower WCR, lower WCR could plausibly indicate increased health, physical fitness, and formidability, and thus be a cue to good genes in males. Further, because of these physical advantages, low-WCR males may seem relatively able to acquire and retain resources and to provide physical protection. Finally, the fact that WCR is such an important aspect of male attractiveness, which is in turn associated positively with social status, may be an additional reason why low-WCR men would be perceived as being more able to provide status-linked (e.g., financial) resources.

From an evolutionary perspective, mate preferences are expected to vary according to whether a potential mate is being evaluated as a short-term or long-term relationship partner (Buss & Schmidt, 1993; Gangestad & Simpson, 2000). If low WCR indicated both good genes and ability to provide parental investment, then it should be attractive to women in both short-

term and long-term relationship contexts. This is true because women generally are expected to be more attracted to good genes traits in short-term partners, and to investment-related traits in long-term partners (Gangestad & Simpson, 2000). However, the factors linking WCR to short-term attractiveness may be different than those linking WCR to long-term attractiveness. The good genes traits that relate especially positively to short-term attractiveness tend to be physical features, especially testosterone-linked traits such as relatively masculine body, face, and voice (Li & Kenrick, 2006; Little, Connely, Feinberg, Jones, & Roberts, 2011; Lucas, Koff, Grossmith, & Migliorini, 2011; Pawlowski & Jasienska, 2005; Provost, Kormos, Kosakoski, & Quinsey, 2006; Puts, 2010). With regard to bodily traits specifically, V-shaped upper body and features indicating muscularity, strength, and physical fitness have been found to be more important in short-term than in long-term contexts (Braun & Bryan, 2006; Li & Kenrick, 2006; Little et al., 2011; Lucas et al., 2011). In contrast, traits that are especially predictive of long-term attractiveness tend to relate more to parental investment, such as social status, access to resources, and the ability to provide protection (Buss & Schmitt, 1993; Li, 2007; Li & Kenrick, 2006). In summary, perceptions of physical traits indicating masculinity and formidability (i.e., dominance) and fitness are hypothesized to mediate the link between WCR and short-term attractiveness, and traits indicating the ability to provide investment and protection are hypothesized to mediate the link between WCR and long-term attractiveness.

Fitness, Protection Ability, and Sociocultural Perspectives

Although sociocultural approaches often are framed in opposition to evolutionary perspectives, each sometimes reaches similar conclusions on the topics of attractiveness and mate selection, albeit for different reasons (Eagly & Wood, 1999; 2011; Wood & Eagly, 2002). Sociocultural theorists argue that observed sex differences are due to social and cultural

pressures more than biological and evolutionary processes. Thus, instead of fitness and parental

investment, emphasis is placed on cultural beliefs and practices such as traditional divisions of

labor, gender-specific expectations and roles, gender equality, and the embedded nature of these

differences in society (Finkel & Eastwick, 2009; Ridgeway & Diekema, 1992; Shelton, 1992;

Tomaskovic-Devey, 1995).

      In terms of physical attractiveness, sociocultural theorists largely emphasize its

constructed nature. Indeed, research provides evidence that definitions of ideal male physical

attractiveness, as portrayed by the media, have changed in recent decades to become leaner and

more muscular (i.e., broader chests and narrower waists), and thus more V-shaped, in both the

United States and Japan (Darling-Wolf, 2004; Hargreaves & Tiggemann, 2009; Leit, Pope, &

Gray, 2001; Luther, 2009; Mishkind, Rodin, Silberstein, & Striegel-Moore, 1986; Pope,

Olivardia, Borowiecki, & Cohane, 2001; Spitzer, Henderson, & Zivian, 1999). Further, evidence

supporting the notion that male body preferences are culturally driven has been obtained (e.g.,

Heron-Delaney, Quinn, Lee, Slater, & Pascalis, 2013). One study on WCR found that adults in

more developed regions (i.e., Great Britain and urban Malaysia) prefer the V-shaped body to a

greater extent than in a less developed region (i.e., rural Malaysia; Swami & Tovée, 2005).

      Interestingly, one study finds that a cultural change towards a more muscular ideal has

corresponded with an increased emphasis on men's role as husbands and fathers in Japan

(Darling-Wolf, 2004). However, this same study reports that the man rated sexiest and the "man

women most want to sleep with" in Japan was less desirable as a long-term mate and did not

appear on the lists of men women wanted to marry. In the United States, though it is easy to find

a list of the sexiest male celebrities (e.g., magazines like *People*), it is far more difficult to find a

list of men women want to marry. *Forbes* publishes perhaps the only list of "most eligible

bachelors" that does not contain the words "sexiest" or "hottest." These differences appear to

indicate that different cultural norms exist for the characteristics women look for in a man,

depending on whether they desire a short-term relationship (i.e., physical attractiveness) or a

long-term relationship (i.e., financial assets/security), and these different norms are similar to

the short-term/long-term preferences predicted by the evolutionary theory discussed above.

Dominance

As aforementioned, as it relates to body shape and attractiveness, dominance has been

previously examined from both evolutionary and sociocultural theoretical perspectives, although

results have been inconsistent. Braun and Bryan (2006) found that the perceived dominance of

men was related to the desire for a short-term, sexual relationship, but not a long-term

relationship. However, they found that men's body shape had little to do with the perception of

dominance. In contrast, other research in which body shape was manipulated found that

muscularity, a variable closely related to WCR, was associated with perceived dominance

(Frederick & Haselton, 2007). Although they did not directly explore dominance as a potential

mediator of the relationship between WCR and attractiveness, Frederick and Haselton (2007) did

find a similar pattern to Braun and Bryan's (2006) research. Specifically, women rated men

described as "brawny," "built," or "toned" (i.e., low WCR) as both more dominant and sexual

desirable, but less likely to be committed to a partner, than men described as "slender," "typical,"

or "chubby," indicating the possibility that dominance may mediate the relationship, particularly

for short-term, sexual relationships. In other empirical work, dominance has been conceptualized

as three separate types: physical, social, and financial (Bryan et al., 2011); perceived physical

dominance was rated as important for both short-term (sexual) relationships and long-term

relationships, whereas perceived social dominance was rated as important only for long-term

relationships. Perceived financial dominance was related to neither. However, this research did not consider the impact of body shape on these perceptions. Therefore, we tested the possibility that a tripartite conceptualization of dominance would mediate the relationship between body shape (i.e., WCR) and perceived attractiveness and shed light on the previously mixed findings.

The Present Study

To our knowledge, no research has examined the possible mediators of perceived fitness, protection ability, and dominance, simultaneously in a comprehensive model. Due to shared variance, it is possible that one or more of these potential mediators might fail to be a significant predictor of attractiveness when all are tested together. To this end, the model presented here tested how these mediators relate to each other and how they relate to both short-term (sexual) and/or long-term (relational) attractiveness. Thus, our research extends past work in several ways. We test a set of hypotheses regarding why low WCR in males is viewed as attractive from the perspective of the perceiver. To be specific, we examine a model that simultaneously tests the contribution of a variable that has strong support in previous research (i.e., fitness), a variable with mixed support (i.e., dominance), and a variable that has yet to be explored empirically with relation to WCR (i.e., protection ability) from the perspective of the individual judging attractiveness. In addition, we attempt to determine their relation to each other and to two types of attraction (short-term and long-term). In short, we hypothesize links from WCR to perceptions of dominance, which in turn influence perceptions of other proposed mediators of the link between attractiveness and WCR: protection ability and perceived fitness.

Figure 1 depicts our model specifying how these variables may be related. Our first hypothesis (H1) was that lower-WCR men would be perceived as more attractive partners in all relationship contexts: short-term, long-term, and in general (no temporal aspect specified). Our

second hypothesis (H2) was that low-WCR men would be perceived as attractive short-term

relationship partners because of their physical features themselves, that is, because these features

give an impression of both physical dominance and physical fitness. Our third hypothesis (H3)

was that low-WCR men would be perceived as attractive long-term relationship partners because

of their perceived social dominance (i.e., high status), financial dominance, and ability to provide

protection.

Method

Participants and Recruitment

One hundred fifty-one women living in the United States completed a five-minute online

survey advertised as a study about women's views of men's attractiveness via Amazon's

Mechanical Turk in exchange for 10 cents. This compensation amount was typical for the five-

minute time investment. Research has found that individuals are motivated to complete surveys

via Mechanical Turk (MTurk) out of personal interest more than desire for compensation and has

found virtually no differences between MTurk participants and participants recruited via other

means (e.g., relatively high quality data by conscientious participants; Buhrmester, Kwang, &

Gosling, 2011). Sample size was determined based on the recommendation of having at least 10

participants for each model variable (Field, 2005). Given that WCR was manipulated, we elected

to have at least 10 participants per condition (i.e., at least 100 participants because our model has

10 variables; see below for additional information). The mean age of participants was 34.50

years ($SD = 11.62$ years, range: 18-66 years); 43% ($n = 65$) were married, 22% ($n = 34$) were

seriously dating or engaged, 22% ($n = 33$) were single, 9% ($n = 13$) were divorced or widowed,

and 4% ($n = 6$) were dating casually. Regarding education level, 45% ($n = 68$) had a high school

diploma or less, 43% ($n = 65$) had completed some college, 10% ($n = 15$) had completed a

bachelors or more advanced degree, and 2% ($n = 3$) chose not to report their education.

Body Scan Selection and Avatar Creation

Fifteen full body avatars were created using data from a set of 56 body scans collected for

another study (Price, Kang, Dunn, & Hopkins, 2011). The scan data was produced by an NX12

3D body scanner, manufactured by [TC]² (Cary, North Carolina, USA). This scanner uses white

light to create a 3D model of the body. According to the manufacturer, the scanner's point

accuracy is <1 mm, and its circumferential accuracy is <3 mm ([TC]², 2010). Men aged 18-41

years ($M = 22.66$, $SD = 4.61$) were scanned wearing briefs that were minimal enough to not

interfere with any bodily measurements. During the scan they stood in a standardized pose,

without flexing any muscles, and with arms straightened and held slightly away from the sides of

the body. Two scans were obtained of each man, so two measures of each of the two

measurements that compose the WCR – narrowest waist circumference and widest chest

circumference – could be extracted. Waist was defined as the narrowest circumference between

the upper pelvis (iliac crest) and lower rib cage. The two measurements were first used to assess

repeatabilities and were then averaged to produce the single measurement used to calculate

WCR. Repeatabilities (intraclass correlation coefficients, two-way random, absolute agreement)

were very accurate (.996 for waist and .978 for chest). Height and weight also were measured[1],

and body mass index (BMI) was calculated for each scan as kg/m^2. The avatars were created by

fitting the scan data to a reference mesh to replicate the body surface in true fashion ([TC]²,

2010). Thus, the avatars are a highly accurate representation of the scanned men and are at least

as realistic as stimuli used in previous research (e.g., Dixson, Dixson, Li, & Anderson, 2007;

Horvath, 1979). The avatars were presented as front-facing images, still images, centered along

both horizontal and vertical axes (Figure 2 contains sample avatars). We selected three avatars

for each of five WCRs to assess the full range of the sample of male bodies scanned: 10th (.72),

25th (.75), 50th (.77), 75th (.80), and 90th (.83) percentiles ($M = 0.77$, $SD = 0.04$), for a total of 15

avatars. In addition, because past research found BMI to be related to both WCR and

attractiveness (Maisey et al., 1999; Swami & Tovée, 2005), we included BMI in our model as a

control variable.[2] The average BMI for the men whose avatars were used was 23.64 kg/m^2 ($SD =$

2.61, range: 20.62-28.37).

Ratings Procedure

Prior to launching the research, ethical approval was granted by the human subjects

committee at Virginia Commonwealth University; the proposal was reviewed as an exempt study

under US guidelines and all data were collected anonymously. Participants were randomly

assigned to rate one of the 15 avatars on a variety of measures. Participants did not know, nor

was their attention directed to, the WCR or other physical measurements of the avatar.

Participants first rated the avatar on three-item versions of Bryan et al.'s (2011) physical,

financial, and social dominance scales with each factor measured on a 7-point semantic

differential scale (e.g., physical: masculine/feminine, financial: rich/poor, social:

passive/assertive). Participants then completed three-item measures of both perceived fitness

(e.g., "This person is in excellent shape") and protection ability (e.g., "This person could protect

his loved ones from harm") on a 1 (*Strongly disagree*) to 7 (*Strongly agree*) point scales (see

Appendix for all items on each scale).[3] Finally, participants rated the avatar on short-term, sexual

attractiveness (i.e., "I would like to have a sexual encounter with this individual"), and long-

term, relational attractiveness (i.e., "I would like to have a long-term relationship with this

individual"), measured on a 1 (*Strongly disagree*) to 7 (*Strongly agree*) point scale, and a

measure of general attractiveness (e.g., "How physically attractive is the person in the image?")

on a 1 (*Not at all physically attractive*) to 7 (*Very physically attractive*) point scale. After

completing their ratings, participants were taken to a debriefing screen that fully explained the

purpose of the study and provided them with researchers' contact information. In addition,

participants provided information to allow calculation of their ovulatory cycle phase (i.e., date of

the first day of their last cycle and typical cycle length). However, ovulatory cycle phase was not

related to any of the attractiveness or potential mediator variables and is not discussed further.

Statistical Analysis

We utilized path modeling using Mplus 6.0 (Muthén & Muthén, 2009) to examine the

overall fit of the model and a bootstrapping analysis to confirm mediation within the relevant

paths. Mplus provides goodness-of-fit indices to evaluate the overall model, and we utilized four

of the most common: chi-square (χ^2), root mean square error of approximation (RMSEA),

comparative fit index (CFI), and the Tucker Lewis Index (TLI). In addition, a bootstrapping

analysis reports the average beta-value and confidence intervals for a specific path in the model

by repeatedly selecting samples from the dataset. We selected 2500 iterations for our

bootstrapping analysis.

<div align="center">**Results**</div>

Table 1 includes means, standard deviations, and correlations for the principal variables.

Hypothesis 1 was supported: lower WCR was significantly associated with greater short-term

sexual attractiveness, long-term relational attractiveness, and general attractiveness (all *p*s <

.001).

Hypotheses 2 and 3 involved potential mediators (i.e., perceived dominance, perceived

fitness, perceived protection ability) of the relationship between WCR and attractiveness. Figure

1 illustrates our initial model that tested these hypotheses. We examined this path model using

Mplus 6.0 (Muthén & Muthén, 2009). Fit statistics revealed that the model was a decent fit to the

data, $\chi^2(23) = 55.30$, $p = .0002$, RMSEA = .10, CFI = .95, TLI = .91. Next, we tested alternative

models to determine if removing any variables or paths (i.e., directional relationships between

variables) would significantly improve the model fit. We found that removing financial

dominance, and the paths associated with it, significantly increased model fit, $\Delta\chi^2(6) = 28.69$, $p <$

.001, and the new model provided an excellent fit to the data, $\chi^2(17) = 26.61$, $p = .06$, RMSEA =

.06, CFI = .99, TLI = .97. We again considered several alternative models, such as models with

single paths (e.g., WCR predicting fitness, predicting physical dominance, predicting protection

ability, predicting attractiveness) as opposed to multiple paths, but none provided a better fit to

the data. Thus, we retained the path model in Figure 3 and this model largely confirms H2 and

H3 (see below for more on specific mediational paths).

This model revealed that both short-term, sexual attractiveness and long-term, relational

attractiveness (which were allowed to correlate for theoretical reasons) predicted general

attractiveness. Two mediators, protection ability and perceived fitness, differently predicted

measures of attractiveness. Greater protection ability predicted long-term, relational

attractiveness, but not short-term, sexual attractiveness. Greater perceived fitness predicted long-

term, relational attractiveness but more strongly predicted short-term, sexual attractiveness.

Greater perceived fitness also predicted greater ability to protect one's loved ones.

In addition, the final model tested two measures of dominance (social and physical) and

their links among WCR and the mediators of protection ability and fitness, as well as their links

to each other. Greater physical dominance predicted greater protection ability, better perceived

fitness and greater social dominance. Greater perceived social dominance predicted greater

protection ability. WCR predicted greater physical dominance but, surprisingly, was not

associated with perceptions of fitness. That is, avatars with a lower WCR were viewed as more

physically dominant but there was not a direct link from WCR to perceptions of fitness.

Similarly, higher BMI predicted greater physical dominance, but poorer perceived fitness.

Thus, the model supports the hypotheses that perceptions of dominance, fitness, and the

ability to protect a mate all mediate the relationship between WCR and attractiveness.

Furthermore, the model supports the hypotheses that protection ability predicts long-term,

relational attraction, and perceived fitness predicts short-term, sexual attractiveness. The model

explains 47% of the variance in sexual attractiveness, 32% of the variance in relational

attractiveness, and 71% of the variance in general attractiveness ratings.

To confirm mediation and provide additional support for our hypotheses (H2 and H3), we

examined the standardized indirect effects of WCR and BMI on our attractiveness measures (see

statistics regarding labelled indirect paths in Table 2; henceforth, we refer to path labels in Table

2). Consistent with our predictions, the sum of all indirect effects for the paths between WCR

and general attractiveness (path 1) resulted in a significant effect, $\beta = -.18$, $p < .001$; similar

significant effects were also found for both short-term, sexual attractiveness (path 3), $\beta = -.22$, p

$< .001$ (confirming H2) and long-term, relational attractiveness (path 5), $\beta = -.19$, $p < .001$

(confirming H3). This was the case in spite of the fact that social dominance did not significantly

mediate the link between WCR and long-term, relational attractiveness (path 5.2) or general

attractiveness (path 1.3).

In addition, it merits mentioning that despite a simple bivariate correlation between BMI

and attractiveness (i.e., rs = -.20, -.22, and -.20 for sexual, long-term, and general attractiveness

respectively), and contrary to past research, the sum of all indirect effects for the paths between

BMI and general attractiveness (path 2) was not significant, β = .01, *p* = .94, and this null effect was consistent across short-term, sexual attractiveness (path 4), β = -.03, *p* = .69, and long-term, relational attractiveness (path 6), β = .04, *p* = .73. The indirect effects reveal that this was due to the relatively strong positive relationship between BMI and physical dominance, and a similarly strong negative relationship between BMI and fitness and health. These effects then led to the indirect effects for BMI, through these paths, canceling each other when predicting attractiveness measures and may explain why WCR is a more powerful predictor of attractiveness than BMI in more developed regions (see Swami & Tovée, 2005).

More importantly, however, these analyses confirmed that the effects of WCR on attractiveness were found when controlling for BMI in our model. That is, lower waist-to-chest ratio predicts greater attraction even when controlling for body mass index. Moreover, the paths among the mediators also remained significant with BMI in the model.

Discussion

Why do women appear to prefer men with a lower waist to chest ratio (WCR) or a more V-shaped body, for both sexual (short-term) and relational (long-term) relationships? This study employed 3D body scans to simultaneously test several proposed mediators via a path model. The results largely supported the hypotheses. To be specific, perceptions of fitness, protection ability, and physical dominance all mediated the relationship between WCR and attractiveness ratings of males, even when controlling for body mass index (BMI). That is, men with a lower WCR are seen as more physically dominant, in better physical shape, and better able to protect their loved ones. The final model represents an empirically supported synthesis and extension of past work on WCR and attractiveness, and has important implications for body image.

Links from these three mediators varied in theoretically meaningful ways when considering short-term (sexual) versus long-term (relational) attractiveness. Specifically, perceptions of fitness were more highly related to short-term (sexual) attractiveness, but also were associated with long-term (relational) attractiveness. Perceptions of the ability to protect were linked only to long-term (relational) attractiveness. Perceptions of physical dominance predicted perceptions of both fitness and protection ability. Taken together, the paths in this model help to explain why women find men with lower WCR attractive for both short-term and long-term relationships. It also helps to explain why some men are viewed as more attractive short-term partners, whereas other men are viewed as better long-term partners.

These findings are noteworthy because they combine a number of previously supported empirical relationships and heretofore empirically unexplored relationships (e.g., those with protection ability) into a single model of perceptions of male body attractiveness. This research extends past work in several ways. First, it is the first, of which we are aware, to empirically link perceptions of an individual's ability to protect a romantic partner to WCR and attractiveness. Second, we examined a tripartite view of dominance based on recent work, and found evidence for theoretically meaningful relationship for physical dominance but not social or financial dominance. Third, the mediators of protection ability, perceived fitness, and dominance naturally covary. Studies that examine these factors singly may derive misleading conclusions about their effects on attractiveness (i.e., significant effects could be driven by shared rather than unique variance). However, by simultaneously testing these, the model illustrates the role that each variable plays. Moreover, these three mediators have somewhat different relations to sexual and relational attractiveness as well as to each other; our path model took these theoretically and empirically derived relationships into account, and found evidence for all three mediators.

We emphasize that these need not be the only mediators of the WCR to attractiveness relationship; there may be other important perceptions of low WCR individuals that are associated with attractiveness. We selected our mediators based on theory as well as past empirical findings, but do not claim that our model is exhaustive. Other body parts (e.g., body hair, height; Tiggemann, Yolanda, & Libby, 2008) may influence perceptions of male attractiveness, and could even interact with WCR. In addition, some of our paths (e.g., those with protection ability, perceived physical dominance with perceived fitness) have not been examined experimentally. Thus, this model can generate several testable hypotheses for researchers to examine in the future. For example, are men who are perceived as more physically dominant actually more genetically fit? Are men with lower WCR more willing and able to act in a protective manner, in alignment with the perceptions we obtained? Can perceived protection ability be influenced by experimentally manipulating perceptions of fitness of males?

A particularly important area of research regarding body image is to examine the extent to which men are aware of women's perceptions regarding WCR and attractiveness. That is, to what extent do men understand how women derive perceptions about dominance, the ability to protect, and fitness from WCR? To what extent do they agree with these perceptions? Do men consciously or unconsciously associate these perceptions by women with the desire to "bulk up" or otherwise attempt to lower their WCR? Although past work has explored these influences in general terms (i.e., muscularity; Swami & Voracek, 2013), our findings may inspire additional and more specific work on some of the modeled paths, to better understand how perceptions of dominance, fitness, and protective ability may influence perceptions and behaviors regarding body image. This may be particularly critical because looking fit may not be the result of actually being fit, if men employ unhealthy means of achieving a very low WCR and

muscularity. Perhaps some men have an inflated view of women's WCR perceptions (i.e.,

assume that women make extremely positive inferences about men with lower WCRs) and this is

one significant cause of their unhealthy approaches to diet, exercise, and/or other body

modification (e.g., liposuction). Moreover, understanding male body-related attractiveness is

especially important because men are more likely to attempt to alter their bodies, as opposed to

their faces, to become more attractive in both healthy and unhealthy ways (e.g., Locker,

Heesacker, & Baker, 2012; Petrie, Greenlead, Reel, & Carter, 2008; Steinfeldt, Gilchrist,

Halterman, Gomory, & Steinfeldt, 2011). In addition, it may be useful to test more directly for

influences that may impose these standards on both men and women (e.g., mass media;

Tiggemann, 2005) to gain a better understanding of how these may affect the predictions

generated by our model. Understanding these specific relationships between what women find

attractive and how men perceive themselves may be important to improving men's relationship

satisfaction and well-being.

Furthermore, future research may seek to explore cultural differences in the model by

utilizing a study design similar to Swami and Tovée's (2005) research on the difference in the

relationship between WCR and attractiveness in Britain and Malaysia. The sample we employed

lacked diversity regarding nation of residence, though the range on socioeconomic status was

good (for personal income, $M = \$28,640US$, $SD = \$24,054US$), and we did not collect data

regarding participant ethnicity. Cross-cultural research similar to Swami and Tovée's (2005)

would provide important data with which the model can continue to be evaluated. In addition, it

may be useful to examine these mediators using different designs. Past work has found different

results when ratings of images were made using a within- versus between-subjects design

(Swami & Hull, 2009), suggesting that some findings employing within-subjects designs may be

due to halo effects or response biases. Future research also could examine the model at the level of the avatar, having participants rate avatars or images that represent the largest possible range of WCR and BMI, to ensure that our findings extend to a larger and more diverse selection of avatars. The current design was used to answer specific questions pertaining to how women perceive male WCR and sought to avoid the aforementioned confounds using from having participants view and rate multiple images. The aforementioned suggestions for future research into specific paths and using cross-cultural samples should necessitate a variety of designs and could potentially provide additional support for the elements of our model.

Some limitations should be mentioned. First, asking participants to rate three different aspects of attractiveness for the same avatar may have influenced each rating. Although this was necessary to test our predictions, future research should examine each of these ratings independently. In addition, single-item measures of attractiveness may have some weaknesses. Although we used them here to be consistent with previous research, future work may use other measures of attractiveness, such as eye-tracking (i.e., the amount of time spent looking at a particular body or body part) to provide converging evidence. Another limitation may be the somewhat narrow range of BMI in our body scan data (20-28 kg/m^2). Underweight individuals were not well represented in the available pool of body scans. Future research may seek to obtain a greater range, and test the polynomial relationship between BMI and attractiveness typically observed when lower BMIs are included in the analysis (i.e., BMIs below 21 are seen as less attractive; Swami et al., 2007). Some concern may be raised regarding the ecological validity of our avatars, as they were computer-generated 3D images and not photographs of men. We used these stimuli to remove features irrelevant to and possibly distracting regarding our hypotheses (e.g., ethnicity, faces), and we believe that these avatars are at least as realistic as stimuli used in

much past work (e.g., Dixson et al., 2007; Horvath, 1979). Nevertheless, we invite researchers to test the above model using photographs or other stimuli.

The results of this research further illuminate the importance of WCR for perceptions of men's attractiveness. A greater understanding of what women find attractive in men and why, particularly regarding men's bodies, may allow for a greater understanding of physical and interpersonal attraction more generally, and may inspire new research on body image. We hope our findings will both illuminate the intricate relationships between WCR and attractiveness, and spur additional research to better understand these relationships.

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Footnotes

[1] Seventy-five additional body measurements were also taken and were assessed as potentially covarying naturally with WCR and other variables. Only five met the requirement for to be a possible natural confound by being related to WCR as well as two of our three measures of attractiveness. Of those, none appeared to fully mediate the relationship between WCR and attractiveness when using a partial correlation and only two reduced the WCR-attractiveness relationship to cause concern. Those two variables were then included as control variables in our model. However, neither the independent effects nor the combined effects of these variables significantly influenced the relationships of interest in the model or the indirect paths indicating significant mediation. Thus, we conclude that none of the additional body measures acted as confounds; the link from WCR to attractiveness (through the three mediators) is robust and not explained by shared variance between WCR and other body measurements.

[2] Past research had found a polynomial relationship between BMI and attractiveness (e.g. Swami et al., 2007). We were unable to include this relationship due to the nature of our path analysis. However, we believe this is not a concern, because we used avatars from men with BMIs exceeding 20 kg/m^2. Past research has found the relation between BMI and attractiveness to be linear above this point. Future research, however, should address the full range of BMI.

[3] We conducted a factor analysis on the items for fitness, protection ability, and attraction. Our initial analyses, with a promax rotation and maximum likelihood estimation with an eigenvalue cutoff of 1.00, revealed a two factor structure with attraction loading onto the first factor, and the fitness and protection ability items loading onto the second. However, a third factor fell just below the 1.00 Eigenvalue at .96. Moreover, the scree plot showed that the curve was greater after this third factor. Thus, a second analysis requesting three factors was run, and

the expected factor structure was obtained: attraction items loaded onto the first factor

(Eigenvalue = 5.29), fitness items onto the second factor (Eigenvalue = 1.19), and protection

items onto the third factor (Eigenvalue = .96). Although one fitness item cross-loaded onto both

the attraction and protection ability factors, these additional loadings were below .32 and not of

concern relative to the item's loading onto the factor related to fitness (.69). In summary, factor

structure of the items developed are consistent with expectations.

Table 1

Means, Standard Deviations, and Correlations among Measures

	1	2	3	4	5	6	7	8	9
M =	0.77	4.17	3.72	3.64	4.71	4.68	4.74	4.31	4.31
SD =	0.06	1.42	1.58	1.47	1.16	1.1	1.15	0.85	1.18
1. WCR	—	-.30***	-.26***	-.26***	-.47***	-.18*	-.25**	-.23**	-0.16
2. Sexual Attractiveness		—	.66***	.69***	.69***	.55***	.49***	.34***	.37***
3. Relational Attractiveness			—	.83***	.54***	.48***	.45***	.30***	.30***
4. General Attractiveness				—	.51**	.45***	.45***	.34***	.28***
5. Fitness					α = .89	.56***	.51***	.46***	.39***
6. Protection Ability						α = .85	.66***	.38***	.61***
7. Physical Dominance							α = .78	.34***	.56***
8. Financial Dominance								α = .82	.49***
9. Social Dominance									α = .88

*Notes:*** $p < .001$; ** $p < .01$; * $p < .05$. Variable names: waist-to-chest ratio (WCR).

Table 2

Indirect Effects of Predictor Variables.

Path	Beta	LL	UL
1. Total Indirect WCR->GenAttract	-.18***	-.26	-.10
1.1 WCR->PhysD->Fitness->Sex->Gen	-.05*	-.10	-.01
1.2 WCR->PhysD->Fitness->Rel->Gen	-.08*	-.14	-.03
1.3 WCR->PhysD->SocialD->Protect->Rel->Gen	-.01	-.03	.001
1.4 WCR->PhysD->Protect->Rel->Gen	-.03^t	-.05	-.004
2. Total Indirect BMI->Gen	.01	-.08	.11
2.1 BMI->Fitness->Sex->Gen	-.05^t	-.10	-.01
2.2 BMI->PhysD->Fitness->Sex->Gen	.05*	.008	.08
2.3 BMI->Fitness->Rel->Gen	-.08*	-.14	-.02
2.4 BMI->PhysD->Fitness->Rel->Gen	.07*	.02	.11
2.5 BMI->PhysD->SocialD->Protect->Rel->Gen	.01	-.001	.02
2.6 BMI->PhysD->Protect->Rel->Gen	-.02^t	.003	.05
3. Total Indirect WCR->Sex	-.22***	-.32	-.12
4. Total Indirect BMI->Sex	-.03	-.16	.10
4.1 BMI->Fitness->Sex	-.21**	-.34	-.09
4.2 BMI->PhysD->Fitness->Sex	.18***	.10	.27
5. Total Indirect WCR->Rel	-.19***	-.27	-.10
5.1 WCR->PhysD->Fitness->Rel	-.13**	-.20	-.05
5.2 WCR->PhysD->SocialD->Protect->Rel	-.02	-.04	.001
5.3 WCR->PhysD->Protect->Rel	-.04*	-.08	-.007

6. Total Indirect BMI->Rel	.04	-.06	.12
6.1 BMI->Fitness->Rel	-.12*	-.21	-.03
6.2 BMI->PhysD->Fitness->Rel	.10**	.04	.17
6.3 BMI->PhysD->SocialD->Protect->Rel	.02	-.001	.04
6.4 BMI->PhysD->Protect->Rel	.04[t]	.004	.07
R-squared values for outcomes	R^2		
Physical Dominance	.19		
Social Dominance	.32		
Fitness	.42		
Protection Ability	.56		
Sexual Attractiveness	.32		
Relational Attractiveness	.47		
General Attractiveness	.71		

Note: *** $p < .001$; ** $p < .01$; * $p < .05$; 95% upper (UL) and lower limits (LL) are reflective of a bootstrapping analysis with 2500 iterations with standardized values reported. Variable names are waist-to-chest ratio (WCR) and body mass index (BMI), sexual attractiveness (Sex), relational attractiveness (Rel), general attractiveness (Gen), Fitness (Fitness), Protection Ability (Protect), Physical Dominance (PhysD), and Social Dominance (SocialD).
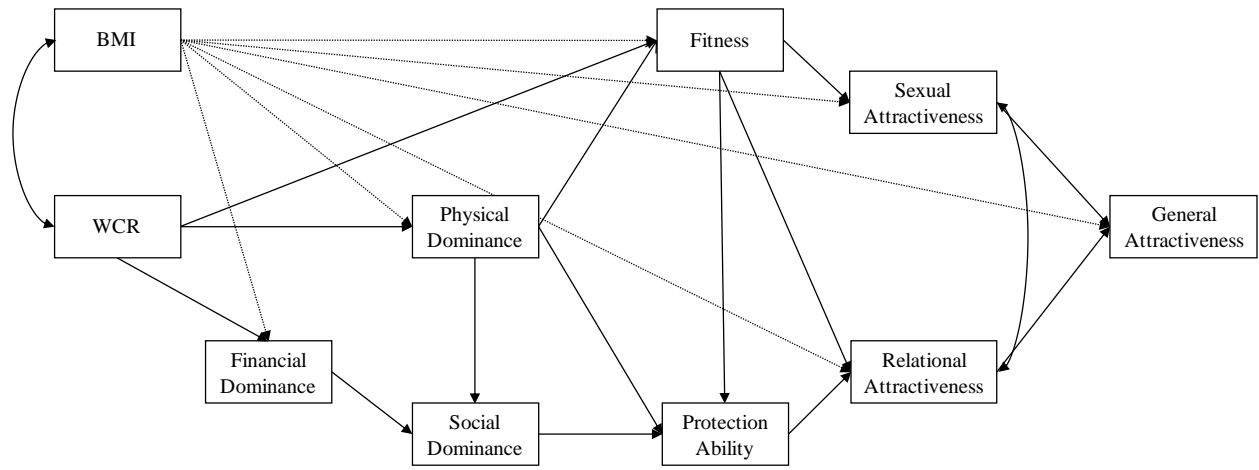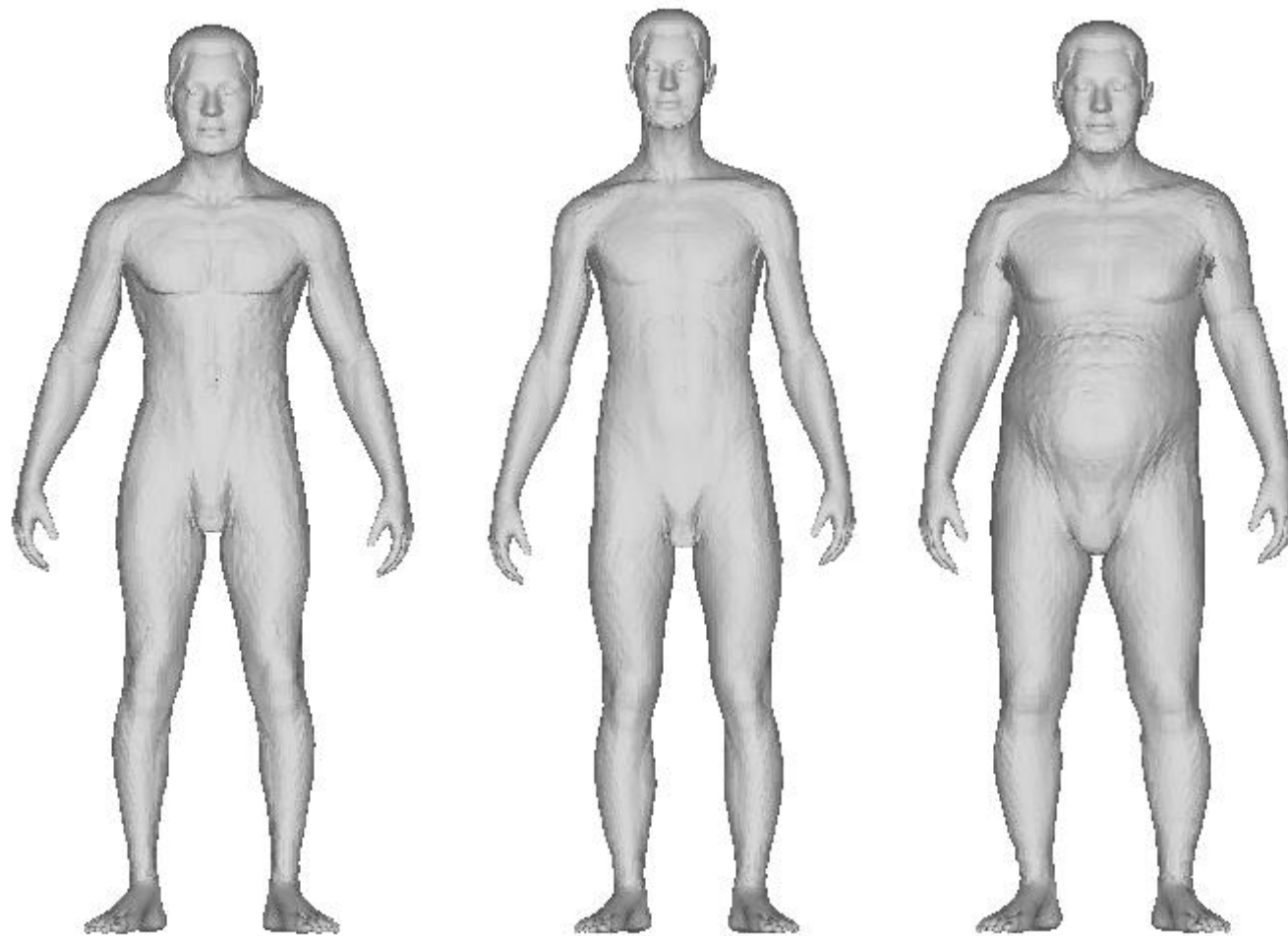
Figure 1. Proposed model.

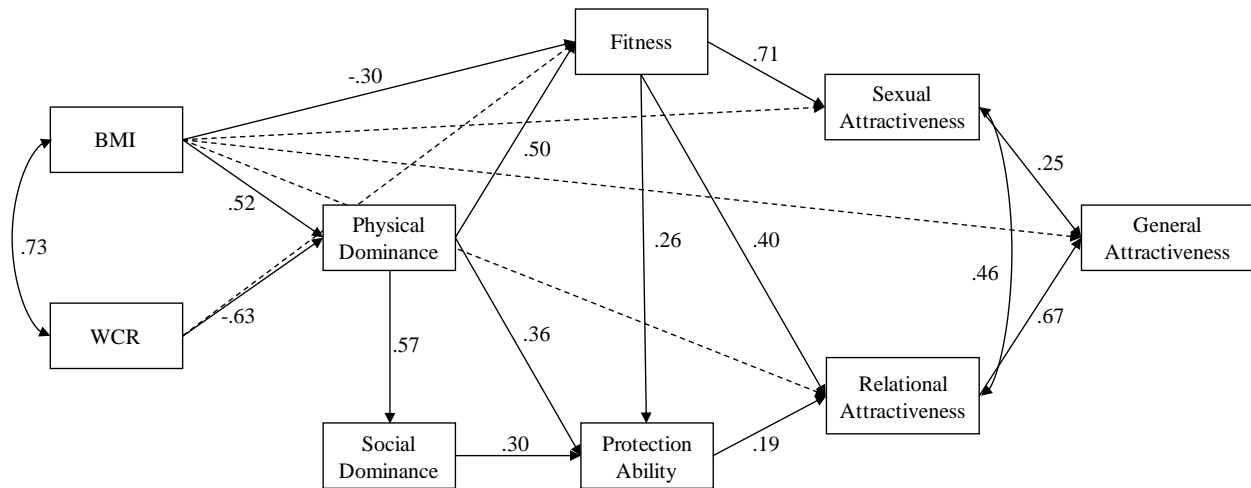*Figure 2*. Sample of body avatars rated by participants.

Figure 3. Path model examining psychological mediators of the relationship between male waist-to-chest ratio and female perception of attractiveness with financial dominance removed. Fit statistics: $\chi^2(17) = 26.61$, $p = .06$, RMSEA $= .06$, CFI $= .99$, TLI $= .97$ Note: Solid lines indicate significant paths, dashed lines indicate non-significant paths, standardized values are reported. Variables names are body mass index (BMI); waist-to-chest ratio (WCR).

Appendix

Protection Ability and Fitness Items

Using the scale below, please rate the image on the following traits.

1	2	3	4	5	6	7

Strongly   Neutral   Strongly

Disagree   Agree

Protection Ability Items

I would feel physically safe with this person around.

This person could protect his loved ones from harm.

This person could protect me if I were in physical danger.

Fitness Items

I think this person will live a long and healthy life.

This person would have very fit/healthy children.

This person is in excellent shape.